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COMMISSION ON WATER RESOURCE MANAGEMENT

OF THE STATE OF HAWAII

PETITION TO AMEND INTERIM INSTREAM FLOW STANDARDS FOR HONOPOU, HUELO (PUOLUA), HANEHOI, WAIKAMOI, ALO, WAHINEPEE, PUOHOKAMOA, HAIPUAENA, PUNALAU/KOLEA, HONOMANU, NUAAILUA, PIINAAU, PALAUHULU, OHIA (WAIANU), WAIOKAMILO, KUALANI, WAILUANUI, WEST WAILUAIKI, EAST WAILUAIKI, KOPILIULA, PUAKAA, WAIOHUE, PAAKEA, WAIAAKA, KAPAULA, HANAWI, AND MAKAPIPI STREAMS

Case No. CCH-MA-13-01

HAWAIIAN COMMERCIAL AND SUGAR COMPANY'S SUBMISSION OF PROPOSED FINDINGS OF FACT AND CONCLUSIONS OF LAW; CERTIFICATE OF SERVICE

Hearing Officer: Dr. Lawrence Miike

HAWAIIAN COMMERCIAL AND SUGAR COMPANY'S SUBMISSION OF PROPOSED FINDINGS OF FACT AND CONCLUSIONS OF LAW

Pursuant to Minute Order 15, Hawaiian Commercial and Sugar Company submits its Brief in Support of Proposed Findings of Fact and Conclusions of Law.

DATED: Honolulu, Hawai'i, October 2, 2015.

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HC&S' PROPOSED FINDINGS OF FACT AND CONCLUSIONS OF LAW

I. INTRODUCTION

This matter relates to proceedings before the Commission on Water Resource Management ("***CWRM***") regarding twenty-seven (27) petitions to amend the Interim Instream Flow Standards ("***IIFS***") for certain streams in East Maui.

II. PROCEDURAL HISTORY

A. The IIFS Petitions

On May 24, 2001, Nā Moku 'Aupuni o Ko'olau Hui ("***Na Moku***") filed with CWRM twenty-seven (27) separate petitions to amend the IIFS for streams in twenty-one (21) hydrologic units located in East Maui (collectively, the "***East Maui IIFS Petitions***"):

	Stream Name	**Hydrologic Unit**
1.	Honopou	Honopou (6034)
2.	Hanehoi and Puolua	Hanehoi (6037)
3.	Waikamoi	Waikamoi (6047)
4.	Alo	Waikamoi (6047)
5.	Wahinepe'e	Waikamoi (6047)
6.	Puohokamoa	Puohokamoa (6048)
7.	Haipua'ena	Haipua'ena (6049)
8.	Kolea – East and Punalau	Punalau (6050)
9.	Honomanū	Honomanū (6051)
10.	Nua'ailua	Nua'ailua (6052)
11.	Pi'ìna'au	Pi'ina'au (6053)
12.	Palauhulu	Pi'ina'au (6053)
13.	Waianu/Ohia	Ohia (6054)
14.	Waiokamilo	Waiokamilo (6055)
15.	Kualani	Waiokamilo (6055)
16.	East and West Wailuanui	Wailuanui (6056)
17.	Waikani	Wailuanui (6056)
18.	West Wailuaiki	West Wailuaiki (6057)
19.	East Wailuaiki	East Wailuaiki (6058)
20.	Kopili'ula	Kopili'ula (6059)
21.	Puaka'a	Kopili'ula (6059)
22.	Waiohue	Waiohue (6060)
23.	Pa'akea	Pa'akea (6061)
24.	Waia'aka	Waiaaka (6062)
25.	Kapaula	Kapaula (6063)

26.	Hanawī	Hanawī (6064)
27.	Makapipi	Makapipi (6065)

B. The Eight Prioritized IIFS Petitions

On July 23, 2001, Native Hawaiian Legal Corporation ("*NHLC*"), as counsel for Nā Moku, met with CWRM staff to discuss how the 27 IIFS Petitions would be handled. CWRM staff and NHLC reached agreement that CWRM would focus initially on restoring stream flow to streams encompassed by the IIFS petitions filed for the streams within 5 hydrologic units covered by the following eight (8) IIFS Petitions: Honopou, Hanehoi and Puolua, Waiokamilo, Kualani, Pi'ina'au, East and West Wailuanui, Waikani, and Palauhulu streams (collectively, the "***8 Prioritized IIFS Petitions***").[1]

CWRM staff used the following protocol to process the 8 Prioritized IIFS Petitions:

1. Conduct a preliminary inventory of the best available information and compile it into a draft IFS Assessment Report ("***IFSAR***");
2. Seek agency review and comments on the draft IFSAR in conjunction with issuing a public notice for a public fact gathering meeting;
3. Conduct a public fact gathering meeting in, or near, the hydrologic unit of interest;
4. Incorporate information obtained from agency review and public fact gathering meetings into a final IFSAR;
5. Using the final IFSAR, make recommendations to CWRM regarding IIFS for the stream in question, which CWRM may vote to accept, reject, or modify. *See* Exh. 3 at 10; *see also, e.g.*, Exh. 4 at 3-4. CWRM may then vote to accept, reject, or modify the recommendations of its staff.

See, e.g., Exh. C-101 (Honopou IFSAR), p. 2-3 and Figure 1-2.

CWRM, at its December 13, 2006 meeting, authorized staff to initiate and conduct public fact gathering on the 8 Prioritized IIFS Petitions. On March 12, 2008, CWRM released public review drafts of IFSARs for the hydrologic units of Honopou (6034), Hanehoi (6037), Pi'ina'au

[1] Although NHLC's July 26, 2001 letter to CWRM memorializing their July 23, 2011 meeting identified only six streams for prioritization, some of those streams actually consist of multiple streams. The six streams identified in the letter are located within five hydrologic units and are covered by the 8 Prioritized IIFS Petitions.

(6053), Waiokamilo (6055), and Wailuanui (6056). its. In response to the draft IFSARs, CWRM received written comments and additional information from 41 individuals and organizations, including people living within the hydrologic units, state and county agencies, nonprofit organizations, and businesses. *See* Exh. C-87, Table of Contents. A public fact gathering meeting was held on April 10, 2008 at the Haiku Community Center. CWRM staff received oral testimony from 46 individuals at the meeting. *See id.*, p. 1.0-1.

On September 24-25, 2008, CWRM met to take up the matter of action on the 8 prioritized IIFS petitions. CWRM staff recommended amendment of the IIFS for 8 of the 10 streams covered in the 8 Prioritized IIFS petitions, as follows:

Honopou (6034)

For Honopou Stream, staff recommended that two measurable interim IFS be established:

- IIFS A: IIFS of 2.00 cubic feet per second ("***cfs***") (1.29 million gallons per day ("***mgd***")) at the lower reach of Honopou Stream near the inactive U.S. Geological Survey ("***USGS***") stream gaging station 16595000 at 383 feet elevation, downstream of Haiku Ditch.
- IIFS B: IIFS of 0.72 cfs (0.47 mgd) at the lower reach of Honopou Stream near 40 feet elevation. This location is upstream of the confluence of Puniawa Stream and Honopou Stream, and downstream of the lowest registered diversion on Honopou Stream.

Hanehoi (6037)

For Hanehoi and Puolua Streams, staff recommended that three measurable interim IFS be established:

- IIFS A: IIFS of 0.89 cfs (0.57 mgd) at the lower reach of Huelo (Puolua) Stream near 420 feet elevation, downstream of Haiku Ditch. This is the location of the ungaged site, station HuelL.
- IIFS B: IIFS of 0.63 cfs (0.41 mgd) at the lower reach of Hanehoi Stream near 420 feet elevation, downstream of Haiku Ditch.
- IIFS C: IIFS of 1.15 cfs (0.74 mgd) at the lower reach of Hanehoi Stream, upstream of Lowrie Ditch and the diversion of water for domestic use in the Huelo community.

Piinaau (6053)

For Piinaau Stream, staff recommended that the IIFS remain at status quo with no modifications to existing diversions.

For Palauhulu Stream, staff recommended that one measurable IIFS be established:

- IIFS B: IIFS of 5.50 cfs (3.56 mgd) is at the lower reach of Palauhulu Stream near 80 feet elevation, upstream from the confluence of Piinaau and Palauhulu Streams. This is the location of the USGS ungaged site, station PhL.

Waiokamilo (6055)
For Waiokamilo Stream, staff recommended that one measurable interim IFS be established:

- IIFS A: IIFS of 4.9 cfs (3.17 mgd) at the lower reach of Waiokamilo Stream at the location of the USGS gaging station 16521300 near Dam 3. This location is downstream of Koolau Ditch, but upstream of the confluence of Waiokamilo and Kualani (Flamau) Streams.

For Kualani (Hamau) Stream, staff recommended that the IIFS remain at status quo with no modifications to existing diversions.

Wailuanui (6056)
For East and West Wailuanui Streams, staff recommended that one measurable IIFS be established:

- IIFS A: IIFS of 3.05 cfs (1.97 mgd) at the lower reach of Wailuanui Stream near the inactive USGS gaging station 16521000 at 620 feet elevation. This location is downstream of Koolau Ditch, below the confluence of the tributaries, East and West Wailuanui Streams.

See Exh. C-85, pp. 60-62. After two days of public testimony and extensive deliberations, CWRM voted unanimously to accept the staff recommendations with amendments. *See* Exh. C-89.

No person requested a contested case hearing as to the 8 Prioritized IIFS Petitions.

C. The Remaining 19 East Maui IIFS Petitions

CWRM staff engaged in the agency review and public fact gathering processes for the 19 remaining East Maui IIFS Petitions (the "***19 East Maui IIFS Petitions***"), prepared final IFSARs corresponding to the hydrologic units covered by those petitions, and made its recommendations to CWRM. CWRM, at its May 25, 2010 meeting, voted to restore flow to six streams. The IIFS for Hanawī and Makapipi Streams were amended upward on year-round basis, and the IIFS for Waikamoi, West Wailuaiki, East Wailuaiki, and Waiohue Streams were amended upward to different minimum flow levels for wet and dry seasons. The following summarizes CWRM's actions on the 19 East Maui IIFS Petitions:

Waikamoi and Alo: An IIFS of 2.80 cfs (1.81 mgd) for Waikamoi Stream below all EMI diversions and just above Hana Highway near an altitude of 500 feet, below the confluence of Waikamoi and Alo Streams.

Wahinepe'e: No change to the current IIFS of 0.50 cfs (0.32 mgd) just above Hana Highway near an altitude of 575 feet.

Puohokamoa: No change to the current IIFS of 0.40 cfs (0.26 mgd) just above Hana Highway near an altitude of 565 feet.

Haipua'ena: No change to the current IIFS of 0.10 cfs (0.06 mgd) just above Hana Highway near an altitude of 510 feet.

Punalau/Kolea: No change to the current IIFS of 0.20 cfs (0.13 mgd) just above Hana Highway near an altitude of 40 feet.

Honomanū: No change to the current IIFS of 0 cfs (0 mgd) just above Hana Highway near an altitude of 20 feet.

Nua'ailua: No change to the current IIFS of 3.10 cfs (2.00 mgd) just above Hana Highway near an altitude of 110 feet.

Ohia (Waianu): No change to the current IIFS of 4.60 cfs (2.97 mgd) just above Hana Highway near an altitude of 195 feet.

West Wailuaiki: An IIFS of 3.80 cfs (2.46 mgd) during the wet season and an IIFS of 0.40 cfs (0.26 mgd) during the dry season just above Hana Highway near an altitude of 1,235 feet.

East Wailuaiki: An IIFS of 3.70 cfs (2.39 mgd) during the wet season and an IIFS of 0.20 cfs (0.13 mgd) during the dry season just above Hana Highway near an altitude of 1,235 feet

Kopili'ula: No change to the current IIFS of 0.50 cfs (0.32 mgd) just above Hana Highway near an altitude of 1,270 feet.

Puakaa: No change to the current IIFS of 1.50 cfs (0.97 mgd) just above Hana Highway near an altitude of 1,235 feet.

Waiohue: An IIFS of 3.20 cfs (2.07 mgd) during the wet season and an IIFS of 0.10 cfs (0.06 mgd) during the dry season just above Hana Highway near an altitude of 1,195 feet.

Pa'akea: No change to the current IIFS of 1.50 cfs (0.07 mgd) just above Hana Highway near an altitude of 1,265 feet.

Waiaaka: No change to the current IIFS of 0 cfs (0 mgd) at Hana Highway near an altitude of 1,235 feet.

Kapaula: No change to the current IIFS of 0.20 cfs (0.13 mgd) just above Hana Highway near an altitude of 1,194 feet.

Hanawī: An IIFS of 0.10 cfs (0.06 mgd) below EMI's main Hanawi diversion (Intake K-3) near an altitude of 1,315 feet.

Makapipi: An IIFS of 0.93 cfs (0.60 mgd) just above Hana Highway near an altitude of 935 feet.

(Exh. C-91, pp. 47-50, 52 (table); Exh. C-103, pp. 21-24).

D. Nā Moku's Contested Case Petition and Appeal

At the conclusion of the CWRM's May 25, 2010 meeting, Alan Murakami of NHLC orally requested a contested case hearing on the 19 East Maui IIFS Petitions. On June 4, 2010, NHLC, on behalf of Nā Moku, followed the oral request with a written petition for a contested case on the 13 East Maui IIFS petitions corresponding to the following hydrologic units and streams (the "***CCH Petition***"):

Waikamoi (6047): Waikamoi Stream, Alo Stream, Wahinepee Stream
Puohokamoa (6048): Puohokamoa Stream
Haipuaena (6049): Haipuaena Stream
Punalau (6050): Punalau Stream and Kolea Stream
Honomanu (6051): Honomanu Stream
West Wailuaiki (6057): West Wailuaiki Stream
East Wailuaiki (6058): East Wailuaiki Stream
Kopiliula (6059): Kopiliula Stream and Puakaa Stream
Waiohue (6060): Waiohue Stream
Paakea (6061): Paakea Stream
Kapaula (6063): Kapaula Stream
Hanawi (6064): Hanawi Stream

CWRM denied the CCH Petition at its October 18, 2010 meeting.

Nā Moku appealed the denial of the CCH Petition to the Intermediate Court of Appeals ("***ICA***"). The ICA vacated the CWRM's decision denying the CCH Petition and remanded to the CWRM with instructions to grant the CCH Petition and conduct a contested case. *In re Interim Instream Flow Standards for Waikamoi, Puohokamoa, Haipuaena, Punalau/Kolea, Honomanu, West Wailuaiki, East Wailuaiki, Kopiliula, Puakaa, Waiohue, Paakea, Kapaula & Hanawi Streams*, 2012 WL 5990241, at *4 (Haw. Ct. App. Nov. 30, 2012) ("***In re East Maui IIFS***"). On July 17, 2013, CWRM authorized the chairperson to appoint a Hearings Officer for the contested case hearing (the "***East Maui IIFS CCH***"). Then-chairperson William Aila appointed Dr. Lawrence Miike as the Hearings Officer.

E. Parties in the East Maui IIFS CCH

The Hearings Officer granted standing to participate as parties in the East Maui IIFS CCH to Nā Moku, the County of Maui Department of Water Supply ("***MDWS***"), Alexander & Baldwin, Inc. ("***A&B***") and East Maui Irrigation Co. ("***EMI***"), Hawaii Farm Bureau Federation ("***HFB***"), and Maui Tomorrow Foundation, Inc. ("***MT***").[2] *See* Minute Order No. 2 dated April 21, 2014.

CWRM subsequently received applications to participate as parties in the East Maui IIFS CCH from Jeffrey C. Paisner, John Blumer-Buell, and Nikhilananda. After reviewing briefs on the applications and holding a hearing on the applications on November 13, 2014, the Hearings Officer granted standing to Mr. Paisner. Mr. Blumer-Buell and Nikhilananda were denied standing but granted leave to present testimony and evidence as witnesses called by the Hearings Officer. *See* Minute Order No. 11 dated December 4, 2014.

[2] In May 2014, MT expressed its desire to withdraw as a party to the East Maui IIFS CCH without prejudice to the ability of its supporters, Neola Caveny and Ernest Shupp, to continue to participate as parties, which request the Hearings Officer granted. *See* Minute Order No. 6 dated May 28, 2014. MT later reconsidered its decision to withdraw and was reinstated as a party by order of the Hearings Officer. *See* Minute Order No. 8 dated June 9, 2014.

F. Expansion of the Scope of the East Maui IIFS CCH

The original scope of the East Maui IIFS CCH was limited to the 13 East Maui IIFS petitions listed in Nā Moku's CCH Petition. In April 2014, Hearings Officer Miike informed the parties of his inclination to expand the scope to encompass all 27 East Maui IIFS Petitions. CWRM, at its August 20, 2014 meeting, voted in favor of expanding the scope of the East Maui IIFS CCH to include all 27 East Maui IIFS Petitions.

G. The Contested Case Hearing

The parties filed their opening submissions in this contested case on December 30, 2014, their responsive submissions on January 27, 2015, and their rebuttal submissions on February 2, 2015. The Hearings Officer conducted evidentiary hearings from March 2 to April 2, 2015.

III. PROPOSED FINDINGS OF FACT

A. Organizational Approach

HC&S' proposed findings of fact are organized in the following manner. The first section of the findings provides an overview of the measurement of stream flows in the streams at issue in this proceeding. The second section contains findings pertaining to native stream biota including an overview of available studies and agency recommendations regarding habitat restoration. The third section contains general findings regarding water cultivation requirements for taro. The fourth section includes findings of fact for each of the hydrologic units. The fifth section includes findings regarding the noninstream uses of the subject streams by HC&S and MDWS. The fifth section contains findings concerning the impact of restricting non-instream uses.

B. Quantifying Stream Flows

1. The principal metric used to quantify stream flows is the flow duration curve. Flow-duration curves are constructed by first ranking all of the daily mean discharge values for

the period of record at a gaging station, next computing the probability of each value being equaled or exceeded, and then plotting the discharges against their associated exceedance probabilities. Flow-duration statistics are points along the flow-duration curve. (*See* Stephen B. Gingerich, "Median and Low-Flow Characteristics for Streams under Natural and Diverted Conditions, Northeast Maui, Hawai'i," USGS Scientific Investigations Report 2004-5262 (the "***USGS Regression Study***"), p. 4.)

2. The Q_{50} flow, or median flow, is the flow that is exceeded 50 percent of the time during the specified period. (*See* USGS Regression Study, p. 4.) So, for example, a Q_{50} of 25 mgd means that the flow of the stream in question was 25 mgd or more for half of the measurements of stream flow and less than 25 mgd for the other half of the measurements of flow during the specified period of time.

3. In order to assess the effects of existing surface-water diversions on flow characteristics for perennial streams in northeast Maui, the USGS, in cooperation with CWRM, estimated selected flow-duration values for gaged and ungaged sites on 21 streams in northeast Maui. The estimates and the methodology used to calculate them are reported in the USGS Regression Study. (USGS Regression Study, pp. 1-2.)

4. The USGS Regression Study's study area covers approximately 67 square miles, is bounded to the north by about 11 miles of coastline and lies between (and includes) the drainage basins of Kolea Stream to the west and Makapipi Stream to the east. (USGS Regression Study, p. 2.)

5. The USGS Regression Study estimated flow-duration values using a combination of continuous-record gaging station data, low-flow measurements, and regression equations. (USGS Regression Study, p. 1.)

A. For gaged stations, USGS estimated flow-duration values with data from its 16 continuous-record stream gaging stations. USGS has operated 16 continuous-record stream gaging stations for various periods at unregulated sites in or near the northeast Maui study area since 1910. In addition, records from 17 continuous-record stream gaging stations on regulated sites are available for analysis. Stream gage records for different streams were normalized using the index station method, with station 5180 on West Wailuaiki Stream being the index station. The median and low-flow characteristics for continuous-record sites is reported in Table 2 of the USGS Regression Study. (USGS Regression Study, pp. 4, 9 (Table 2), 11; Gingerich, Tr., 3/3/15, p. 94, l. 10 to p. 95, l. 9.)

B. For ungaged sites, USGS used multiple linear-regression analysis to estimate streamflow values. The estimated values for ungaged sites are reported in Table 10 of the USGS Regression Study. (USGS Regression Study, pp. 14, 48-57 (Table 10).)

C. USGS made most-reliable estimates of natural (undiverted) streamflow at 21 streams in the study area using a combination of continuous-record gaging station data, low-flow measurements, and values determined from regression equations. The estimated statistics of natural streamflow are reported in Table 11 of the USGS Regression Study. (USGS Regression Study, pp. 58, 60-62 (Table 11).)

D. USGS made estimates of flow-duration values for gaged and ungaged sites under diverted conditions on 21 streams in the study area downstream from the main diversion systems on the basis of a combination of continuous-record gaging station data, low-flow measurements, and values determined from regression equations. USGS assumed that the diversion systems remove all flow lower than TFQ_{50} at an altitude above 1,200 feet in all diverted streams. The flow-duration statistics for diverted streams are calculated by subtracting the flows above the diversion system from the estimated undiverted flows below the diversion system. The estimated values of diverted streamflow are reported in Table 12 of the USGS Regression Study. (USGS Regression Study, pp. 63, 64-66 (Table 12).)

6. The accuracy of the flow estimates in the USGS Regression Study is influenced by several considerations.

A. Generally, an estimate of flow at an ungaged site made on the basis of a flow-duration discharge at an upstream gaging station and a single measurement of flow at the ungaged site resulted in a large uncertainty in the estimate. For most ungaged sites in the study area, however, these values were all the information that was available. (USGS Regression Study, p. 43.)

B. USGS applied a single regression equation for both hydrologic regimes (east or west of Ke'anae Valley). Ordinarily, regression equations would be developed for each distinct hydrologic regime to better account for the basin characteristics controlling streamflow, but dividing the gaging stations used to generate the regression equations into two groups would have resulted in too few stations in each group for significant statistical analysis. The consequence of using a single equation is that the equation does not account for variable subsurface geology. East of Ke'anae Valley, the TFQ_{95} equation generally underestimates flow due to gains in flow from groundwater discharge. Within and west of Ke'anae Valley, the regression equation generally overestimates flow due to loss of water at lower elevations in the area. (USGS Regression Study, p. 58.)

C. Application of the regression equations to estimate flow at some of the sites violates the assumptions of the regression analysis because they are intermittent-flow sites or have basin characteristics that are outside of the range used to develop the equations. Some of the poor results can be explained by these violations. (USGS Regression Study, p. 58.)

7. The accuracy of flow-duration values estimated with regression equations may be measured in terms of standard error and relative error. Standard error measures the precision with which the equation estimates the flow-duration statistic at a site where data are unavailable. The standard error, expressed in percent, shows the range within which the predicted statistic falls. Relative error, also expressed in percent, indicates how well the estimated flow-duration value matches with the measured value where one is available. (USGS Regression Study, p. 34; Gingerich, Tr., 3/3/15, p. 9, l. 12 to p. 100, l. 19.)

8. Estimates developed on the basis of continuous-record gaging stations are deemed the most reliable. Estimates developed from regression equations alone are deemed the least reliable. Estimates developed for sites downstream from gaging stations and adjusted on the basis of low-flow measurements or the regression equations are considered to be of intermediate reliability. (USGS Regression Study, p. 58.)

9. The regression equation for TFQ_{50} estimates that value within a relative error of ±25% at 20 of the continuous-record gaging stations. Flow at 15 stations is underestimated and flow at 12 stations is the same as the measured statistic or overestimated. All but one of the TFQ_{50} flows at stations east of Ke‘anae Valley and downstream of the Ko‘olau Ditch are underestimated, indicating the influence of springs with high discharge volume in this area. The only overestimate east of Ke‘anae Valley is at gaging station 5070 on an intermittent reach of Makapipi Stream. (USGS Regression Study, p. 43.)

10. The regression equation for BFQ_{50} estimates that value within a relative error of ±25% at 18 of the continuous-record gaging stations. Flow at 13 stations is underestimated and

flow at 14 stations is the same as measured or overestimated. Most of the flow at stations east of Ke'anae Valley is underestimated with the stations downstream of the Ko'olau Ditch having the greatest errors. (USGS Regression Study, p. 43.)

11. The regression equation for TFQ_{95} estimates that value within a relative error of ±50% at 15 of the continuous-record gaging stations. The errors are higher for lower flows because, for the same absolute error in flow, the relative error, in percent, increases as the actual flow decreases. Flow at 13 stations is underestimated and flow at 14 stations is the same as the measured statistic or overestimated. The cluster of underestimated stations east of Ke'anae Valley and downstream from the Ko'olau Ditch is apparent at lower flows. (USGS Regression Study, p. 43.)

12. The regression equation for BFQ_{95} estimates that value within a relative error of ±50% at 12 of the continuous-record gaging stations. Flow at 12 stations is underestimated and flow at 15 stations is the same as the measured statistic or overestimated. The cluster of underestimated stations east of Ke'anae Valley and below the ditch is persistent at this lowest flow statistic. (USGS Regression Study, p. 43.)

13. Stephen Gingerich of the USGS attached to his testimony a table summarizing the median base flow statistics (BFQ_{50}) under natural (undiverted) and diverted conditions that were reported in Table 11 and Table 12 of the USGS Regression Study, respectively. (Table attached to Gingerich Written Direct Testimony ("***WDT***") 10/31/14.)

C. Native stream biota

1. Native amphidromous species

14. The native species of special concern in this proceeding consist of five native fishes (four gobies and one eleotrid), two snails, one shrimp, and one prawn:

Scientific Name	Hawaiian Name	Type
Awaous guamensis	ʻOʻopu nākea	Goby
Lentipes concolor	ʻOʻopu hiʻukole (alamoʻo)	Goby
Sicyopterus stimpsoni	ʻOʻopu nōpili	Goby
Stenogobius hawaiiensis	ʻOʻopu naniha	Goby
Eleotris sandwicensis	ʻOʻopu akupa (okuhe)	Eleotrid
Atyoida bisulcata	ʻŌpae kalaʻole	Shrimp
Macrobrachium grandimanus	ʻŌpae ʻoehaʻa	Prawn
Neritina granosa	Hīhīwai	Snail
Neritina vespertina	Hapawai	Snail

(Exh. C-101, p. 35.)

15. Hawaii's native stream animals have amphidromous life cycles. In general, the animals have an oceanic larval phase where they develop in the open ocean for up to six months. This is followed by recruitment to stream as the larvae metamorphose to postlarvae. The postlarvae then migrate upstream to suitable habitat and complete their development into juvenile animals. Within the suitable stream habitat the juveniles grow to adults and then reproduce. The newly hatched larvae drift downstream back to the ocean to undergo their oceanic larval phase. As a general model, the important phases can be separated into (1) oceanic larval phase, (2) recruitment, (3) upstream migration, (4) instream habitat, and (5) downstream migration and drift). HSHEP Study (Appendix A to Higashi WDT), p. 5.

16. There is no evidence that any of the nine native Hawaiian amphidromous species is at risk of either endangerment or extinction in East Maui streams or elsewhere within the State of Hawaiʻi. Native amphidromous species persist in East Maui streams and other streams throughout the State despite 1,600 years of human modifications to the landscape and a century of modern development. (Exh. C-66, pp. 18, 27.)

2. Factors affecting native amphidromous animal populations

17. The survival and propagation of native amphidromous animal populations are influenced by various factors.

18. Larvae of amphidromous stream animals may be eaten, starve, or drift off into the open ocean. The chance for all necessary conditions lining up correctly for larvae to successfully complete the oceanic larval phase and recruit to suitable habitat has been likened to winning a lottery. HSHEP Study (Appendix A to Higashi WDT), p. 5; Parham, Tr., 3/16/15, p. 115, l. 5 to p. 116, l. 8.)

19. Large waterfalls may prevent upstream migration of certain amphidromous species. This is true under both natural and diverted conditions. Changes in aquatic habitat caused by diversions in upstream reaches are not relevant to those species that do not normally inhabit reaches above natural bottlenecks or cannot migrate upstream to inhabit these reaches. (Stephen B. Gingerich and Reuben H. Wolff, *Effects of Surface-Water Diversions on Habitat Availability for Native Macrofauna, Northeast Maui, Hawaii*, USGS Scientific Investigations Report 2005-5213 ("***USGS Habitat Study***"), p. 5.)

20. Four of the five ‘o‘opu species are true gobies and have a fused pelvic fin. The fused pelvic fin forms a suction disk that enables these fishes to attach themselves to the stream substrate and to climb cascades and waterfalls. Differences in climbing abilities have allowed the fish species to segregate along a longitudinal gradient. Although there is considerable overlap, especially in streams with high waterfalls or in dewatered streams, the fish species tend to inhabit stream reaches according to their climbing abilities. ‘O‘opu akupa is not a true goby and lacks the fused pelvic fin and therefore is restricted to the lowest stream reaches, stream mouths, and estuaries. ‘O‘opu naniha has the weakest climbing ability, and is also confined to

the lowest stream reaches, stream mouths, and estuaries. ʻOʻopu nākea, the largest of the stream species, is a moderate climber and is commonly found in lower and middle stream reaches, and has been observed to climb waterfalls. ʻOʻopu nōpili often inhabits the middle stream reaches, but has been observed to climb waterfalls. ʻOʻopu alamoʻo, the best climber, is typically found in middle and upper stream reaches. (USGS Habitat Study, p. 5; Hau, Tr., 3/3/15, p. 173, l. 22 to p. 174, l. 11.)

21. The mountain ʻōpae have exceptional climbing ability and most often inhabit the upper stream reaches. (USGS Habitat Study, p. 5).

22. Hīhīwai are commonly found in lower stream reaches but have been observed to climb up waterfalls. (USGS Habitat Study, p. 5; Hau, Tr., 3/3/15, p. 173, l. 22 to p. 174, l. 11.)

23. The East Maui streams with high terminal falls include Kolea, Waikamoi, Wahinepeʻe, Haipuaʻena, Waiokamilo, and Paʻakea. Paʻakea has a freshwater plunge pool just above the mouth of the stream. However, the falls above the pool restricts other amphidromous fishes from inhabiting the stream above the terminal pool. (Exh. C-66, p. 20.)

24. Under existing diverted conditions, flow volume and frequency is sufficient to allow upstream migration by ʻoʻopu nākea, ʻoʻopu alamoʻo, and ʻōpae kalaʻole. (Exh. C-66, p. 18.)

25. Stream diversions can create physical barriers that prevent the upstream migration of amphidromous animals. Physical barriers can result from many different designs, but the major issues are height of the dam wall, inappropriate hydraulic conditions, or the creation of an overhanging drop-off in the stream channel. (HSHEP Study (Appendix A to Higashi WDT), p. 5).

26. Given the climbing ability of most amphidromous animals found in the middle reach to the headwaters of Hawaiian streams, as long as the height of structure is not substantially greater than natural waterfalls occurring downstream of the diversion location, then the vertical wall should have minimal impact on upstream migration. In cases where a dam is located in a relatively low gradient stream, blockage of upstream migration may be a problem. (HSHEP Study (Appendix A to Higashi WDT), p. 10).

27. Creation of an overhanging drop off is a problem for migrating animals wherever it is encountered in the stream because amphidromous animals require contact to a continuous wetted surface in order to overcome an obstacle. If water falls freely from the lip of the drop-off to the pool below, then the animals cannot pass the structure. This is relatively easy to remedy by re-engineering the structure to remove the overhang. (HSHEP Study (Appendix A to Higashi WDT), p. 10).

28. Depending on the design of the diversion structure, individual post-larvae may be entrained as they pass over the diversion structure. (HSHEP Study (Appendix A to Higashi WDT), pp. 13-14.)

29. Stream diversions may result in the dewatering of a section of stream. This disruption of the physical connection between the upstream and downstream sections prevents the passage of migrating post-larvae to suitable adult habitats. (HSHEP Study (Appendix A to Higashi WDT), p. 11.)

3. Habitat restoration

30. Habitat is one of many factors that influence animal populations in a particular stream. Other factors of importance in determining whether a species will inhabit a stream reach include the available recruitment pool, food source, the presence of predatory alien species, and

high flow events in the streams. (USGS Habitat Study, p. 50; Gingerich, Tr., 3/3/15, p. 121, l. 22 to p. 122, l. 2.)

31. Recommendations developed by CWRM staff and the Division of Aquatic Resources of the Department of Land and Natural Resources ("***DAR***") with regard to habitat restoration have relied principally on habitat selection modeling to estimate the availability of habitat for native stream animals in East Maui streams under various flow conditions. The basic mechanism behind habitat selection modeling involves combining the biological with the hydrological components of a stream. The biological component is usually measured by reference to the frequency of microhabitat utilization of a target species. The ratio of microhabitat availability is defined in terms of preference criteria or habitat suitability criteria. The "preferred" microhabitat is assumed the most advantageous for a specific activity and life stage of the target species. The hydrological component includes the determination of base-flow conditions and the stream geomorphology. Computer models like the Physical Habitat Simulation model (PHABSIM) are used to merge these components to estimate the quantity of "preferred" microhabitat that will be available for the target species with incremental changes in the amount of stream flow. (USGS Habitat Study, p. 7.)

a. <u>USGS Habitat Study</u>

32. In 2005, the USGS published a study on the effects of surface water diversions on habitat for native stream species in East Maui streams entitled: Stephen B. Gingerich and Reuben H. Wolff, *Effects of Surface-Water Diversions on Habitat Availability for Native Macrofauna, Northeast Maui, Hawaii*, USGS Scientific Investigations Report 2005-5213. *See* USGS Habitat Study.

33. The USGS Habitat Study intensively studied five East Maui streams: Waikamoi, Honomanū, Wailuanui, Kopili'ula, and Hanawī. The subject species were 'o'opu nākea, 'o'opu alamo'o, 'o'opu nōpili, 'ōpae, and hīhīwai. (USGS Habitat Study, pp. 3, 5.)

34. The USGS Habitat Study used PHABSIM to estimate the availability of aquatic habitat under different flow levels, both under diverted and undiverted conditions. PHABSIM is a habitat selection model. PHABSIM combines one-dimensional hydraulic modeling of water depth and velocity with data indicating aquatic species preference. Hydrologic data, collected over a range of low-flow discharges, were used to calibrate hydraulic models of selected transects across the streams. The models were then used to predict water depth and velocity over a discharge range up to estimates of natural median streamflow determined during the study. The biological importance of each stream's hydraulic attributes was then assessed with the suitability criteria for each native species and life stage to produce a relation between discharge and habitat availability. The results of the PHABSIM model are presented in plots showing the area of estimated usable bed habitat over a streamflow range. The results are also presented as habitat relative to natural conditions with 100% of natural habitat available at natural median base flow and 0% of habitat available for a dry stream. (USGS Habitat Study, pp. 7, 18, 35.)

35. The overall hydrologic conditions in the study area of the USGS Habitat Study were drier than normal during the period when the stream reaches were intensively studied from July 30, 2002 to July 23, 2003. (USGS Habitat Study, p. 14.)

36. The USGS Habitat Study used the estimated values of diverted and natural annual median base flow calculated in the USGS Regression Study. However, there are discrepancies between the estimates of median base flow in the USGS Habitat Study and those stated in the USGS Regression Study with respect to certain stream stretches. For example, Table 8 of the

USGS Habitat Study states that the median base flow of the Hanawī middle stream section is 14 cfs under diverted conditions and 16 cfs under natural (undiverted) conditions, whereas Table 12 of the Regression Study states that the median base flow of the same section is 19 cfs diverted conditions and 24 cfs under natural (undiverted) conditions. (USGS Habitat Study, pp. 35, 41 (Tables 8 and 9), 47 (Table 10); USGS Regression Study, pp. 60 (Table 11) and 64 (Table 12); Gingerich, Tr., 3/3/15, p. 122, l. 12 to p. 124, l. 19.) flow duration statistics for the [relied on regression estimates]

37. Because the USGS Habitat Study was based on the USGS Regression Study, to the extent a regression estimate underestimates flow in a stream section, the estimate of available habitat in that stream section under diverted conditions would also be underestimated. Conversely, if the regression estimate overestimates flow in a stream section, the estimate of available habitat in the stream section under diverted conditions would also be overestimated. (Gingerich, Tr., 3/3/15, p. 125, l. 18 to p. 126, l. 4.)

38. Estimates of the relative amount of habitat available at diverted conditions range from 100 percent for stream sites with relatively small or no diversion to 0 percent for stream sites that are dry due to diversion. The maximum amount of relative habitat at a stream site that is not dry is about 37% of expected natural habitat for ʻoʻopu alamoʻo, ʻoʻopu nōpili, ʻoʻopu nākea, and hīhīwai, and 58% of expected natural habitat for ʻōpae at the Haipuaʻena middle-lower site, where the base flow at diverted conditions is approximately 10% of natural conditions. (USGS Habitat Study, p. 46.)

39. The USGS Habitat Study does not predict the number of animals that will occur in a stream at a given flow rate. The study did not consider other factors of importance in determining whether a particular species will inhabit a stream reach, such as the available

recruitment pool, food source, the presence of predatory alien species, high flow events, the presence of suitable refuges, pathways for migration, availability of spawning habitats, flow mediated triggers for reproductive events, or seasonally variable flow rates. (USGS Habitat Study, p. 50; Exh. C-103, p. 17; Appendix D to Higashi WDT, p. 2; Gingerich, Tr., 3/3/15, p. 120, l. 25 to p. 121, l. 14.)

b. <u>HSHEP Study</u>

40. In response to CWRM's request for an assessment of the biological resources of the 27 East Maui streams that are the subject to of the IIFS petitions, DAR collaborated with Bishop Museum on a study for which they published a report entitled: James E. Parham and Glenn R. Higashi, et al. "The Use of Hawaiian Stream Habitat Evaluation Procedure to Provide Biological Resource Assessment in Support of Instream Flow Standards for East Maui Streams" (2009) (the "***HSHEP Study***"). *See* Appendix A to Higashi WDT.

41. The HSHEP Study employed the Hawaii Stream Habitat Evaluation Procedure ("***HSHEP***"), a habitat model based on the U.S. Fish and Wildlife Service's Habitat Evaluation Procedural Models, to quantify suitable habitat for native amphidromous stream animals in terms of Habitat Units ("***HU***"). (Appendix A to Higashi WDT, p. 21; Parham, Tr., 3/16/15, p. 7, ll. 7-11.)

42. The four purposes of the HSHEP Study are to:

1. explain the influence of stream diversions on the distribution and habitat availability of native stream animals;

2. provide documentation for the HSHEP model's design, underlying data structure, and application;

3. show changes in habitat availability for native amphidromous animals on a stream by stream basis; and

4. prioritize habitat and passage restoration actions among the streams of concern in East Maui.

(Appendix A to Higashi WDT, p. 3.)

43. The streams studied in the HSHEP Study were: Kolea, Waikamoi, Puohokamoa, Haipua‘ena, Punalau, Honomanū, Nua‘ailua, Ohia, West Wailuaiki, East Wailuaiki, Kopili‘ula Waiohue, Pa‘akea, Kapaaula, Hanawī, and Makapipi. The subject species were: ‘o‘opu nākea, ‘o‘opu alamo‘o, ‘o‘opu naniha, ‘o‘opu nōpili, ‘o‘opu akupa, ‘ōpae kala‘ole, ‘ōpae ‘oeha‘a, hīihīwai. (Appendix A to Higashi WDT, pp. 20, 21.)

44. The HSHEP Study relied on flow estimates from the USGS Regression Study to quantify the expected change in site habitat availability in response to a particular amount of water diversion. (Appendix A to Higashi WDT, p. 26; Parham, Tr., 3/16/15, p. 12, l. 11 to p. 13, l. 6.)

45. Like the USGS Regression Study, the HSHEP model does not account for losing and gaining stretches in a stream. (FOF 6.B; Parham, Tr., 3/16/15, p. 117, l. 23 to p. 118, l. 6.)

46. As stated above, the HSHEP Study quantifies the amount of habitat available in a stream in terms of Habitat Units, or HU. The total number of HU in a given stream under undiverted conditions is calculated by multiplying the unit length of the stream by the suitability value for that length of the stream. Suitability is a measure of the usability of the habitat to a stream animal. Suitability values range from zero to one, with zero representing unusable habitat and one representing extremely usable habitat. Thus, if a stream reach has 100 meters of habitat and the suitability of that habitat is 0.5, there are 50 HU in the stream reach. Similarly, if a stream reach has 50 meters of habitat with a suitability value of 1.0, that reach also has 50 HU. (Appendix A to Higashi WDT, p. 68; Parham, Tr., 3/16/15, p. 100, ll. 11-20 and p. 101, ll. 2-9.)

47. The HSHEP Study addressed three broad areas associated with impacts on the habitat of native stream animals resulting from surface water diversions: (1) loss of habitat as a

result of water diversion; (2) barriers to animal movement and migration resulting from diversion structures; and (3) entrainment of animals in the diversion ditches. (Higashi WDT, ¶ 4.)

48. Three components influence the calculation of HU in a stream segment due to loss of flow or diversion structures: (1) local habitat; (2) barriers to upstream passage; and (3) downstream entrainment. (Parham, Tr., 3/16/15, p. 103, l. 10 to p. 104, l. 24.)

A. The local habitat in the segment being diverted is affected by the flow upstream of the diversion and downstream of the diversion. The HSHEP Study used estimates reported in the USGS Habitat Study to calculate the impact of loss of flow on habitat in a given stream stretch. For example, if the USGS Habitat Study estimated that the flow in a stream reach below a diversion left 50% of instream habitat remaining, the total linear meters of HU in that segment would be reduced by 50%. (Appendix A to Higashi WDT, ¶ 27; Parham, Tr., 3/16/15, p. 103, l. 10 to p. 104, l. 3 and p. 105, l. 4 to p. 106, l. 5.)

B. Blockage of upstream migration of native stream species, such as an overhanging barrier, reduces the availability of habitat upstream of the diversion. The reduction is expressed in terms of a discount to the suitability value of the habitat. The HSHEP Study assumes that upstream barriers decrease the suitability of habitat above the diversion 80% of the time; approximately 20% of the time, flows overtopping the diversion provide passage. Thus, the suitability value of habitat upstream of a diversion that creates a barrier to upstream migration is discounted by 80%. (Appendix A to Higashi WDT, p. 28 (#13) and p. 65 (Table 3); Parham, Tr., 3/16/15, p. 104, ll. 5-11 and p. 106, l. 6 to p. 107, l. 5.)

C. Entrainment of larvae drifting downstream in diversion structures reduces the availability of habitat downstream of the diversion. Again, the reduction is expressed in terms of a discount to the suitability value of the habitat. The HSHEP Study assumes that entrainment decreases the suitability of habitat downstream of the diversion 80% of the time. Thus, the suitability value of habitat downstream of a diversion that entrains stream animals drifting downstream is discounted by 80%. (Appendix A to Higashi WDT, p. 28 (#13) and p. 65 (Table 3); Parham, Tr., 3/16/15, p. 104, ll. 12-21 and p. 107, ll. 6-24.)

D. Using the process described above, the HU calculated for the portion of the stream segment above the diversion are combined with the HU calculated for the portion below the diversion to determine the total HU for the entire segment. (Parham, Tr., 3/16/15, p. 107, l. 25 to p. 108, l. 15.)

E. The following is a concrete illustration of how HU for a stream segment is calculated in the HSHEP Study. A stream segment is 100 meters long and its habitat has a suitability value of 1.0. An overhanging diversion structure is situated in the midpoint of the segment. In terms of local habitat, the diversion structure dewaters all of the baseflow downstream of the diversion. This results in 50 HU upstream of the diversion (50m x 1.0 suitability = 50 HU), but only 10 HU downstream of the diversion ((50m x 0.20) x 1.0 suitability = 10 HU). The diversion structure is a barrier to upstream migration, so the suitability value of the habitat in the upstream portion of the segment is discounted by 80%, reducing the upstream habitat to 10 HU (50m x (1.0 x 0.20 suitability) = 10 HU). The diversion also entrains larvae drifting downstream, so downstream habitat is reduced to 2 HU due to the 80% discount in suitability value ((50m x 0.20) x (1.0 x 0.20 suitability) = 2 HU). In total, the segment has 12 HU (10 HU upstream + 2 HU downstream = 12 HU).

49. The HSHEP Study calculated all HU available to the subject species in each segment of the study streams, taking into account the impacts of flow diversion, barriers to upstream passage, and entrainment. Table 12 of the HSHEP Study reports the total HU in each

stream for every species. (Appendix A to Higashi WDT, p. 95 (Table 12); Parham, 3/16/15, p. 109, ll. 2-17.)

50. The HSHEP Study ranked the stream segments according to the total number of HU that could potentially be restored in the segment. (Appendix A to Higashi WDT, pp. 96-98 (Table 13); Parham, Tr., 3/16/15, p. 112, l. 19 to p. 113, l. 15.)

51. Modification of a diversion to eliminate barriers to upstream migration or entrainment would negate the respective 80% discount in suitability value that otherwise would apply to the calculation of HU in the segment. Thus, modifying diversion structures to restore connectivity at a small number of locations can result in large gains in HU. (Parham, Tr., 3/16/15, p. 109, ll. 18-24 and p. 113, l. 18 to p. 114, l. 7.)

c. **DAR and CWRM staff recommendations**

52. On December 15, 2009, DAR submitted to CWRM its recommendations for restoration to enhance habitat for native aquatic biota in eight (8) of the nineteen (19) streams: Honomanu, Puohokamoa, Waikamoi, Kopiliʻula, East Wailuaiki, West Wailuaiki, Makapipi, and Hanawī. The recommendations were based on the findings of the HSHEP Study. DAR advised that the amount of water to be returned at any recommended location would be the amount necessary to achieve 90% habitat restoration based on relationships between habitat and stream flow developed by the USGS for East Maui streams. DAR estimated that its recommendations would result in restoration of 45.8 km of HU for native species out of the total 67.3 HU lost as a result of the major ditch diversions. (Appendix B to Higashi WDT, pp. 2-4.)

53. On April 1, 2010, DAR submitted to CWRM its revised recommendations for stream restoration and a detailed explanation of its revised recommendations along with a "report card" of each stream for which it recommended restoration. (Appendix C to Higashi WDT.)

A. DAR's recommendations with regard to flow restoration were based on two flow regimes. The first is the minimum viable habitat flow (known as H_{min} or H_{90}) for the maintenance of suitable instream habitat for growth, reproduction, and recruitment of native stream animals, which is defined as 64% of the median base flow (BFQ_{50}). The second is the minimum viable connectivity flow (known as C_{min}) for the maintenance of a wetted pathway between the ocean and stream habitats, which is defined as 20% of BFQ_{50}. The C_{min} flows are expected to allow native stream animals to move among habitats, but are considered too low to support suitable long-term growth and reproduction. DAR explained that seasonally adjusted flows – H_{min} during the wet season and C_{min} during the dry season – may mimic the natural flow variability observed in Hawaiian streams and support most ecological functions required by the stream animals. (Appendix C to Higashi WDT, p. 1.)

B. DAR recommended avoidance of entrainment at diversion locations. (Appendix C to Higashi WDT, p. 1.)

C. DAR recommended avoiding co-mingling of stream and ditch flows where at all possible to limit the potential spread of invasive aquatic species. According to DAR, flow restoration should reflect the water budget of the individual stream catchment, and use of trans-basin water diversions from ditches to restore stream sections should be avoided where at all possible. (Appendix C to Higashi WDT, p. 1.)

D. DAR supported geographically spreading out restoration of streams, which would provide greater protection against localized habitat disruptions, a wider benefit to estuarine and nearshore marine species, and result in more comprehensive ecosystem function across the entire East Maui sector. The offspring produced in one healthy stream will spread along the coastal areas over time and populate other streams. DAR preferred one or two streams restored to H_{min} rather than more streams restored to lower flows. (Appendix C to Higashi WDT, p. 1; Appendix D to Higashi WDT, p. 3; Exh. C-91, pp. 9, 43.)

E. Based on the above management framework, DAR articulated the following criteria it used to reassess the East Maui streams it recommended for restoration:

(1) the amount of HU currently lost to diversion that could be restored;

(2) seasonality (wet versus dry seasons) was considered by setting C_{min} flows during the dry season and H_{min} flows during the wet season;

(3) issues relating to losing stream reaches;

(4) restoration of stream systems most biologically impacted by dewatering, assessed on the basis of missing faunal components;

(5) the number and difficulty of modifications for diversions;

(6) the efficient use of water in terms of the rate of HU restored per cfs of water returned;

(7) whether restoration of flow in a given stream segment involved the co-mingling of stream and ditch water; and

(8) geographical distribution of streams proposed for restoration across the entire East Maui ecosystem.

(Appendix C to Higashi WDT, p. 2.)

F. Applying the above criteria, DAR recommended restoration of wet season flows and dry season flows for the following streams (ranked in order of priority): (1) East Wailuaiki, (2) West Wailuaiki, (3) Puohokamoa, (4) Waikamoi, (5) Kopili'ula, (6) Haipua'ena, (7) Waiohue, and (8) Hanawī. DAR also proposed diversion structure modifications for each of the streams for which it recommended flow restoration. Honomanū Stream and Makapipi Stream were eliminated for consideration in consultation with CWRM, USGS, and Bishop Museum on the basis of losing reach concerns. (Appendix C to Higashi WDT, pp. 2, 5-14.)

54. On May 17, 2010, DAR submitted to CWRM a memorandum clarifying its position on the flow rates needed for protection of native aquatic biota and providing the H_{70} and

H_{50} flow estimates as directed by the DLNR administration. DAR stated that it did not support the conclusion that the percentage of habitat available in a stream is linearly related to the size of animal populations in the stream, i.e., that H_{70} is only 20% less habitat than H_{90} and therefore would result in only 20% fewer animals than under H_{90} conditions, or that H_{50} is only 20% less habitat than H_{70}, and therefore would result in only 20% fewer animals than under H_{70} conditions. (Appendix D to Higashi WDT, p. 2.)

55. DAR's prioritization of East Maui streams for restoration was based upon the "biggest bang for the buck" concept, where priority is placed on streams with the greatest potential to increase suitable habitat for native species. The predicted habitat loss calculated across the 19 streams was 67.3 km. By addressing eight of the streams, DAR believes that 68% of that habitat loss could be recovered. (Appendix D to Higashi WDT, p. 3; Higashi WEDT, ¶ 12.)

56. DAR has expressed that it supports a "share-the-pain" approach in dealing with droughts, under which instream flow requirements might be suspended when an area is experiencing drought conditions. According to DAR, the native aquatic animals in Hawai'i streams have evolved in a system where droughts and the resultant low flows naturally occur. (Exh. C-91, p. 41; Appendix D to Higashi WDT, p. 4.)

57. CWRM staff recommended flow restoration in the following streams: Waikamoi, West Wailuaiki, East Wailuaiki, Waiohue, Hanawī, and Makapipi. (Exh. C-103, p. 19.)

58. CWRM staff applied the same approach as DAR in developing its recommendations for flow restoration, except that it proposed flow measurements at locations near USGS stream gages where staff could monitor the IIFS. Whereas DAR's IIFS locations were in the middle and lower stream reaches, CWRM staff's IIFS points are near the upper gage

or near the Ko'olau Ditch at the Hana Highway. Moreover, CWRM staff used data from USGS stream gages to develop its flow recommendations. (Exh. C-91, pp. 12, 41-42.)

d. <u>Monitoring Study</u>

59. In 2015, DAR completed a four-year study monitoring changes to East Maui Streams as a result of flow restoration in connection with the 2010 CWRM IIFS decisions. The study is entitled Glenn R. Higashi and James E. Parham, et al., "Monitoring Changes in Habitat, Biota, and Connectivity Resulting From Water Returns in the East Maui Streams of East Wailua Iki, West Wailua Iki, and Waiohue" (the "***Monitoring Study***"). (Appendix E to Higashi WDT.)

60. The Monitoring Study represents the first multi-stream attempt at monitoring changes over time to stream biota and habitat with respect to stream flow restoration. (Appendix E to Higashi WDT, p. 2.)

61. The Monitoring Study's subject streams were East Wailuaiki Stream, West Wailuaiki Stream, and Waiohue Stream. The study collected data from monitoring stations located at an upper reach and lower reach of each stream. (Appendix E to Higashi WDT, p. 1.)

62. The Monitoring Study focused on changes in physical habitat, changes in stream biota, and the presence of connectivity between lower and upper stream stations. (Appendix E to Higashi WDT, p. 11.)

63. The Monitoring Study was not designed to determine the validity of the HSHEP model with statistical significance. (Parham, Tr., 3/16/15, p. 124, l. 22 to p. 125, l. 16; Higashi, Tr., 3/16/15, p. 198, ll. 10-17.)

64. In general, the Monitoring Study showed weak or no relationship between flow releases and habitat, connectivity, or biota. (Higashi WDT, ¶ 29; Appendix E to Higashi WDT, p. 2.)

65. To measure changes in biota in response to the flow releases, the Monitoring Study determined whether small animals were recruiting to the study areas, and if so, the study looked at the distribution of individuals within size classes to see if more animals and larger animals were present over time. In general, the data fail to show that increased flow resulted in larger animal populations and/or increased recruitment activity. (Appendix E to Higashi WDT, p. 11.)

66. In East Wailuaiki Stream and West Wailuaiki Stream, the correlation between flow and biota appears to be inverted. At the lower monitoring station on East Wailuaiki Stream, there were a greater number of animals and range of sizes observed for seven of the nine species studied (*Sicyopterus stimpsoni* (ʻoʻopu nōpili), *Awaous stamineus* (ʻoʻopu nākea), *Stenogobius hawaiiensis* (ʻoʻopu nōpili), *Eleotris sandwicensis* (ʻoʻopu akupa), *Neritina granosa* (hīihīwai), *Neritina vespertina* (hapawai), and *Macrobrachium grandimanus* (ʻōpae ʻoehaʻa)) during the summer water release months as opposed to the winter release months in which more water was released. The same was true for one of the three species studied (*Atyoida bisulcata* (ʻōpae kalaʻole)) in the East Wailuaiki Stream upper monitoring station. In West Wailuaiki Stream, the inverted correlation between flow and biota was observed for six of the seven species studied in the lower monitoring station (*Lentipes concolor* (ʻoʻopu alamoʻo), *Sicyopterus stimpsoni, Awaous stamineus, Eleotris sandwicensis*, *Neritina granosa*, and *Macrobrachium grandimanus*) and for one of the two species studied in the upper monitoring station (*Atyoida bisulcata*). Waiohue Stream was the only stream in which DAR observed a positive correlation between flows and animal populations and range of sizes, but the correlation was weak. (Appendix E to Higashi WDT, pp. 51-65.)

67. In the upper stations of all streams, stream animal assemblages did not show the healthy characteristics observed in the lower stations. In general, DAR did not see consistent patterns of occurrence, growth in numbers, or increases in size classes of the animals. (Appendix E to Higashi WDT, p. 68.)

68. To measure changes in habitat in response to the flow releases, the Monitoring Study averaged measurements of individual habitat variables and then plotted them to observe changes over time. The pattern of change was compared between the lower and upper stations on a stream to determine if consistent changes were observed. Digital images of the sites over time were also compared. (Appendix E to Higashi WDT, p. 11.)

69. The data on physical habitat were generally inconclusive. In East Wailuaiki Stream, the physical parameters measured at both lower and upper monitoring stations appeared to provide good conditions for stream animals. Flow restoration appeared to improve habitat at the upper station, but not the lower station. In West Wailuaiki Stream, no clear patterns were observed at either monitoring station. At the lower station, winter flow restoration did not appear to have a clear impact on the physical parameters measured. At the upper station, dewatered sections in the summer period were observed prior to flow restoration, but this pattern was not observed in later samples. At both West Wailuaiki monitoring stations, winter flows did not measurably result in substantial improvements in physical habitat, and there was no consistent pattern with regard to the effects of summer flow restoration. Only in Waiohue Stream did flow restoration appear to improve stream-like conditions at both sites. (Appendix E to Higashi WDT, pp. 12-13, 19, 25, 31, 37, 43.)

70. To measure whether connectivity was improved by water returns, the Monitoring Study looked at species that were expected to occur in the upstream stream stations to determine

if small animals occurred more frequently after the water releases. For East Wailuaiki Stream, all species were present in the lower station, indicating connectivity to the ocean despite the presence of a cobble berm at the stream mouth. In the upper station, there appeared to be connectivity over time for *Atyoida bisulcata* and *Neritina granosa*, but the connectivity data for *Lentipes concolor* were inconclusive. For West Wailuaiki Stream, there was continuous connectivity to the ocean in the lower station, and the upper station appeared to have connectivity over time for *Atyoida bisulcata*. There appeared to be intermittent connectivity for *Lentipes concolor*, but it was not consistently observed during the winter releases. In Waiohue Stream, all species were present showing continuous connectivity to the ocean. (Appendix E to Higashi WDT, pp. 11, 65-67.)

71. The Monitoring Study did not consider passage and entrainment issues at the diversions because the upper monitoring stations were below the diversions. (Appendix E to Higashi WDT, pp. 2, 69.)

72. The Monitoring Study results suggest that winter flow releases made a positive improvement to instream habitat in the upper stations and that the summer flow releases showed little difference in habitat, connectivity and biota. However, the results of the Monitoring Study were not definitive. (Higashi WDT, ¶ 27.)

73. The naturally variable flow conditions observed in the Monitoring Study may have obscured some of the changes related to the flow restoration. (Appendix E to Higashi WDT, p. 67.)

74. Glenn Higashi of DAR believes that the four-year study period was too short to document changes given natural variability in rainfall and streamflow, and recruitment and dispersal of stream animals. Monitoring of the instream flow release needs to be performed over

a longer period of time to document whether or not improvement to the animal population occurs. (Higashi WDT, ¶¶ 29, 32.)

e. Relationship of stream flow to habitat and animal populations

75. DAR has acknowledged that setting an IIFS to "fully" or "partially" support the needs of native Hawaiian stream animals is not an exact science, and that it is difficult to recommend a single flow value that is neither too large nor too small to support such needs in torrential Hawaiian streams. (Appendix E to Higashi WDT, p. 4.)

76. According to DAR, restoration of 64% of natural median base flow (BFQ_{50}) is the minimum viable flow (the H_{90} or H_{min} flow) necessary to restore 90% of the habitat. DAR expects H_{min} to provide suitable conditions for growth, reproduction, and recruitment of native stream animals, although no study exists to quantify what constitutes "suitable conditions." (Higashi, Tr., 3/16/15, p. 203, l. 4 to p. 205, l. 7; Higashi WDT, ¶ 22; Appendix D to Higashi WDT, p. 2; Exh. C-103, pp. 17, 18 (Table 4).)

77. DAR's recommendations to CWRM in 2010 supported restoration of 20% of BFQ_{50} (the C_{min} flow) to support minimum connectivity for upstream and downstream migration of stream animals during the dry season. DAR hypothesized that C_{min} flows would create a wetted pathway during the dry season to allow stream animals to move between pools or move further upstream to areas where they can survive until more suitable flows return. Unlike H_{min}, C_{min} does not enable a range of biological functions. In light of the results of the Monitoring Study, DAR now recommends establishment of a constant flow year-round. (Higashi WDT, ¶ 32; Appendix D to Higashi WDT, pp. 2, 4; Exh. C-103, pp. 17, 18 (Table 4).)

78. DAR calculated H_{90} flows by taking the average of BFQ_{50} flows in the middle and lower reaches of a stream and multiplying it by 0.64 for H_{min} flows or 0.20 for C_{min} flows. DAR

relied on regression estimates for middle and lower reaches as reported in the USGS Regression Study. Thus, DAR's estimates of H_{90} flows do not take into account gains and losses in middle and lower reaches. (Appendix D to Higashi WDT, p. 4.; Exh. C-91, p. 13.)

79. The relationship between flow discharge rates and availability of habitat for select species is not linear. The results of the USGS Habitat Study indicate that the addition of even a small amount of water to a dry stream has a significant effect on the availability of habitat in the stream. As the flow discharge rate increases, the incremental recovery of habitat diminishes. (USGS Habitat Study, pp. 36-40 (Figures 14 to 18), 46; Gingerich, Tr., 3/3/15, p. 119, l. 25 to p. 120, l. 24.)

80. The relationship between the amount of habitat available in a stream and animal populations in that stream is also not linear. H_{90} conditions do not result in 20% more animals in a stream than H_{70} conditions just because H_{90} conditions theoretically provide 20% more habitat. Similarly, just because H_{95} theoretically restores 5% more habitat than H_{90} does not mean it would result in 5% more animals than under H_{90} coonditions. (Appendix D to Higashi WDT, p. 1; Exh. C-103, p. 17; Gingerich, Tr., 3/3/15, p. 120, l. 25 to p. 121, l. 14; Higashi, Tr., 3/16/15, p. 207, l. 19 to p. 208, l. 15.)

81. The incremental benefit to animal populations between H_{90} and H_{95} or H_{100} is not known. (Higashi, Tr., 3/16/15, p. 208, ll. 16-21.)

82. Losing stretches of a stream prevent connectivity between the ocean and upper stream reaches. If water is restored to a losing stream, stream animals might initiate recruitment in response to water returns, but get stranded when they reach a dry stretch and die. (Hau, Tr., 3/3/15, p. 162, l. 19 to p. 163, l. 1 and p. 169, l. 3 to p. 170, l. 8; Parham, Tr., 3/16/15, p. 118, l. 22 to p. 119, l. 10; Higashi, Tr., 3/16/15, p. 160, l. 21 to p. 161, l. 14; Exh. E-62, p. 178.)

D. Water Needs For Taro Cultivation

83. In the contested case hearing on petitions to amend the IIFS for Nā Wai ʻEhā streams, CWRM concluded:

> For kalo loʻi on kuleana lands, 130,000 to 150,000 gad, or about 260,000 to 300,000 gad when adjusted for the 50 percent of the time that no water is needed to flow into the loʻi, is sufficient for proper kalo cultivation. Consumption by the loʻi themselves comprises 15,000 to 40,000 gad, so the large amounts of inflow and outflow would result in substantial losses, which can be reduced if as much of the outflow as practical is channeled back into the streams. Leakage from the inflow and 30 outflow ditches must also be reduced as much as practically possible.

(Exh. C-120, COL 219 (citations omitted).)

84. Paul Reppun, a taro farmer who testified as an expert on taro cultivation in the Nā Wai ʻEhā proceeding as well as the instant proceeding, has similarly opined that the water requirement of kalo loʻi ranges from 100,000 to 300,000 gad. (Reppun, WDT 12/30/14, Exh. A thereto, p. 5.)

85. In 2007, the USGS published Open-File Report 2007-1157 entitled "Water Use in Wetland Kalo Cultivation in Hawaiʻi" ("***USGS Kalo Study***") a study designed to collect baseline flow and temperature data from kalo cultivation areas on Kauai, Oahu, Maui, and Hawaiʻi. The average inflow value for the 19 loʻi complexes measured in the study is 260,000 gad, and the median inflow value is 150,000 gad. (Exh. C-108, p. 1.)

86. The temperature of 27°C (80.6°F) is the threshold point at which wetland kalo becomes more susceptible to fungi and rotting diseases. (Reppun, Tr., 3/4/15, p. 27, l. 11 to p. 28, l. 5; Exh. C-108, p. 1.)

87. The USGS Kalo Study found that, of the 17 loʻi complexes where water inflow temperature was measured, only 3 had inflow temperatures that rose above 27°C. All 15 of the sites where outflow temperatures were measured had some temperatures greater than 27°C.

Outflow temperatures exceeded 27°C about 2.5% and 40% of the time. Mean outflow temperatures ranged from 23.0°C to 26.7°C. (Exh. C-108, p. 1.)

88. Water temperature in a lo'i complex is dependent on variables including the amount of foliage cover, the size of the complex, the amount of inflow, and the presence of prior pythium rot. (Reppun, Tr., 3/4/15, p. 32, l. 12 to p. 33, l. 5.)

89. Every lo'i complex varies in its configuration and the way in which water is managed by the taro farmer. Different factors in a lo'i can contribute to how soon and how quickly taro rot occurs. (Reppun, Tr., 3/4/15, p. 31, ll. 5-9.)

E. Findings of Fact Regarding Individual Hydrologic Units

1. Honopou (6034)

a. Physical features

90. The hydrologic unit of Honopou is located northwest of Haleakala. It covers an area of 2.7 square miles from the lower slopes of Haleakala at 2,286 feet elevation to the sea. (Honopou IFSAR § 1.1, p. 1.)

91. Honopou Stream is 4 miles in length, traversing north from its headwaters near Ulalena to the ocean. Tributary to Honopou Stream is Puniawa Stream, which is 2.6 miles in length with intermittent flow. (Honopou IFSAR § 1.1, p. 1.)

b. Diversions

92. EMI operates diversions on Honopou Stream at Haiku Ditch, Lowrie Ditch, New Hamakua Ditch, and Wailoa Ditch. As of March 9, 2004, three 4-inch bypass pipes had been installed at Haiku Ditch on Honopou to allow water to bypass the diversion structure and flow back into the stream. (Exh. C-33; Exh. C-52, p. 12; Exh. C-85, p. 10.)

c. Gaging stations

93. Four continuous-record stream gaging stations operated by the USGS, one of which (station 16587000) is still taking active measurements, are located along Honopou Stream.

A. Station 16595000 is located at 383 feet elevation below Haiku Ditch and was active in 1907 and from 1932 to 1947. (Honopou IFSAR § 1.1, p. 28, (Table 3-1).)

B. Station 16593000 is located at 441 feet elevation above Haiku Ditch and was active in 1907 and from 1932 to 1947. (Honopou IFSAR § 1.1, p. 28 (Table 3-2).)

C. Station 16591000 is located at 557 feet at the Lowrie Ditch and was active from 1932 to 1947. (Honopou IFSAR § 1.1, p. 28 (Table 3-3).)

D. Station 16587000 is located at 1,208 feet near Wailoa (Koʻolau) Ditch and is still active. (Honopou IFSAR § 1.1, p. 28 (Table 3-4).)

d. <u>Previous IIFS recommendations, CWRM action, and implementation actions</u>

94. In 2008, CWRM staff recommended that CWRM set an IIFS A of 2.00 cfs (1.29 mgd) at the lower reach of Honopou Stream near inactive USGS stream gaging station 16595000 at 383 feet elevation, downstream of Haiku Ditch. CWRM staff stated:

> The first proposed interim IFS A is set downstream of Haiku Ditch to ensure that an adequate amount of water reaches the downstream users. According to measured streamflow data, Honopou is mostly a gaining stream. The average annual ground water contribution to Honopou Stream upstream of Wailoa Ditch is 1.78 cfs. Between Wailoa Ditch and Haiku Ditch, the stream gains another 1.78 cfs from ground water. If diversion of water from Wailoa Ditch is allowed and diversions at Lowrie and Haiku Ditch are minimal, the flow below Haiku Ditch should be larger than 1.78 cfs, which is the amount of ground water contribution to streamflow. Considering that Honopou Stream continues to gain an unknown amount of ground water flow below Haiku Ditch, the flow near the inactive USGS gaging station 16595000 is approximately 2.0 cfs.

(Exh. C-85, p. 14.)

95. CWRM staff also recommended that CWRM set an IIFS B of 0.72 cfs (0.47 mgd) at the lower reach of Honopou Stream near 40 feet elevation, upstream of the confluence of

Puniawa Stream and Honopou Stream, and downstream of the lowest registered diversion on Honopou Stream. The rationale for the recommendation was as follows:

> The second interim IFS B is proposed to regulate the flow in stream reaches downstream of domestic and taro diversions located in the lower part of the hydrologic unit. A second interim IFS downstream of all surface water users prevents the drying of the stream from the domestic and taro diversions. This interim IFS would increase the continuity of flow to enhance biological integrity in the stream. According to long-term data (94 complete years) at USGS gaging station 16587000 upstream of Wailoa Ditch, a flow of 0.72 cfs is present in the stream 90 percent of the time. This value is commonly referred as 90 percent of total flow in the stream (Q_{90}) or flow that is present in the stream 90 percent of the time. Since the gaging station is located above all diversions, this flow may also represent the median base flow in the stream, although the median base flow could also be as high as Q_{70} or 70 percent of total flow. Considering that Honopou Stream is gaining ground water flow from the headwaters to the coast, the minimum amount of water that should flow through the stream near the outlet should be at least, if not greater, than 0.72 cfs. Since the diverted Q_{90} flow at gaging station 16595000 below Haiku Ditch is 0.51 cfs, the interim IFS should be set at a higher flow in order for stream restoration to occur.

(Exh. C-85, pp. 14-15.)

96. CWRM adopted CWRM staff's recommendation as to Honopou Stream at its September 24-25, 2008 meeting. (Exh. C-89, p. 31.)

97. Implementation measures to achieve the 1.29 mgd IIFS at Site A on Honopou Stream since its adoption were taken by EMI in consultation and coordination with CWRM staff, including the following:

(a) October 27, 2008 – measurements were taken, and temporary work was done at the Haiku Ditch diversion with boulders and banana leaves to push more water through the three 4-inch bypass pipes and the sluice gate at the Lowrie diversion was opened;

(b) March 23, 2009 – low flow bypass channel was completed at the Haiku Ditch diversion;

(c) June 23, 2010 – modifications were made to the New Hamakua Ditch diversion to bypass water downstream; and

(d) April 27, 2011 – modifications to the Haiku Ditch and Wailoa Ditch diversions were agreed to by DAR, CWRM staff and EMI to achive biological connectivity.

As of of the dates of the hearing, water was being passed through all four of EMI's ditch diversions on Honopou Stream such that, during periods of low stream flows, no water is being taken by EMI from Honopou Stream into its ditch system. (Hew, Tr., 3/17/15, p. 153, l. 7 to p. 154, l. 1 and p. 262, l. 1 to p. 264, l. 11; Hew, Tr., 3/18/15, p. 223, l. 21 to p. 229, l. 9; Exh. C-147, pp. 274-75 (FIR2011042701).)

98. CWRM's gage data for IIFS Site A on Honopou Stream indicates that during wetter weather, the IIFS is usually met or exceeded. During dry conditions, however, there are times when there is not enough water in Honopou Stream to meet the IIFS even though EMI takes no water from the stream during such conditions. (Uyeno, 12/18/14 written report, p. 10.)

e. <u>Instream values</u>

i. Maintenance of aquatic life and wildlife habitats

99. Honopou rates average in comparison to other watersheds in Maui and statewide. DAR assigns Honopou a total watershed rating of 5 out of 10, a total biological rating of 5 out of 10, and a combined 5 out of 10. Native species observed in the stream include:

> Fish – *Awaous guamensis*, *Eleotris sandwicensis*, *Lentipes concolor*, and *Sicyoperus stimpsoni*
> Crustaceans – *Atyoida bisulcata* and *Macrobrachium grandimanus*
> Mollusks – none observed

Also observed were two native dragonflies, *Anax strenuous* and *Pantala flavescens* and the native damselfly, *Megalagrion pacificum*. ‘O‘opu alamo‘o was found only in the upper reaches.

Larval recruitment of native fish has been observed near the stream mouth. (DAR Report on Honopou Stream, Maui, Hawai'i, June 2008, pp. 1-2; Exh. C-100, p. 28.)

100. The flow in Honopou Stream needed to achieve H_{90} is unknown. (Exh. HO-1; Uyeno, Tr., 3/30/15, p. 13, ll. 2-10.)

ii. Outdoor recreational activities

101. The recreational resources of Honopou Stream were classified as moderate by the Hawaii Stream Assessment's regional recreational committee. The Hawaii Stream Assessment identified opportunities for swimming related to Honopou Stream and it was not considered to be a high-quality experience. The following activities are known to occur or have been observed at or near Honopou: pole and line fishing, trolling/bottom fishing, and some specialized fisheries. (Exh. C-101, p. 37.)

iii. Maintenance of ecosystems such as estuaries, wetlands, and stream vegetation

102. The riparian resources of Honopou Stream were not classified by the Hawaii Stream Assessment. Nearly 25% of the Honopou hydrologic unit falls within the Ko'olau Forest Reserve. Nearly 21% of Honopou is classified as seasonal, non-tidal palustrine wetlands occurring in the headwaters of the hydrologic unit. The density of threatened and endangered plant species is high at elevations above 1,300 feet, while the rest of the unit, roughly 72%, has a low concentration of threatened and endangered plant species at lower elevations. (Exh. C-101, pp. 41-44.)

iv. Aesthetic values

103. The headwaters of Honopou Stream originate in the lush tropical forests of the Ko'olau Forest Reserve and the stream flows through approximately two miles of evergreen forests before tumbling over Twin Falls and into a natural pool below. Twin Falls is a popular

tourist attraction where people are often seen jumping into the pool from the top of the waterfall. Below the waterfall, the surrounding vegetation changes to mainly grasses and shrubs. At about the same elevation, the tributary of Puniawa Stream begins and flows through cultivated and shrub lands. Honopou Stream empties into Puniawa Bay, which can be viewed above the ocean cliffs at Honopou Point. (Exh. C-101, p. 48.)

v. Navigation

104. No navigation values are present. (Exh. C-101, p. 50.)

vi. Instream hydropower generation

105. HC&S operates three run-of-river hydroelectric facilities on the Wailoa Ditch, which is supplied with water from Honopou Stream. (Exh. C-101, p. 51.)

vii. Maintenance of water quality

106. Honopou Stream does not appear on the 2006 List of Impaired Waters in Hawai'i, Clean Water Act § 303(d). While some data exist for Honopou Stream, there were not sufficient data for decision-making. Samples collected in Honopou Stream indicated no exceedance of water quality standards. (Exh. C-101, p. 53; Exh. C-85, p. 11.)

viii. Conveyance of irrigation and domestic water supplies to downstream points of diversion

107. There are 22 registered diversions, 15 of which are not EMI's. Of this 15, 13 were declared for domestic purposes, in part, with a total of 15 service connections. All 15 diversions are utilized for irrigation of various crops and taro. (Exh. C-101, p. 55.)

ix. Protection of traditional and customary Hawaiian rights

108. According to the 1990 Hawai'i Coastal Zone Management Program's *Hawaiian Fishpond Study for the Islands of Hawaii, Maui, Lanai, and Kauai*, there are no fishponds present in the hydrologic unit of Honopou. (Exh. C-101, p. 66.)

f. **Kuleana users**

109. CWRM records for the hydrologic unit of Honopou indicate that there are a total of 22 registered diversions. Six of the diversions were declared for taro cultivation. (Exh. C-101, p. 68.)

110. In Table No. 1 at page 10 of Na Moku's Opening Brief, Na Moku claims 26.06 acres of cultivable area in Honopou and "Total Estimated Water Needs for Taro (in addition to 64% base flow)" of 2.61 – 7.82 mgd. This is said to be based on Exhibits A-137 (the "***Na Moku TMK Spreadsheet***") and Exhibits A-138 and A-139 (tax maps with highlighted areas referencing certain parcels in Honopou).

111. The 26.06 acres is simply the sum of the total acreage of TMK Nos. 2-9-01-14, 2-9-01-23, 2-9-01-25, 2-9-14-13, and 2-9-14-23, which are described in the declaration of Lurlyn Scott ("***Scott***") as parcels in which her family has an interest. These appear to be the same properties referenced generally in the declarations of her cousins, Sanford Kekahuna, Jonah Jacintho, Juliana Jacintho and Lezley Jacintho.

112. The only information offered about the specific locations on these properties currently being used or planned to be used for taro cultivation is in Scott's declaration and Exhibit A-149, a schematic drawing she prepared to show the loi system on her family's properties in Honopou. She initially estimated this system to be approximately one acre in size, but later increased her estimate to two acres. (Scott, WDT 12/16/14, ¶ 30; Scott, Tr., 3/4/15, p. 193, ll. 19-24.)

113. Nā Moku has estimated the water need for taro on Honopou by simply multiplying the total acreage of all the parcels in which Scott's family has an interest by Paul

Reppun's ("***Reppun***") estimate of 100,000 to 300,000 gad as the irrigation requirement for taro, which resulted in the 2.61 mgd – 7.82 mgd (in addition to 64% baseflow) claimed by Nā Moku.

114. The median baseflow of Honopou at the level of the Haiku Ditch, according to USGS, is 2.3 mgd, with 50% being contributed by ground water above Wailoa Ditch and 50% between Wailoa Ditch and Haiku Ditch. This is the average amount estimated by USGS to be in the stream at the level of the Haiku Ditch in its natural condition when it is not raining. Nā Moku wants 1.472 mgd (64% of 2.3 mgd) to be left in the stream before calculating the amount to be restored to satisfy taro needs. This would only leave 0.828 mgd of average baseflow from which to meet Nā Moku's taro water claim of 2.61 mgd – 7.82 mgd. There is obviously not enough base flow in Honopou Stream, even in the absence of any diversions by EMI, to satisfy Nā Moku's claimed amounts for "restoration." (Exh. C-85, pp. 13-16.)

115. Honopou Stream can, however, support cultivation by Scott's family of the entire one to two acre loi system (the "***Kekahuna lo'i system***") shown on A-149. Using the taro irrigation requirement of 130,000 to 150,000 gad previously established by CWRM in the Nā Wai 'Eha case, the flows needed would be 260,000 to 300,000 gad. At the current IIFS of 1.29 mgd below the Haiku Ditch, this irrigation requirement can easily be satisfied without dewatering the stream between the loi intake diversion and the outflow ditch.

116. Nā Moku has complained that, notwithstanding the current availability of water at the Kekahua lo'i system intake, the water at times is too warm for taro and thus more water needs to be released into the stream.

117. Sometime between 2008 and 2010, USGS installed gages in the Kekahuna lo'i system to measure water flow and temperature in the complex, among other things. The gages are no longer operational. (Scott, Tr., 3/4/15, p. 179, ll. 7-30, p. 180, l. 20 to p. 182, l. 6.)

118. USGS gage 205548156143901 ("***Gage '3901***") was installed at the 'auwai at the top of the lo'i complex and it measured the inflow temperature of water. USGS gage 205549156143601 ("***Gage '3601***") was installed on the 'auwai near the bottom on the western boundary of the complex (Lo'i Outlet #1) and it measured the outflow temperature of water. USGS gage 205549156143602 ("***Gage '3602***") was installed on an 'auwai situated near the middle of the complex (Lo'i Outlet #2) and it also measured the outflow temperature of water. The locations of the gages are depicted on Exhibit A-149A. (Scott, Tr., 3/4/15, p. 184, ll. 12-20, p. 194, l. 3 to p. 195, l. 3; Exh. A-149A.)

119. In general, the outflow temperatures recorded at Gage '3601 in Lo'i Outlet #1 tended to be lower and exhibited less variability than the outflow temperatures recorded at Gage '3602 in Lo'i Outlet #2. For example, during the period from July 2009 to July 2010, the daily mean inflow temperatures recorded at Gage '3901 ranged between 64°F and 76°F. During the same period, the daily mean outflow temperatures recorded at Gage '3601 ranged between 65°F and 77°F, whereas the daily mean outflow temperatures recorded at Gage '3602 ranged between 68°F and 82°F. (Exh. A-155; Exh. A-156; Exh. A-157.)

120. At the location of Gage '3602, the water in the 'auwai has passed through a series of taro patches above. (Scott, Tr., 3/4/15, p. 202, ll. 10-19.)

121. The 'auwai in which Gage '3601 was installed takes water directly from the intake and traverses along the western boundary of the lo'i complex, bypassing taro patches that are in cultivation. The cooler water from this 'auwai can be, but is not, used to irrigate those patches by diverting it to an 'auwai in the middle of the complex. (Scott, Tr., 3/4/15, p. 195, l. 4 to 196, l.6, p. 196, ll. 7-22; Hew, Tr., 3/17/15, p. 117, l. 1 to p. 118, l. 9; Exh. A-149A.)

122. Reppun testified that the way each farmer manages his water is important to

understanding how much and why outflow temperatures might exceed inflow temperatures. Reppun did not study and did not express an opinion on the Kekahuna lo'i system water management practices as they may affect the higher temperature of the outflows measured by Gage '3602 versus Gage '3601. There was also no explanation offered by Nā Moku for this discrepancy. (Reppun, Tr., 3/4/15, p. 17, ll. 16-23, p. 59, l. 2 to p. 60, l. 4, p. 77, l. 6 to p. 83, l. 13, p. 98, l. 11 to p. 99, l. 11.)

123. The flow measurements recorded at USGS gage station 16595100 on Honopou Stream in the vicinity of the Kekahuna lo'i system consistently exceed 300,000 gpd. (Exh. A-155, pp. 1, 4; Hew, Tr., 3/17/15, p. 113, l. 4 to p. 116, l. 24.)

124. EMI had previously taken measurements of flow and temperature at the intake to the 'auwai feeding the Kekahuna lo'i complex for a 14-month period from March 15, 2004 to May 20, 2005 during which time water was being passed through EMI's Haiku Ditch diversion via three 4-inch pipes. During the period covered by those measurements, the 'auwai intake gate was not fully open because if it were, all of the water available at the intake would overflow the banks of the 'auwai during times of high flows in Honopou Stream. The flow rate measured at the intake consistently remained in excess of 235,500 gpd except on one occasion, even during times of low rainfall. At certain times, the flow rate was so high that it was not possible to obtain a measurement with a Parshall Flume. (Exh. C-52, p. 13; Exh. C-107, Exh. A-13 thereto.)

125. Based on the foregoing evidence, there is adequate flow in Honopou Stream under current conditions to support the cultivation of up to two acres of taro in the Kekahuna lo'i complex without substantially dewatering the stream at the loi intake. During extended periods of dry weather, there are nonetheless times when the IIFS amount is not met, even when no water is being diverted by EMI. These are likely the same periods when water temperatures in

the Kekahuna lo'i complex may become elevated. Increasing the IIFS will not result in more stream flow during these conditions or lower the water temperature in the Kekahuna lo'i complex.

2. Hanehoi (6037)

a. Physical features

126. The hydrologic unit of Hanehoi is located in the northwest section of Haleakala. It covers an area of 41 square miles on the lower slopes of Haleakala from 1,361 feet elevation to the sea. (Hanehoi IFSAR § 1.1, p. 1.)

127. Hanehoi Stream is 1.3 miles in length and flows intermittently in the upper section of the stream. (Hanehoi IFSAR § 1.1, p. 1.)

128. A terminal waterfall at the mouth of the stream would likely restrict upstream migration. (Exh. C-85, p. 20.)

b. Diversions

129. EMI operates diversions on Hanehoi Stream at Haiku Ditch, Lowrie Ditch, New Hamakua Ditch, and Wailoa Ditch. (Exh. C-33.)

c. Gaging stations

130. No USGS gaging station was installed in Hanehoi Stream. (Hanehoi IFSAR § 3.0 at 27.)

d. Previous IIFS recommendations, CWRM action, and implementation actions

131. In 2008, CWRM staff recommended that CWRM set an IIFS A of 0.89 cfs (0.57 mgd) at the lower reach of Huelo (Puolua) Stream near 420 feet elevation, downstream of Haiku Ditch. CWRM staff also recommended an interim IIFS B of 0.63 cfs (0.41 mgd) at the lower reach of Hanehoi Stream near 420 feet elevation of Haiku Ditch. The rationale for the recommendation was as follows:

> The proposed interim IFS A and B are set on Huelo (Puolua) Stream and Hanehoi Stream, respectively, upstream of their confluence, to ensure that an adequate amount of surface water reaches users downstream from Haiku Ditch. According to the estimated flow statistics, the base flow that is present in the stream 95 percent of the time (BFQ_{95}) at ungaged site HaneL is 3.04 cubic feet per second (cfs), which is similar to the total flow that is present in the stream 95 percent of the time (3.07 cfs). In this case, BFQ_{95} represents a conservative estimate of natural base flow for reasons stated in the previous paragraph. Based on the USGS study on habitat availability, when 50 percent of natural base flow is present in the stream, potentially 80 to 90 percent of the natural habitat for selected native species is available. Fifty percent of the natural base flow in Hanehoi Stream (3.04 cfs) is 1.52 cfs. This flow is assumed to maintain biological integrity of the stream. Although the research conducted by the USGS on habitat availability does not include Hanehoi as part of the study area, results of this study are the best information available to determine the needs of native species in the stream.
>
> Since there is currently insufficient information for the Commission to determine whether Hanehoi Stream is gaining or losing ground water flow, the only reasonable assumption to make is that the tributaries of Huelo (Puolua) and Hanehoi Streams contribute to the 1.52 cubic feet of flow per second at ungaged site HaneL. The proposed interim IFS for Huelo (Puolua) Stream is set at the low base flow value (BFQ_{95}) of 0.89 cubic feet per second, and one for Hanehoi Stream is set at the 0.63 cfs (1.52 cfs minus 0.89 cfs equals 0.63 cfs). These sites are below the irrigation ditches. Another interim IFS is proposed further upstream on Hanehoi Stream to allow withdrawal of stream water by domestic users in the Huelo community (discussed below). The downstream proposed interim IFS for Hanehoi Stream is set at a lower value than the low base flow value of 1.15 cubic feet per second because the stream is an important source of irrigation water for EMI. Compared to two major diversions on Huelo (Puolua) Stream, EMI is diverting water from Hanehoi Stream at four ditches (Wailoa, New Hamakua, Lowrie, and Haiku Ditch). The interim IFS for Huelo (Puolua) Stream is set at a higher flow to allow water to be available for the downstream surface water users, both in Huelo (Puolua) Stream and below its confluence with Hanehoi Stream.

(Exh. C-85, pp. 24-25.)

132. CWRM staff further recommended that CWRM set an IIFS C of 1.15 cfs (0.74 mgd) at the lower reach of Hanehoi Stream, upstream of Lowrie Ditch and the diversion of water for domestic use in the Huelo community. The rationale for the recommendation was as follows:

> An interim IFS C is proposed to provide adequate surface water for domestic use of the Huelo community. The site of the proposed interim IFS is just above the pool in which there is an intake (pipe) for domestic users in the Huelo community; this intake is just upstream of Lowrie Ditch. The proposed interim

> IFS value is the low base flow (BFQ_{95}) of 1.15 cfs estimated at an ungaged site, designated station HaneM. This value is used because the ungaged site location is relatively close to that of the proposed interim IFS location upstream of Lowrie Ditch. Assuming this flow represents the above-mentioned conservative estimate of the natural base flow in the stream, then this flow would allow for the improvement of stream biota, as well as provide enough flow for the large number of domestic users of the Huelo community.

(Exh. C-85, p. 25.)

133. CWRM staff did not propose an IIFS at the stream mouth because of the small number of registered surface water users below the confluence of the streams, and because the stream has a terminal waterfall. (Exh. C-85, p. 25.)

134. CWRM adopted CWRM staff's recommendation as to Hanehoi Stream at its September 24-25, 2008 meeting. (Exh. C-89, p. 31.)

135. Petitioners complain that EMI has not complied with the IIFS for Hanehoi Stream because the flows that have been measured at IIFS site C since the IIFS has been amended have consistently been less than what was hoped for when the IIFS was set.

136. EMI provided testimony to the effect that its understanding of the September 24, 2008 Staff Submittal recommending the amended IIFS for Hanehoi was based on a similar intent as the recommendation for Honopou, which was to rely on ground water arising in the stream below the level of the Wailoa Ditch to satisfy the IIFS. Hanehoi is a smaller stream than Honopou, however, and unlike the situation with Honopou, there was very little measured streamflow data from which to estimate how much water the stream gains between the EMI diversions. (Hew, WDT 1/27/15, ¶ 13.)

137. According to EMI, the 1.15 cfs (0.74 mgd) IIFS set for Site C on Hanehoi below the Wailoa and New Hamakua Ditches was the flow that CWRM staff expected to be naturally present at low flow conditions without any releases from the Wailoa Ditch and that it is uncertain

whether, at low flow conditions, any water arising above Wailoa Ditch would reach Site C. (Hew, WDT 1/27/15, ¶ 14.)

138. Water is passed over the Lowrie Ditch below Site C by two pipes. Water can then bypass the Haiku Ditch through a sluice gate. After the IIFS was amended, based on discussions with Staff, EMI was directed to and did open the Haiku Ditch sluice gate in an attempt to allow the proposed IIFS of 0.63 cfs for Site B, below the Haiku Ditch, to be met. (Hew, WDT 1/27/15, ¶ 15.)

139. After several site visits and measurements, it appeared that much less water than expected was present at Site C, above because the amount of ground water that arises in Hanehoi between the Wailoa Ditch and the Lowrie Ditch is less than had been estimated. (Hew, WDT 1/27/15, ¶ 16.)

140. Puoloa Stream, which is a tributary of Hanehoi, originates below the Wailoa Ditch. Water is passed over the Lowrie Ditch through a pipe. Water can then bypass the Haiku Ditch through a sluice gate. This is similar to the situation on Hanehoi, which crosses the Lowrie and Haiku Ditches just to the east. Below the Haiku Ditch, Puoloa merges into Hanehoi. (Hew, WDT 1/27/15, ¶ 17.)

141. Since the IIFS was amended, EMI has passed water over the Lowrie Ditch on Puoloa Stream and through the sluice gate on the Haiku Ditch below, as directed by CWRM staff. (Hew, WDT 1/27/15, ¶ 18.)

142. Apparently due to the limited resources of CWRM Staff, and the prioritization of such resources to other projects, no field work was done prior to the commencement of the hearing herein to investigate the feasibility of further modifiying EMI's diversions at the Lowrie,

New Hamakua and Wailoa ditches to satisfy the current IIFS amount. (Uyeno, Tr., 3/2/15, p. 177, l. 22 to p. 187, l. 9; Hew, Tr. 3/17/15, p. 154, l. 14 to p. 156, l. 21.)

143. After the hearing commenced, EMI did some modifications to the pipes that pass water through the Lowrie diversion on Puolua Stream, in an attempt to pass more water but it is unknown whether that will be sufficient to result in the IIFS being met. (Hew, Tr., 3/17/15, p. 156, l. 3 to p. 157, l. 7.)

e. Instream values

i. Maintenance of aquatic life and wildlife habitats

144. Hanehoi rates below average in comparison to other watersheds in Maui and statewide. DAR assigns Hanehoi a total watershed rating of 6 out of 10, a total biological rating of 2 out of 10, and a combined 4 out of 10. Native species observed in the stream include:

Fish – none observed
Crustaceans – *Atyoida bisulcata*
Mollusks – none observed

Also observed were two native dragonflies, *Anax strenuous* and *Pantala flavescens* and two native damselflies, *Megalagrion nigrohamatum* and *Megalagrion pacificum.* Hanehoi has degraded native aquatic and insect biota in the middle and lower reaches. Large sections of the stream are currently unsuitable habitat for native animals. Only native mountain ʻōpae observed and are present in the upper reaches. Native dragonflies and damselflies were observed in the upper reaches as well. (DAR Report on Hanehoi Stream, Maui, Hawaiʻi, June 2008, pp. 1-2; Exh. C-85, p. 20; Exh. C-100, p. 44.)

145. The flow in Hanehoi Stream needed to achieve H_{90} is unknown. (Exh. HO-1.)

ii. Outdoor recreational activities

146. The recreational resources of Hanehoi Stream were classified as limited by the Hawaii Stream Assessment's regional recreational committee. The Hawaii Stream Assessment identified no recreational opportunities for Hanehoi Stream. (Hanehoi IFSAR § 5.0, p. 33.)

iii. Maintenance of ecosystems such as estuaries, wetlands, and stream vegetation

147. Riparian resources of Hanehoi Stream were not classified by the Hawaii Stream Assessment. Nearly 30% of Hanehoi falls within the Ko'olau Forest Reserve. Nearly 26% of Hanehoi is classified as seasonal, non-tidal palustrine wetlands occurring in the headwaters of the hydrologic unit. The density of threatened and endangered plant species is high at elevations above 1,200 feet, while the rest of the unit, roughly 79%, has a low concentration of threatened and endangered plant species at lower elevations. (Hanehoi IFSAR § 6.0, pp. 37-40.)

iv. Aesthetic values

148. The headwaters of Hanehoi Stream originate in the lush tropical forests of the Ko'olau Forest Reserve. Along with its tributary Puolua (Huelo) Stream, they flow northeasterly through miles of evergreen forests before reaching the confluence where the surrounding vegetation is dominated by grasses and shrubs. Hanehoi Stream empties into the western boundary of Hoalua Bay, which can be viewed above the ocean cliffs at Hanehoi Point. (Hanehoi IFSAR § 7.0, p. 44.)

v. Navigation

149. No navigation values are present. (Hanehoi IFSAR § 8.0, p. 46.)

vi. Instream hydropower generation

150. HC&S operates the run-of-river hydroelectric facilities on the Wailoa Ditch, which is supplied with water from Hanehoi Stream. (Hanehoi IFSAR § 9.0, p. 47.)

vii. Maintenance of water quality

151. Neither Hanehoi nor Puolua (Huelo) Stream appears on the 2006 List of Impaired Waters in Hawai'i, Clean Water Act § 303(d). While some data exist for Hanehoi, there were not sufficient data for decision-making. Hanehoi Stream is Class 2 from the coast to approximately 1,200 feet elevation. Above that elevation, it is Class 1. Puolua (Huelo) Stream is Class 2. Marine waters at the mouth of the hydrologic unit of Hanehoi are mostly Class AA waters, except for the northern tip of the hydrologic unit, where they are Class A waters. (Hanehoi IFSAR § 10.0, p. 49.)

viii. Conveyance of irrigation and domestic water supplies to downstream points of diversion

152. There are a total of 12 registered diversions, of which five are non-EMI. Of these five, one was declared for domestic purposes, in part, for one service connection. Four of the five diversions are utilized for irrigation of various crops and livestock, including the cultivation of taro. The one remaining registrant claimed to use water for irrigation 0.09 acres of taro, but in the course of the field verification, no diversion could be located and the declarant expressed the intention to grow taro in the future. (Hanehoi IFSAR § 11.0, p. 51.)

ix. Protection of traditional and customary Hawaiian rights

153. According to the 1990 Hawai'i Coastal Zone Management Program's *Hawaiian Fishpond Study for the Islands of Hawaii, Maui, Lanai, and Kauai*, there are no fishponds present in the hydrologic unit of Hanehoi. (Hanehoi IFSAR § 12.0, p. 61.)

f. <u>Kuleana users</u>

154. CWRM records for the hydrologic unit of Hanehoi indicate that there are a total of 12 registered diversions, of which five are non-EMI. Of these five, two registrants declared water use for taro cultivation with an estimated cultivable area of 2.25 acres. One other registrant claimed to use water for 0.09 acres of taro, but in the course of the field verification no

diversion could be located and the declarant expressed the intention to grow taro in the future. (Hanehoi IFSAR § 12.0, p. 63.)

155. There is one taro farmer, Ernest Schupp, who has cultivated approximately one acre of taro off and on since 1998 on the parcel designated as TMK No. 2-9-08:15, which is owned by George and Mary Keala. The intake for his auwai is on Puolua Stream just below where the Haiku Ditch crosses and diverts water from the stream. Water passes through the Haiku Ditch diversion through two four inch pipes. (Schupp, WDT 12/15/14, ¶¶ 3, 9, 13.)

156. Mr. Schupp also testified that he is involved with an organization that would like to restore ancient loi along the stream that have long been abandoned and that may have appurtenant rights, but no testimony was submitted by the owners of the property where these ancient loi are located. (*See generally* Schupp on behalf of TARO, WDT 12/15/14.)

157. Neola Caveny owns a parcel adjacent to Hanehoi Stream but does not cultivate taro. She currently obtains water for her property from a private catchment system, and claims that she is unable to exercise her riparian rights to use water from Hanehoi Steam due to low stream flows. (*See generally* Caveny, WDT 12/13/14.)

158. Solomon Lee owns a number of parcels adjacent to Hanehoi Stream. While no taro is currently cultivated on these parcels, he testified that taro was previously cultivated on portions of these parcels and he would like to restore and cultivate taro on three acres. (*See generally*, Lee, WDT 12/30/14.)

159. Lucienne De Naie tesitified in support of restoration but does not reside on either stream and thus does not claim any appurtenant or riparian rights. (*See generally*, De Naie, WDT 12/30/14.)

160. Donald M. Halley Jr. and Crista A. Morf similarly testified in support of restoration, but do not reside on land bordered by any stream and thus do not claim any appurtenant or riparian rights. (*See generally*, Halley, WDT 12/30/14.)

161. Michael D'Addario is the land manager of the Hale Akua Garden Farm and Agricultural Education Center (the "Center") located on top of a steep pali overlooking Hanehoi Stream. Because of its elevation where the Center's land abuts the stream, the Center only receives water from Hanehoi Stream through the Huelo Community pipeline. Mr. D'Addario alluded in his testimony to possible appurtenant rights in favor of the Center, but did not offer any evidence of prior taro cultivation on the Center's land or explain how, given its elevation above the stream, Hanehoi Stream may have been the irrigation source for any such prior taro cultivaton. (*See generally*, D'Addario, WDT 12/30/14.)

3. <u>Waikamoi (6047)</u>

a. <u>Physical features</u>

162. The hydrologic unit of Waikamoi consists of 5.3 square miles from the upper slopes of Haleakala at 9,300 feet elevation to the sea. (Waikamoi IFSAR § 1.1, p. 1.)

163. Waikamoi Stream is 8.5 miles in length, traversing north from the headwaters of its tributaries to Hosmer Grove Spring at the 6,560 feet altitude to the ocean. A major tributary to Waikamoi Stream is Alo Stream, which branches east at about 840 feet altitude. East of Waikamoi Stream within the same hydrologic unit is Wahinepe'e Stream, which is a mile in length with headwaters beginning at about the 800 feet elevation. (Waikamoi IFSAR § 1.1, p. 1.)

164. The presence of terminal waterfalls in Waikamoi Stream and Wahinepe'e Stream have restricted those native species that lack climbing ability from inhabiting the stream.

(Waikamoi IFSAR § 4.4, pp. 51, 52; DAR Report on Waikamoi Stream, Maui, Hawai'i, August 2009, pp. 6, 7.)

b. Diversions

165. EMI operates diversions on Waikamoi Stream at the Ko'olau/Wailoa Ditch, Spreckels Ditch, and the Manuel Luis/Center Ditch. Waikamoi Stream is also diverted by the Upper Kula Pipeline and Lower Kula Pipeline. (Waikamoi IFSAR § 3.3, p. 30.)

166. Alo Stream is diverted by the Ko'olau/Wailoa Ditch and New Hamakua Ditch. (Waikamoi IFSAR § 3.3, p. 30.)

167. Wahinepe'e Stream is diverted by the Manuel Luis/Center Ditch. (Waikamoi IFSAR § 3.3, p. 30; Exh. C-33.)

c. Gaging stations

168. Waikamoi Stream has one active USGS continuous-record stream gaging station and seven inactive gaging stations, one of which was located on Alo Stream. Station number 5528 remains active, and is located at an altitude of 4,487 feet, upstream from the Upper Kula Pipeline. (Waikamoi IFSAR § 3.3, p. 29 (Table 3-2).)

d. Flow duration values

169. According to USGS, the natural median baseflow immediately downstream of a minor diversion at the upper reach of Waikamoi Stream is 3.50 cfs (1.88 mgd). (Table attached to Gingerich WDT 10/31/14, p. 3; USGS Regression Study, p. 66 (Table 12).)

170. According to USGS, the natural median baseflow at the upper reach of Alo Stream directly downstream of the Spreckels Ditch is 1.50 cfs (0.81 mgd); at the middle-upper reach directly downstream of the Center Dich, it is 6.60 cfs (3.55 mgd); at the middle-lower reach, it is 6.70 cfs (3.61 mgd); and at the lower reach it is 7.00 cfs (3.77 mgd). (Table attached to Gingerich WDT 10/31/14, p. 3; USGS Regression Study, p. 66 (Table 12).)

171. According to USGS, the natural median baseflow at the middle reach of Wahinepe'e Stream is 0.90 cfs (0.48 mgd). (Table attached to Gingerich WDT 10/31/14, p. 3; USGS Regression Study, p. 66 (Table 11).)

e. **Previous IIFS recommendations, CWRM action, and implementation actions**

172. In 2010, CWRM staff recommended that one measurable IIFS be established for Waikamoi Stream at an estimated flow of 4.30 cfs (2.80 mgd) below the confluence with Alo Stream, below all EMI diversions and just above Hana Highway, near an altitude of 550 feet. CWRM staff also recommended that the IIFS for Wahinepe'e Stream remain as designated on October 8, 1988, at an estimated flow of 0.50 cfs (0.32 mgd) below all EMI diversions and just above Hana Highway, near an altitude of 575 feet. (Exh. C-103, p. 21.)

173. CWRM staff recommended Waikamoi Stream for restoration because it supported DAR's position of a geographic approach to flow restoration, meaning that flow would be restored to streams both east and west of Ke'anae Valley. Benefits of this approach include biological diversity in the East Maui area, and regional diversity in traditional gathering opportunities. CWRM staff also noted that many area residents expressed interests in gathering native animals from this stream. (Exh. C-103, p. 19.)

174. CWRM staff did not recommend flow restoration for Alo Stream and Wahinepe'e Stream because restoration of additional flow would not result in significant biological return in these streams. (Exh. C-103, p. 20).

175. In 2010, DAR recommended that restoration actions be focused on the main channel of Waikamoi Stream and none on the Alo tributary. DAR recommended the release of a total of 2.6 cfs into Waikamoi Stream during the wet season to provide for minimum habitat flows for native species and no additional water during the dry season to provide connectivity for

such species. DAR also recommended modifications to the C-1 intake into Center Ditch, W-2 intake into Wailoa Ditch, and S-10 Skimming Dam Intake into Spreckels Ditch diversion structures. DAR estimated that the recommended restoration actions on Waikamoi Stream would result in the creation of over 2 km of habitat for native species. DAR ranked Waikamoi Stream fourth in priority among the streams it recommended for restoration. (Appendix C to Higashi, WDT, p. 8.)

176. At its May 25, 2010 meeting, CWRM adopted CWRM staff's recommendation to establish an IIFS for Waikamoi Stream of 2.80 cfs (1.81 mgd) during the wet season and 0 cfs during the dry season at an altitude of 550 feet, just above Hana Highway. CWRM did not establish an IIFS for Alo Stream and did not modify the existing IIFS for Wahinepe'e Stream of 0.50 cfs (0.32 mgd). (Exh. C-91, pp. 49-50, 52.)

f. Instream values

i. Maintenance of aquatic life and wildlife habitats

177. Only the native 'o'opu alamo'o (*Lentipes concolor*) and 'ōpae kala'ole (*Atyoida bisulcata*) were observed in Waikamoi Stream. During the more recent surveys, both species were observed in the upper reach; although, the 'ōpae kala'ole was seen in the middle and headwater reaches of the stream in earlier surveys. Waikamoi rates high in comparison to other watersheds in Maui and statewide. DAR assigns Honopou a total watershed rating of 7 out of 10, a total biological rating of 7 out of 10, and a combined 8 out of 10. Native species observed in the stream include:

> Fish – *Awaous guamensis*, *Eleotris sandwicensis*, *Kuhlia xenura* and *Sicyoperus stimpsoni*
> Crustaceans – *Atyoida bisulcata*
> Insects – *Anax junius*, *Anax* sp, *Anax strenuous*, *Limonia grimshawi*, *Limonia jacobus*, *Megalagrion blackburni*, *Megalagrion calliphya*, *Megalagrion* sp., *Procanacae acuminata*, *Procanace confusa*, *Saldula exulans*, *Scatella cilipes*, *Scatella clavipes*, *Scatella femoralis*, *Telmatogeton abnormis*, *Telmatogen* sp., *Telmatogeton torrenticola*

Snails – *Ferrissia sharpi* and *Neritina granosa*
Sponge – *Heteromeyenia baileyi*

(DAR Report on Waikamoi Stream, Maui, Hawai'i, August 2009, pp. 5-6; Waikamoi IFSAR § 4.4, p. 51.)

178. The estimated natural (undiverted) median baseflow of Waikamoi Stream is 6.60 cfs (4.26 mgd). The amount of flow in Waikamoi Stream below the confluence of Waikamoi Stream and Alo Stream needed to achieve H_{90} is 4.20 cfs (2.71 mgd). (Table attached to Gingerich WDT 10/31/14, p. 3; Exh. HO-1.)

179. The estimated natural (undiverted) median baseflow of Wahinepe'e Stream is 0.90 cfs (0.58 mgd). The amount of flow in Wahinepe'e Stream needed to achieve H_{90} is 0.58 cfs (0.37 mgd). (Table attached to Gingerich WDT 10/31/14, p. 3; Exh. HO-1.)

ii. Outdoor recreational activities

180. Recreational resources of Waikamoi Stream were classified as "substantial" by the Hawaii Stream Assessment's regional recreation committee. Hawaii Stream Assessment identified opportunities for hunting, swimming, and scenic views. None of the recreational opportunities were considered to be a high-quality experience. CWRM determined that trolling, bottom fishing, and opihi picking were the only activities known to occur or observed at or near Waikamoi. (Waikamoi IFSAR § 5.0, p. 60.)

iii. Maintenance of ecosystems such as estuaries, wetlands, and stream vegetation

181. Riparian resources of Waikamoi Stream were classified as "substantial" by the Hawaii Stream Assessment. About 29% of the Waikamoi hydrologic unit falls within the Haleakala National Park. Approximately 28% of the Waikamoi hydrologic unit falls within the Ko'olau Forest Reserve. Approximately 7% of the Waikamoi hydrologic unit falls within the Waikamoi Preserve. (Waikamoi IFSAR § 6.0, pp. 63-64.)

iv. Aesthetic values

182. The headwaters of Waikamoi Stream originate in Haleakala National Park where vegetation is predominately native shrub lands with sparse alien grasses. In the intermediate slopes of the hydrologic unit, Waikamoi Stream flows through native communities of Ohia forests and Uluhe shrub lands that lie within the Waikamoi Preserve and Ko'olau Forest Reserve. The lower elevations are mostly alien forests of the Ko'olau Forest Reserve. The surrounding vegetation for Wahinepee Stream is predominately alien forests. A number of waterfalls and plunge pools are located along the lower reaches of Waikamoi Stream, which provide scenic spots for the public. Among the many waterfalls is Waikamoi Falls that is about 70-foot high and it can be seen from Hana Highway. There are two springs in the hydrologic unit, Hosmer Grove Spring at the 6,560 feet altitude near the headwaters and Waikamoi Spring at 3,200 feet altitude. Keopuka Rock, a State seabird sanctuary, can be seen from the shoreline of the hydrologic unit. Located at Hana Highway between Kolea and Waikamoi Streams is the Waikamoi Roadside Park, which offers views of Waikamoi Stream and access to the upper reach of the stream. (Waikamoi IFSAR § 7.0, p. 72.)

v. Navigation

183. No navigation values are present. (Waikamoi IFSAR § 8.0, p. 74.)

vi. Instream hydropower generation

184. No instream hydropower generation occurs in Waikamoi. (Waikamoi IFSAR § 9.0, p. 75.)

vii. Maintenance of water quality

185. Waikamoi Stream appears on the 2006 List of Impaired Waters in Hawai'i, Clean Water Act § 303(d). Waikamoi Stream is classified as Class 1a inland waters at its headwater tributary that lies in the Haleakala National Park, and in the lower reach that lies within the

Ko'olau Forest Reserve. From the tributary down to approximately 6,100 feet elevation and the short section of the stream near the ocean, Waikamoi Stream is classified as Class 2 inland waters. Between the 6,100 feet and 1,300 feet altitudes, the stream is classified as Class 1b inland waters as parts of the stream lie in the Waikamoi Preserve (upper reaches) and the Ko'olau Forest Reserve (lower reaches). Marine waters at the mouth of the Waikamoi hydrologic unit are Class AA waters. (Waikamoi IFSAR § 10, pp. 80-81.)

viii. Conveyance of irrigation and domestic water supplies to downstream points of diversion

186. One diversion, registered by Puohokama Farm, diverts water for domestic purposes. The diversion is a 1-inch pipe and is also used for watering of livestock, aquaculture, hydroelectric power generation, and irrigation. The DOH Safe Drinking Water Branch does not currently regulate any public water systems in the Waikamoi hydrologic unit. (Waikamoi IFSAR § 11.0, p. 83.)

ix. Protection of traditional and customary Hawaiian rights

187. According to the 1990 Hawai'i Coastal Zone Management Program's *Hawaiian Fishpond Study for the Islands of Hawaii, Maui, Lanai, and Kauai*, there are no fishponds present in the Waikamoi hydrologic unit. (Waikamoi IFSAR § 12.0, p. 100.)

g. Kuleana users

188. CWRM records for the hydrologic unit of Waikamoi indicate that there are a total of eleven registered diversions (10 by EMI or MDWS). The remaining diversion is registered by Puohokamoa Farm, and is declared for domestic water use purposes, watering of livestock, aquaculture, hydroelectric power generation, and irrigation. Waikamoi does not currently have any active taro diversions. (Waikamoi IFSAR § 12.0, p. 94; Exh. C-90, p. 17.)

4. Puohokamoa (6048)

a. Physical features

189. The hydrologic unit of Puohokamoa consists of 3.15 square miles, extending from the coast to inland elevation of 1,700 feet above mean sea level that terminates into the slope of a cinder cone. (Puohokamoa IFSAR § 1.1, p. 1.)

190. Puohokamoa Stream splits into three branches (west, middle, and east branch) 4.4 miles from the coast at 2,100 feet elevation. The longest is the middle branch that is headed at the 4,400 feet altitude 6.4 miles inland. (Puohokamoa IFSAR § 3.3, p. 27.)

b. Diversions

191. EMI operates diversions on Puohokamoa at the Lower Kula Pipeline and Upper Kula Pipeline for MDWS as well as at the. Spreckels Ditch, Manuel Luis Ditch, and Ko'olau Ditch. (Puohokamoa IFSAR § 13.1 at 98-105, Table 13-1; Exh. C-33.)

192. Puohokamoa Stream is used to convey water from one ditch to another. (Exh. C-103, p. 20.)

c. Gaging stations

193. Six inactive USGS continuous-record stream gaging stations were located in the hydrologic unit of Puohokamoa. (Puohokamoa IFSAR § 3.3, p. 28.)

d. Flow duration values

194. According to USGS, the natural median baseflow at the upper reach of Puohokamoa Stream immediately downstream of the Ko'olau Ditch is 6.40 cfs (3.44 mgd); at the middle-upper reach immediately downstream of the Manuel Luis Ditch, it is 8.40 cfs (4.52 mgd); at the middle-lower reach it is 10.00 cfs (5.38 mgd); and at the lower reach it is 11.00 cfs (5.92 mgd). (Table attached to Gingerich WDT 10/31/14, p. 2; USGS Regression Study, p. 61 (Table 11) and p. 66 (Table 12).)

e. **<u>Previous IIFS recommendations, CWRM action, and implementation actions</u>**

195. In 2010, CWRM staff recommended that the IIFS for Puohokamoa Stream remain as designated on October 8, 1988, at an estimated flow of 0.40 cfs (0.26 mgd) below all EMI diversions and just above Hana Highway, near an altitude of 565 feet. (Exh. C-103, p. 21.)

196. CWRM staff did not recommend flow restoration for Puohokamoa Stream because it is used for conveyance of water from one ditch to another. Flow restoration is not recommended for conveyance streams because more water may exist in the portion of stream used for conveyance than would naturally occur. Moreover, commingled water exists for a considerable distance upstream of the diversion structures on the stream. CWRM staff believes that any IIFS should be based solely on the surface available within the given hydrologic unit. Any modification to the existing diversion infrastructure on the stream would result in more water being released than naturally occurs. (Exh. C-103, p. 20.)

197. In 2010, DAR recommended the release of a total of 5.40 cfs (3.49 mgd) into Puohokamoa Stream during the wet season to provide for minimum habitat flows for native species and 0.30 cfs (0.16 mgd) during the dry season to provide connectivity for such species. DAR also recommended modifications to the ML-3 Manuel Luis Ditch, K-33 Ko'olau Ditch, and S-9 Spreckels Ditch diversion structures. DAR estimated that the recommended restoration actions on Puohokamoa Stream would result in the creation of 2.8 km of habitat for native species. DAR ranked Puohokamoa Stream third in priority among the streams it recommended for restoration. (Appendix C to Higashi, WDT, p. 7.)

198. At its May 25, 2010 meeting, CWRM decided to adopt CWRM staff's recommendation to not modify the existing IIFS for Puohokamoa Stream of 0.40 cfs (0.26 mgd). (Exh. C-91, pp. 50, 52.)

f. Instream values

i. Maintenance of aquatic life and wildlife habitats

199. The Hawaii Stream Assessment classifies the aquatic resources of Puohokamoa Stream as "limited", meaning very little native species were present. Only the native ʻoʻopu alamoʻo (*Lentipes concolor*), ʻoʻopu nākea (*Awaous guamensis*), and ʻōpae kalaʻole (*Atyoida bisulcata*) were observed in Puohokamoa Stream. During the more recent surveys, alamoʻo was observed in the middle reach below diversions. Puohokamoa Stream rates in the middle in comparison to other watersheds in Maui and statewide. DAR assigns Puohokamoa a total watershed rating of 8 out of 10, a total biological rating of 5 out of 10, and a combined overall rating of 5 out of 10. Native species observed in the stream include:

> Fish – *Awaous guamensis* and *Lentipes concolor*
> Crustaceans – *Atyoida bisulcata*
> Insects – *Anax junius*, *Anax* sp, *Megalagrion* sp., and *Telmatogen* sp.

(Puohokamoa IFSAR § 4.2, p. 42 and § 4.4, p. 46; DAR Report on Puohokamoa Stream, Maui, Hawaiʻi, October 2009, p. 6.)

200. The estimated natural (undiverted) median baseflow of Puohokamoa Stream is 8.40 cfs (5.43 mgd). The amount of flow in Puohokamoa Stream needed to achieve H_{90} is 5.40 cfs (3.49 mgd). (Table attached to Gingerich WDT 10/31/14, p. 2; Exh. HO-1.)

ii. Outdoor recreational activities

201. The recreational resources of Puohokamoa Stream were classified as "substantial" by the Hawaii Stream Assessment regional recreational committee. The Hawaii Stream Assessment identified opportunities for hunting, swimming, and scenic views related to Puohokamoa. Of the three, only swimming was considered to be a high-quality experience. There is a hunting area of approximately 1.8 square miles or 56% of the Puohokamoa hydrologic unit, and it lies within the lower half of the hydrologic unit. (Puohokamoa IFSAR § 5.0, p. 54.)

iii. Maintenance of ecosystems such as estuaries, wetlands, and stream vegetation

202. Riparian resources of Puohokamoa Stream were classified as "substantial" by the Hawaii Stream Assessment. About 56% of Puohokamoa unit lies within the Ko'olau Forest Reserve, and less than 1% within the Waikamoi Preserve. Approximately 76% of Puohokamoa is classified as non-tidal palustrine wetlands occurring in the upper slopes of the hydrologic unit. Based on current designations, the Puohokamoa hydrologic unit contains critical habitat areas for five plant species: *Brighamia rochii* (Pua'ala), *Cyanea hamatiflora ssp. hamatiflora*, *Cyanea mceldowneyi*, *Diplazium molokaiense*, *Phyllostegia mannii*. The density of threatened and endangered plant species is high at elevations above 1,300 feet, while the rest of the unit, roughly 14%, has a low concentration of threatened and endangered plant species at lower elevations. (Puohokamoa IFSAR § 6.0, pp. 58-60.)

iv. Aesthetic values

203. Puohokamoa Stream is fed by lush native communities of Ohia forests and forested wetlands that dominate the upper and intermediate slopes of the hydrologic unit. Vegetation surrounding the lower reaches of Puohokamoa Stream is predominately alien forests that lie within the Ko'olau Forest Reserve. A number of waterfalls are located along the middle and lower reaches of the stream, most of which are followed by a plunge pool. Among the many waterfalls is Puohokamoa Falls that is about 20-foot high and it can be seen from Hana Highway. Keopuka Rock, a State seabird sanctuary, can be seen from the shoreline of the hydrologic unit. (Puohokamoa IFSAR § 7.0, p. 66.)

v. Navigation

204. No navigation values are present. (Puohokamoa IFSAR § 8.0, p. 68.)

vi. Instream hydropower generation

205. No instream hydropower generation values are present. (Puohokamoa IFSAR § 9.0, p. 69.)

vii. Maintenance of water quality

206. Puohokamoa Stream appears on the 2006 List of Impaired Waters in Hawai'i, Clean Water Act § 303(d). While some data exist for Puohokamoa, there were not sufficient data for decision-making; therefore, no decision was made pertaining to the attainment of water quality standards or the applicable designated uses. Puohokamoa Stream is classified as Class 1b inland waters from its headwaters to approximately 1,200 feet elevation, as the surrounding land is in the conservation subzone "protective." From there down to about 700 feet elevation, Puohokamoa Stream is classified as Class 1a inland waters because the stream lies in the Ko'olau Forest Reserve. From there to the sea, it is classified as Class 2 inland waters. Marine waters at the mouth of the Puohokamoa hydrologic unit are Class AA waters. (Puohokamoa § 10.0, p. 74.)

viii. Conveyance of irrigation and domestic water supplies to downstream points of diversion

207. Other than EMI's and MDWS' diversions, no diversions divert water from Puohokamoa Stream for domestic or irrigation purposes. The DOH Safe Drinking Water Branch does not currently regulate any public water systems in the Puohokamoa hydrologic unit. (Puohokamoa IFSAR § 11.0, p. 76.)

ix. Protection of traditional and customary Hawaiian rights

208. According to the 1990 Hawai'i Coastal Zone Management Program's *Hawaiian Fishpond Study for the Islands of Hawaii, Maui, Lanai, and Kauai*, there are no fishponds present in the Puohokamoa hydrologic unit. (Puohokamoa IFSAR § 12.0, p. 93.)

g. <u>Kuleana users</u>

209. CWRM records for the hydrologic unit of Puohokamoa indicate that there are a total of eight registered diversions (all EMI or MDWS). None of the diversions were declared for taro cultivation or other domestic purposes. Puohokamoa currently does not have any active taro diversions. (Puohokamoa IFSAR § 12.0, p. 93; Exh. C-90, p. 21.)

5. Haipua'ena (6049)

a. Physical features

210. The hydrologic unit of Haipua'ena is located north of Haleakala, and it covers an area of 1.6 square miles from the intermediate slopes of Haleakala at 6,100 feet elevation to the sea. (Haipua'ena IFSAR § 1.1, p. 1.)

211. Haipua'ena Stream is 7.7 miles in length, traversing north from its headwaters near 5,100 feet elevation to the altitude. (Haipua'ena IFSAR § 1.13, p. 1.)

212. When flow is abundant, Haipua'ena Stream terminates as a waterfall, allowing only 'ōpae and 'o'opu alamo'o to migrate upstream. (Haipua'ena IFSAR § 4.3, p. 43.)

b. Diversions

213. EMI operates diversions on Haipua'ena Stream at the Upper Kula Pipeline, Lower Kula Pipeline, Spreckels Ditch, Manuel Luis Ditch, and Ko'olau Ditch. (Haipua'ena IFSAR § 13.1 at 96-101, Table 13-1; Exh. C-33.)

214. Haipua'ena Stream is used to convey water from one ditch to another. (Exh. C-103, p. 20.)

c. Gaging stations

215. Four inactive USGS continuous-record gaging stations are in the hydrologic unit of Haipua'ena. (Haipua'ena IFSAR § 3.3, p. 27.)

d. Flow duration values

216. According to USGS, the natural median baseflow at the upper reach of Haipua'ena Stream immediately downstream of Spreckels Ditch is 3.60 cfs (1.94 mgd); at the middle-upper reach immediately downstream of the Manuel Luis Ditch it is 4.30 cfs (2.31 mgd); at the middle-lower reach it is 4.90 cfs (2.64 mgd); and at the lower reach it is 5.50 cfs (2.96 mgd). (Table attached to Gingerich WDT 10/31/14, p. 2; USGS Regression Study, p. 61 (Table 11) and p. 66 (Table 12).)

217. Near the coast, Haipua'ena Stream loses water and retains approximately 50% of the expected habitat availability. (Haipua'ena IFSAR § 4.3, p. 43.)

e. <u>Previous IIFS recommendations, CWRM action, and implementation actions</u>

218. In 2010, CWRM staff recommended that the IIFS for Haipua'ena Stream remain as designated on October 8, 1988, at an estimated flow of 0.10 cfs (0.07 mgd) below all EMI diversions and just above Hana Highway, near an altitude of 565 feet. (Exh. C-103, p. 21.)

219. CWRM staff did not recommend flow restoration for Haipua'ena Stream because it is used for conveyance of water from one ditch to another. Flow restoration is not recommended for conveyance streams because more water may exist in the portion of stream used for conveyance than would naturally occur. Moreover, commingled water exists for a considerable distance upstream of the diversion structures on the stream. CWRM staff believes that any IIFS should be based solely on the surface available within the given hydrologic unit. Any modification to the existing diversion infrastructure on the stream would result in more water being released than naturally occurs. (Exh. C-103, p. 20.)

220. In 2010, DAR recommended the release of a total of 2.50 cfs (1.35 mgd) into Haipua'ena Stream during the wet season to provide for minimum habitat flows for native species and 0.10 cfs (0.07 mgd) during the dry season to provide connectivity for such species.

DAR also recommended modifications to the ML-2 Manuel Luis Ditch and S-8 Spreckels Ditch diversion structures. Haipua'ena Stream replaced Honomanū Stream based a consensus among DAR, CWRM, Bishop Museum, and USGS that the reach from the waterfall at the head of the canyon to the seaward terminus of Honomanū Stream does not contain surface flow under base flow conditions. DAR determined that Haipua'ena Stream has the potential to recover 1.5 km of lost native species habitat although the diversion modification are more difficult. DAR ranked Haipua'ena Stream sixth in priority among the streams it recommended for restoration. (Appendix C to Higashi, WDT, p. 10.)

221. At its May 25, 2010 meeting, CWRM decided to adopt CWRM staff's recommendation to not modify the existing IIFS for Haipua'ena Stream of 0.10 cfs (0.07 mgd). (Exh. C-91, pp. 50, 52.)

f. Instream values

i. Maintenance of aquatic life and wildlife habitats

222. The Hawaii Stream Assessment classifies the aquatic resources of Haipuaena as "limited," meaning very little native species were present. The presence of a terminal waterfall has restricted most of the native species that lack climbing ability from inhabiting the stream. Only the native 'o'opu alamo'o (*Lentipes concolor*), 'o'opu nākea (*Awaous guamensis*), and 'ōpae kala'ole (*Atyoida bisulcata*) were observed in Haipua'ena Stream. Haipua'ena Stream rates in the middle in comparison to other watersheds in Maui and statewide. DAR assigns Haipua'ena a total watershed rating of 8 out of 10, a total biological rating of 5 out of 10, and a combined overall rating of 6 out of 10. Native species observed in the stream include:

Fish – *Awaous guamensis* and *Lentipes concolor*
Crustaceans – *Atyoida bisulcata*
Insects – *Megalagrion blackburni*, *Megalagrion calliphya*, *Megalagrion hawaiiense*, *Megalagrion pacificum*, *Megalagrion* sp., and *Telmatogen* sp.

(Haipua'ena IFSAR § 4.4, pp. 41, 45; DAR Report on Haipua'ena Stream, Maui, Hawai'i, October 2009, p. 6.).

223. The estimated natural (undiverted) median baseflow of Haipua'ena Stream is 4.30 cfs (2.78 mgd). The amount of flow in Haipua'ena Stream needed to achieve H_{90} is 2.80 cfs (1.81 mgd). (Table attached to Gingerich WDT 10/31/14, p. 2; Exh. HO-1.)

ii. Outdoor recreational activities

224. The recreational resources of Haipua'ena Stream were classified as "moderate" by the Hawaii Stream Assessmentt's regional recreational committee. The Hawaii Stream Assessment identified opportunities for hunting, swimming, and scenic views related to Haipuaena. Of the three, none was considered to be a high-quality experience. (Haipuaena IFSAR § 5.0, p. 53.)

iii. Maintenance of ecosystems such as estuaries, wetlands, and stream vegetation

225. Riparian resources of Haipua'ena Stream were not classified by the Hawaii Stream Assessment. In Haipua'ena, about 53% of the unit lies within the Ko'olau Forest Reserve, and about 6% within the Waikamoi Preserve. Approximately 58% of Haipua'ena is classified as non-tidal palustrine wetlands occuring in the upper slopes of the hydrologic unit. (Haipua'ena IFSAR § 6.0, pp. 57-59.)

iv. Aesthetic values

226. Haipua'ena Stream is fed by lush native communities of Ohia forests and forested wetlands that dominate the upper and intermediate slopes of the hydrologic unit. Vegetation surrounding the lower reaches of Haipua'ena Stream is predominately alien forests that lie within the Ko'olau Forest Reserve. Of the three waterfalls located along Haipuaena Stream, two are located in the middle reach and one is located in the lower reach that can be seen from Hana

Highway. Keopuka Rock, a State seabird sanctuary, can be seen from the shoreline of the hydrologic unit. (Haipua'ena IFSAR § 7.0, p. 65.)

v. Navigation

227. There are no navigation values present. (Haipua'ena IFSAR § 8.0, p. 67.)

vi. Instream hydropower generation

228. HC&S operates three run-of-river hydroelectric facilities on the Wailoa Ditch, which is supplied with water from several sources including Haipua'ena Stream. (Haipua'ena IFSAR § 9.0, p. 68.)

vii. Maintenance of water quality

229. Haipua'ena Stream appears on the 2006 List of Impaired Waters in Hawai'i, Clean Water Act § 303(d). While some data exist for Haipua'ena Stream, there were not sufficient data for decision-making; therefore, no decision was made pertaining to the attainment of water quality standards or the applicable designated uses. Haipua'ena Stream is classified as Class 1b inland waters from its headwaters to approximately 1,200 feet elevation, as the surrounding land is in the conservation subzone "protective." From there down to about 700 feet elevation, Haipua'ena Stream is classified as Class 1a inland waters because the stream lies in the Ko'olau Forest Reserve. From there to the sea, it is classified as Class 2 inland waters. Marine waters at the mouth of the Haipua'ena hydrologic unit are Class AA waters. (Haipua'ena IFSAR § 10.0, pp. 72-74.)

viii. Conveyance of irrigation and domestic water supplies to downstream points of diversion

230. The State Division of State Parks registered a diversion for the purpose of providing non-potable waer to the comfort station at the Kaumahina State Wayside. Approximately 5,000 to 8,000 gpd of water is diverted via a 2-in. pipe to a 10,000 gallon holding

tank. The DOH Safe Drinking Water Branch does not currently regulate any public water systems in the Haipua'ena hydrologic unit. (Haipuaena IFSAR § 11.0, p. 75.)

ix. Protection of traditional and customary Hawaiian rights

231. According to the 1990 Hawai'i Coastal Zone Management Program's *Hawaiian Fishpond Study for the Islands of Hawaii, Maui, Lanai, and Kauai*, there are no fishponds present in the Puohokamoa hydrologic unit. (Haipua'ena IFSAR § 12.0, p. 92.)

g. Kuleana users

232. CWRM records for the hydrologic unit of Haipua'ena indicate that there are a total of five registered diversions (4 EMI or MDWS, 1 by Hawai'i Divisions of State Parks for non-potable use at its comfort station in Kaumahina State Wayside). None of the diversions were declared for taro cultivation or other domestic purposes. (Haipua'ena IFSAR § 12.0, p. 86.)

6. Punalau (6050)

a. Physical features

233. The hydrologic unit of Punalau is located north of Haleakala, and it covers an area of 1.2 square miles from the lower slopes of Haleakala at 2,558 feet elevation to the sea. (Punalau IFSAR § 1.1, p. 1.)

234. Punalau Stream runs 3 miles in length, traversing northeast from its headwater tributary Kolea Stream at 2,050 feet elevation to the ocean. (Punalau IFSAR § 3.3, p. 27.)

b. Diversions

235. EMI operates diversions on Punalau Stream at Ko'olau/Wailoa Ditch. EMI operates diversions on Kolea Stream at Manuel Luis Ditch and Spreckels Ditch. (Exh. C-90, p. 23; Exh. C-33.)

c. Gaging stations

236. Two inactive USGS gaging stations were located in the hydrologic unit of Punalau.

A. Station 16529000 was located at Spreckels Ditch on tributary Kolea Stream. (Punalau IFSAR § 3.3, p. 28.)

B. Station 16535000 is located at about 1,880 feet elevation, where water was diverted from Haipuaena Stream into tributary Kolea Stream from 1938 to 1960 to generate electricity. (Punalau IFSAR § 3.3, p. 28.)

d. Flow duration values

237. According to USGS, the natural median baseflow at the middle reach of Punalau Stream is 3.90 cfs (2.10 mgd); at the lower reach it is 4.50 cfs (2.42 mgd). (Table attached to Gingerich WDT 10/31/14, p. 2; USGS Regression Study, p. 61 (Table 11) and p. 66 (Table 12).)

e. Previous IIFS recommendations, CWRM action, and implementation actions

238. In 2010, CWRM staff recommended that the IIFS for Punalau Stream remain as designated on October 8, 1988, at an estimated flow of 0.20 cfs (0.13 mgd) below all EMI diversions and just above Hana Highway, near an altitude of 565 feet. (Exh. C-103, p. 21.)

239. CWRM staff did not recommend flow restoration for Punalau Stream because restoration of additional flow would not result in significant biological return in this stream. (Exh. C-103, p. 20).

240. Puanalau Stream was not among the streams recommended for restoration by DAR.

241. At its May 25, 2010 meeting, CWRM decided to adopt CWRM staff's recommendation to not modify the existing IIFS for Punalau Stream of 0.20 cfs (0.13 mgd). (Exh. C-91, pp. 50, 52.)

f. Instream values

i. ***Maintenance of aquatic life and wildlife habitats***

242. For Punalau Stream, the Hawaii Stream Assessment classifies the aquatic resources as "limited", meaning very little or no native species were present. Only the native ʻoʻopu nākea (*Awaous guamensis*) and ʻoʻopu nōpili (*Sicyopterus stimpsoni*) were observed in Punalau Stream. While no native species were observed during the more recent surveys, the ʻoʻopu nākea were seen in the upper and lower reaches and the ʻoʻopu nōpili were seen in the middle reach of the stream in earlier surveys. Introduced species such as river prawns (*Macrobrachium lar*) were observed in the lower reach. Punalau Stream rates average in comparison to other watersheds in Maui and statewide. DAR assigns Punalau a total watershed rating of 7 out of 10, a total biological rating of 5 out DAR assigns Haipuaena a total watershed rating of 5 out of 10, a total biological rating of 5 out of 10, and a combined overall rating of 5 out of 10. Native species observed in the stream include:

Fish – *Awaous guamensis* and *Sicyopterus stimpsoni*
Insects – *Megalagrion blackburni*, *M. hawaiiense* and *M. pacificum*

(Punalau IFSAR § 4.2, pp. 37, 41; DAR Report on Punalau Stream, Maui, Hawaiʻi, October 2009, pp. 5-6.).

243. The estimated natural (undiverted) median baseflow of Punalau Stream is 3.90 cfs (2.52 mgd). The amount of flow in Punalau Stream needed to achieve H_{90} is 2.50 cfs (1.62 mgd). (Table attached to Gingerich WDT 10/31/14, p. 2; Exh. HO-1.)

ii. ***Outdoor recreational activities***

244. The recreational resources of Punalau Stream were classified as "limited" by the Hawaii Stream Assessment's regional recreational committee. The Hawaii Stream Assessment did not identify any recreational opportunities. (Punalau IFSAR § 5.0, p. 47.)

iii. ***Maintenance of ecosystems such as estuaries, wetlands, and stream vegetation***

245. Riparian resources of Punalau Stream were not classified by the Hawaii Stream Assessment. Nearly 92% of the Punalau hydrologic unit lies within the Ko'olau Forest Reserve, and about 1% within the Kaumahina State Wayside. Approximately 47% of Punalau is classified as non-tidal palustrine wetlands occurring in the upper slopes of the hydrologic unit. (Punalau IFSAR § 6.0, p. 54.)

iv. Aesthetic values

246. Punalau Stream is fed by lush native communities of Ohia forests and forested wetlands that dominate the upper slopes. In the intermediate and lower slopes, vegetation surrounding the stream is mostly alien forests. Almost the entire hydrologic unit of Punalau lies within the Ko'olau Forest Reserve, with the exception of the shoreline. Punalau Falls is located near Hana Highway, and it is publicly accessible. Punalau Stream empties into Honomanū Bay, where a number of coastal activities are enjoyed by the public in addition to being a popular surf spot. Located at the west end of the hydrologic unit is Kaumahina State Wayside, which offers great views of the northeast Maui coastline and the Ke'anae Peninsula. (Punalau IFSAR § 7.0, p. 59.)

v. Navigation

247. No navigation values are present. (Punalau IFSAR § 8.0, p. 61.)

vi. Instream hydropower generation

248. HC&S operates three run-of-river hydroelectric facilities on the Wailoa Ditch, which is supplied with water from several sources included Punalau Stream and tributary Kolea Stream. (Punalau IFSAR § 9.0, p. 62.)

vii. Maintenance of water quality

249. Punalau Stream appears on the 2006 List of Impaired Waters in Hawai'i, Clean Water Act § 303(d). While some data exist for Punalau Stream, there were not sufficient data for

decision-making; therefore, no decision was made pertaining to the attainment of WQS or the applicable designated uses. Punalau Stream is classified as Class 1b inland waters from its headwaters to approximately 1,200 feet elevation, as the surrounding land is in the conservation subzone "protective", and it is part of the Ko'olau Forest Reserve. From there down to about 300 feet elevation, Punalau Stream is classified as Class 1a inland waters because the stream lies in the Ko'olau Forest Reserve. From there to the sea, it is classified as Class 2 inland waters. Marine waters at the mouth of the Punalau hydrologic unit are Class AA waters. (Punalau IFSAR § 10.0, pp. 65-66, 74.)

viii. Conveyance of irrigation and domestic water supplies to downstream points of diversion

250. All three registered diversions are owned by EMI. The DOH Safe Drinking Water Branch does not currently regulate any public water systems in the Punalau hydrologic unit. (Punalau IFSAR § 11.0, p. 67.)

ix. Protection of traditional and customary Hawaiian rights

251. According to the 1990 Hawai'i Coastal Zone Management Program's *Hawaiian Fishpond Study for the Islands of Hawaii, Maui, Lanai, and Kauai*, there are no fishponds present in the Punalau hydrologic unit. (Punalau IFSAR § 12.0, p. 86.)

g. Kuleana users

252. None of the registered diversions were declared for taro cultivation or other domestic purposes. (Punalau IFSAR § 12.0, p. 86.)

7. Honomanū (6051)

a. Physical features

253. The hydrologic unit of Honomanū covers an area of 5.6 square miles from the upper slopes of Haleakala at about 8,700 feet elevation to the sea. (Honomanū IFSAR § 1.1, p. 1.)

254. Honomanū Stream is 8.7 miles in length, traversing northeast from its headwaters at about 8,700 feet elevation. (Honomanū IFSAR § 1.1, p. 1.)

b. Diversions

255. EMI operates diversions on Honomanū Stream at Spreckels Ditch, Lower Kula Pipeline, and Center Ditch. (Honomanū IFSAR § 13.1, pp. 100-110, Figure 13-1; Exh. C-33.)

c. Gaging stations

256. Four inactive USGS stream gaging stations are located in the hydrologic unit of Honomanū, two of which are long-term continuous-record gaging stations. (Honomanū IFSAR at § 3.3, p. 28.)

d. Flow duration values

257. According to USGS, the natural median baseflow at the upper reach of Honomanu directly downstream of the Spreckels Ditch is 2.80 cfs (1.81 mgd); at the middle reach it is 6.70 cfs (3.61 mgd); and at the lower reach it is 9.00 cfs (4.84 mgd). (Table attached to Gingerich WDT 10/31/14, p. 2; USGS Regression Study, p. 61 (Table 11) and p. 65 (Table 12).)

e. Previous IIFS recommendations, CWRM action, and implementation actions

258. In 2010, CWRM staff recommended that the IIFS for Honomanū Stream remain as designated on October 8, 1988, at an estimated flow of 0 cfs below all EMI diversions and just above Hana Highway, near an altitude of 20 feet. (Exh. C-103, p. 21.)

259. CWRM staff did not recommend flow restoration for Honomanū Stream because restoration of additional flow would not result in significant biological return in this stream. (Exh. C-103, p. 20).

260. Honomanū Stream was not among the streams recommended for restoration by DAR in 2010. DAR originally ranked Honomanū Stream first priority among the streams it recommended for restoration, but replaced Honomanū Stream with Haipua'ena Stream after DAR, CWRM, Bishop Museum, and USGS reached consensus that the reach from the waterfall at the head of the canyon to the seaward terminus of Honomanū Stream does not contain surface flow under base flow conditions. (Appendix C to Higashi, WDT, p. 10.)

261. At its May 25, 2010 meeting, CWRM decided to adopt CWRM staff's recommendation to not modify the existing IIFS for Honomanū Stream of 0 cfs. (Exh. C-91, pp. 50, 52.)

f. <u>Instream values</u>

i. Maintenance of aquatic life and wildlife habitats

262. For Honomanū Stream, the Hawai'i Stream Assessment classifies the aquatic resources as limited, meaning very little native species were present. While the available instream habitats were limited, a number of native stream animals were observed in Honomanū Stream, including 'o'opu nākea (*Awaous guamensis*), 'o'opu akupa (*Eleotris sandwicensis*), 'o'opu alamo'o (*Lentipes concolor*), 'ōpae kala'ole (*Atyoida bisulcata*), hīihīwai (*Neritina granosa*), and hapawai (*Neritina vespertina*). During the more recent surveys, both freshwater snail species and the 'o'opu akupa were observed near the stream mouth and the 'o'opu nākea were seen in the lower and middle reaches (below diversions). The 'o'opu alamo'o and 'ōpae kala'ole were observed in the upper reach (above diversions); although the 'ōpae kala'ole had been seen in the headwaters during earlier surveys. Cast net sampling of the estuary at

Honomanū resulted in catches of endemic aholehole (*Kuhlia xenura*), Iao (*Atherinomorus insularum*), Kanda mullet (*Valamugil engeli*), and indigenous amaama (*Mugil cephalus*). Honomanū Stream rates high in comparison to other watersheds in Maui and statewide. DAR assigns Honomanū a total watershed rating of 8 out of 10, a total biological rating of 7 out of 10, and a combined overall rating of 8 out of 10. Native species observed in the stream include:

> Fish – *Awaous guamensis*, *Eleotris sandwicensis*, *Kuhlia xenura*, *Lentipes concolor*, and *Mugil cephalus*
> Crustaceans – *Atyoida bisulcata*
> Insects – *Anax junius*, *Anax* sp., *Megalagrion hawaiiense*, *Megalagrion* sp., and *Telmatogen* sp.
> Snails – *Neritina vespertina* and *Neritina granosa*

(Honomanū IFSAR §§ 4.2, p. 42 and § 4.4, pp. 47, 48; Exh. C-143, p. 6.)

263. The estimated natural (undiverted) median baseflow of Honomanū Stream is 2.80 cfs (1.81 mgd). The amount of flow in Honomanū Stream needed to achieve H_{90} is 1.80 cfs (1.16 mgd). (Table attached to Gingerich WDT 10/31/14, p. 2; Exh. HO-1.)

ii. Outdoor recreational activities

264. The recreational resources of Honomanū Stream were classified as "outstanding" by the Hawaii Stream Assessment's regional recreational committee. The HAS identified opportunities for camping, hiking, fishing, hunting, swimming, and scenic views related to Honomanū Stream. Of the six, only scenic views were considered to be a high-quality experience. (Honomanū IFSAR § 5.0, p. 56.)

iii. Maintenance of ecosystems such as estuaries, wetlands, and stream vegetation

265. Riparian resources of Honomanū Stream were classified as "outstanding" by the Hawaii Stream Assessment. About 45% of the hydrologic unit of Honomanū lies within the Ko'olau Forest Reserve, 17% in the Waikamoi Preserve, and about 4% within the Haleakala National Park. Approximately 59% of Honomanū is classified as non-tidal palustrine wetland

wetlands occurring in the upper slopes of the hydrologic unit. (Honomanū IFSAR § 6.0, pp. 60-62.)

iv. Aesthetic values

266. The headwaters of Honomanū Stream originate in Haleakala National Park where vegetation is predominately native shrub lands with sparse alien grasses. In the intermediate slopes of the hydrologic unit, Honomanū Stream flows through native communities of Ohia forests and Uluhe shrub lands that lie within the Waikamoi Preserve and Ko'olau Forest Reserve. The lower elevations are mostly alien forests of the Ko'olau Forest Reserve. A number of waterfalls and plunge pools are located along the middle reach of Honomanū Stream, which provide great scenic spots for the public. The stream empties into Honomanū Bay, where a number of coastal activities are enjoyed by the public in addition to being a popular surf spot. (Honomanū IFSAR § 7.0, p. 69.)

v. Navigation

267. No navigation values are present. (Honomanū IFSAR § 8.0, p. 71.)

vi. Instream hydropower generation

268. HC&S operates three run-of-river hydroelectric facilities on the Wailoa Ditch, which is supplied with water from several sources including Honomanū and its tributaries. (Honomanū IFSAR § 9.0, p. 72.)

vii. Maintenance of water quality

269. Honomanū Stream appears on the 2006 List of Impaired Waters in Hawai'i, Clean Water Act § 303(d). While some data exist for Honomanū Stream, there were not sufficient data for decision-making; therefore, no decision was made pertaining to the attainment of water quality standards or the applicable designated uses. Honomanū Stream is classified as Class 1a inland waters from its headwaters to the 6,200 feet elevation, and from 1,700 feet to 100 feet

elevation as parts of the stream lie in the Waikamoi Preserve (upper reaches) and the Ko'olau Forest Reserve (lower reaches). Between the 6,200 feet and 1,700 feet altitudes, the stream is classified as Class 1b inland waters because the surrounding land is in the conservation subzone "protective." The stream reach near the ocean is classified as Class 2 inland waters. Marine waters at the mouth of the hydrologic unit of Honomanū are Class AA waters. (Honomanū IFSAR § 10.0, pp. 76-78.)

viii. Conveyance of irrigation and domestic water supplies to downstream points of diversion

270. There 8 registered diversions in Honomanū, of which five are EMI diversions and one was registered by both EMI and MDWS. The two remaining diversions were registered by Haleakala Ranch for the primary purpose of watering livestock (6,000 to 7,000 heads of cattle) with occasional use for domestic purposes at two cabins on the property. (Honomanū IFSAR § 11.0, p. 80.)

ix. Protection of traditional and customary Hawaiian rights

271. According to the 1990 Hawai'i Coastal Zone Management Program's *Hawaiian Fishpond Study for the Islands of Hawaii, Maui, Lanai, and Kauai*, there are no fishponds present in the Honomanū hydrologic unit. (Honomanū IFSAR § 12.0, p. 97.)

g. <u>Kuleana users</u>

272. CWRM records for the hydrologic unit of Honomanū indicate that there are a total of 8 registered diversions. None of the diversions were declared for taro cultivation. (Honomanū IFSAR § 12.0, p. 91.)

8. <u>Nua'ailua (6052)</u>

a. <u>Physical features</u>

273. The hydrologic unit of Nua'ailua covers an area of 1.6 square miles from the lower slopes of Haleakala at 2,400 feet elevation to the sea. (Nua'ailua IFSAR § 1.1, p. 1.)

274. Nua'ailua Stream is 3.2 miles in length, traversing north from its headwaters near the 2,250 feet altitude to the ocean. (Nua'ailua IFSAR § 1.1, p. 1.)

b. <u>Diversions</u>

275. EMI operates diversions on Nua'ailua Stream at Spreckels Ditch. (Nua'ailua IFSAR § 13.1, pp. 95-96, Table 13-2; Exh. C-33.)

c. <u>Gaging stations</u>

276. There are no stream gaging stations within the hydrologic unit. (Nua'ailua IFSAR § 3.3, p. 29.)

d. <u>Flow duration values</u>

277. According to USGS, the natural median baseflow at the upper reach of Nua'ailua Stream directly downstream of the Spreckels Ditch is 0.28 cfs (0.18 mgd); at the middle reach it is 2.50 cfs (1.35 mgd); and at the lower reach it is 7.40 cfs (3.98 mgd). (Table attached to Gingerich WDT 10/31/14, p. 2; USGS Regression Study, p. 61 (Table 11) and p. 65 (Table 12).)

e. <u>Previous IIFS recommendations, CWRM action, and implementation actions</u>

278. In 2010, CWRM staff recommended that the IIFS for Nua'ailua Stream remain as designated on October 8, 1988, at an estimated flow of 3.10 cfs (2.00 mgd) below all EMI diversions and just above Hana Highway, near an altitude of 110 feet. (Exh. C-103, p. 22.)

279. CWRM staff did not recommend flow restoration for Nua'ailua Stream because restoration of additional flow would not result in significant biological return in this stream. (Exh. C-103, p. 20).

280. Nua'ailua Stream was not among the streams recommended for restoration by DAR in 2010.

281. At its May 25, 2010 meeting, CWRM decided to adopt CWRM staff's recommendation to not modify the existing IIFS for Nua'ailua Stream of 3.10 cfs (2.00 mgd). (Exh. C-91, pp. 50, 52.)

f. Instream values

i. Maintenance of aquatic life and wildlife habitats

282. For Nua'ailua Stream, the Hawaii Stream Assessment classifies the aquatic resources as "limited", meaning very little native species were present. While the available instream habitats were limited, a number of native stream animals were observed in Nua'ailua Stream, including 'o'opu nākea (*Awaous guamensis*), 'o'opu nōpili (*Sicyopterus stimpsoni*), 'o'opu akupa (*Eleotris sandwicensis*), 'o'opu alamo'o (*Lentipes concolor*), 'ōpae kala'ole (*Atyoida bisulcata*), hīhīwai (*Neritina granosa*), and hapawai (*Neritina vespertina*). During the more recent surveys, almost all these stream animals were observed in the lower and middle reaches (below diversions). The 'ōpae kala'ole had been seen in the upper reach during earlier surveys. Cast net sampling of the stream mouth at Nua'ailua resulted in catches of the endemic Hawaiian surf fish (*Iso hawaiiensis*) and aholehole (*Kuhlia xenura*). No flow was observed from the stream to the small coastal embayment. Nua'ailua Stream rates high in comparison to other watersheds in Maui and statewide. DAR assigns Haipuaena a total watershed rating of 7 out of 10, a total biological rating of 7 out of 10, and a combined overall rating of 8 out of 10. Native species observed in the stream include:

> Fish – *Awaous guamensis*, *Eleotris sandwicensis*, *Gobiid sp. Kuhlia xenura*, *Lentipes concolor*, and *Sicyopterus stimpsoni*
> Crustaceans – *Atyoida bisulcata*
> Insects – *Anax junius*, *Anax* sp., and *Megalagrion* sp.
> Mollusks – *Neritina vespertina* and *Neritina granosa*

(Nua'ailua IFSAR §§ 4.2, p. 39 and § 4.4, p. 43; Exh. C-146, p. 5.)

283. The estimated natural (undiverted) median baseflow of Nua'ailua Stream is 0.28 cfs (0.18 mgd). The amount of flow in Nua'ailua Stream needed to achieve H_{90} is 0.18 cfs (0.12 mgd). (Table attached to Gingerich WDT 10/31/14, p. 2; Exh. HO-1.)

ii. Outdoor recreational activities

284. The recreational resources of Nua'ailua Stream were classified as "substantial" by the Hawaii Stream Assessment's regional recreational committee. The Hawaii Stream Assessment identified opportunities for hiking, fishing, and scenic views related to Nua'ailua Stream. Of the three, only fishing was considered to be a high-quality experience. (Nua'ailua IFSAR § 5.0, p. 50.)

iii. Maintenance of ecosystems such as estuaries, wetlands, and stream vegetation

285. Riparian resources of Nua'ailua Stream were not classified by the Hawaii Stream Assessment. In Nua'ailua, nearly 90% of the unit lies within the Ko'olau Forest Reserve. Approximately 42% of Nua'ailua is classified as non-tidal palustrine wetlands occurring in the upper slopes of the hydrologic unit. (Nua'ailua IFSAR § 6.0, pp. 54-55.)

iv. Aesthetic values

286. Nua'ailua Stream is fed by lush native communities of Ohia forests that dominate the upper slopes. In the intermediate and lower slopes, vegetation surrounding the stream is mostly alien forests. Almost the entire hydrologic unit of Nua'ailua lies within the Ko'olau Forest Reserve, with the exception of the shoreline. Two waterfalls are located in the upper reaches of Nua'ailua Stream, which are not visible from Hana Highway but do provide great scenic spots for the occasional adventurer. The stream empties into Nua'ailua Bay, where a number of coastal activities are enjoyed by the locals as well as the public. Located in the west

end of the hydrologic unit is Kapapa Point and the east end is Ke'anae Point, both of which offer views of Nua'ailua Bay and the islet Mokuholua. (Nua'ailua IFSAR § 7.0, p. 62.)

v. Navigation

287. No navigation values are present. (Nua'ailua IFSAR § 8.0, p. 64.)

vi. Instream hydropower generation

288. HC&S operates three run-of-river hydroelectric facilities on the Wailoa Ditch, which is supplied with water from several sources including Nua'ailua Stream. (Nua'ailua IFSAR § 9.0, p. 65.)

vii. Maintenance of water quality

289. Nua'ailua Stream does not appear on the 2006 List of Impaired Waters in Hawai'i, Clean Water Act § 303(d). While some data exist for Nua'ailua Stream, there were not sufficient data for decision-making; therefore, no decision was made pertaining to the attainment of water quality standards or the applicable designated uses. Nua'ailua Stream is classified as Class 1b inland waters from its headwaters to approximately 1,600 feet elevation, as the surrounding land is in the conservation subzone "protective." From there down to the sea, Nua'ailua Stream is classified as Class 2 inland waters. Marine waters at the mouth of the Nua'ailua hydrologic unit are Class AA waters. (Nua'ailua IFSAR § 10.0, pp. 69-70.)

viii. Conveyance of irrigation and domestic water supplies to downstream points of diversion

290. Two diversions divert water for domestic or irrigation purposes (one for EMI, and the other for Maui Family YMCA for the purpose of irrigating taro and flowers; however, this diversion is inactive). The DOH Safe Drinking Water Branch does not currently regulate any public water systems in the Nua'ailua hydrologic unit. (Nua'ailua IFSAR § 11.0, p. 72.)

ix. Protection of traditional and customary Hawaiian rights

291. According to the 1990 Hawai'i Coastal Zone Management Program's *Hawaiian Fishpond Study for the Islands of Hawaii, Maui, Lanai, and Kauai*, there are no fishponds present in the Nua'ailua hydrologic unit. (Nua'ailua IFSAR § 12.0, p. 90.)

g. Kuleana users

292. CWRM records for the hydrologic unit of Nua'ailua indicate that there are no diversions declared for taro cultivation or other domestic purposes. (Nua'ailua IFSAR § 12.0, p. 84.)

9. Pi'ina'au (6053)

a. Physical features

293. The hydrologic unit of Pi'ina'au is located on the northeast slope of Haleakala. It covers an area of 22 square miles from the summit of Haleakala at 10,000 feet to the sea. (Pi'ina'au IFSAR § 1.0, p. 1.)

294. Pi'ina'au Stream is 13.1 miles in length, traversing in a northeasterly direction from its headwaters originating in the Waikamoi Preserve to Waialohe Pond before entering the ocean. A tributary to Pi'ina'au Stream is Palauhulu Stream, which is 4.8 miles in length. It is fed perennially by the Ko'olau Forest Reserve and flows through Keahu Falls, Waiokuna Falls, and the Waiokuna Pond before joining with Pi'ina'au Stream. (Pi'ina'au IFSAR § 1.0, p. 1.)

b. Diversions

295. EMI operates the Ko'olau Ditch on Pi'ina'au Stream and Palauhulu Stream. (Pi'ina'au IFSAR § 13.0, p. 97; Exh. C-33.)

c. Gaging stations

296. There is an inactive USGS gaging station at the Ko'olau Ditch near Pi'ina'au Stream, Station 16523000. There is an inactive USGS continuous-record gaging stations on

Palauhulu Stream upstream of the confluence with Pi'ina'au Stream, Station 16522000. (Pi'ina'au IFSAR § 13.0, pp. 112, 113.)

d. Flow duration values

297. USGS did not make estimates of flow-duration statistics for natural (undiverted) streamflow for Pi'ina'au Stream because no flow data were available and the regression equations were not applicable to this intermittent stream. Furthermore, all three of the basin characteristics that were used in the regression equations fall outside the range of values used to develop the equations, thus rendering any estimate unreliable. (USGS Regression Study, p. 58, 63; Gingerich, WDT 10/31/14, Table attached thereto, p. 2.)

298. Palauhulu Stream loses water in its middle reach. The average flow of Plunkett Spring at the middle reach below Ko'olau Ditch is 2.7 cfs, but the stream goes dry above Store Spring due to infiltration losses, so the effects of natural flow addition are unknown. (Pi'ina'au IFSAR, p. 32 (Table 3-1); Exh. C-85, p. 30.)

299. According to USGS, the natural median baseflow at Hauoli Wahine Stream, the western tributary of Palauhulu Stream, before the Ko'olau Ditch (station HWU), is 0.93 cfs (0.50 mgd); at Kano Stream, the eastern tributary of Palauhulu Stream, before the Ko'olau Ditch (station KoU), it is 2.50 cfs (1.35 mgd); at the middle reach, below Plunkett Spring and above Store Spring (station PhM), it is 9.30 cfs (15.77 mgd); and at the lower reach, below Store Spring (station 5220), it is 11.00 cfs (5.92 mgd). (Exh. C-85, p. 36; USGS Regression Study, p. 61 (Table 11).)

e. Previous IIFS recommendations, CWRM action, and implementation actions

300. In 2008, CWRM staff recommended that CWRM set an IIFS A that keeps the status quo at the lower reach of Pi'ina'au Stream near 40 feet elevation, upstream from the

confluence of Pi'ina'au and Palauhulu Streams (the location of ungaged site PiL). The rationale for the recommendation was as follows:

> The complex geology and hydrology of Piinaau Stream makes the determination of an interim IFS particularly challenging. Much of Piinaau Stream, especially in higher elevations, is inaccessible due to the complex geomorphology of Keanae Valley, as well as the occurrence of a large landslide in 2001 that covered the stream from 1,000 feet to 600 feet elevation, a large section below Koolau Ditch. The landslide complicates the flow characteristics in the stream; therefore, streamflow data collected by USGS in 2003 is questionable in regards to its representation of normal flow in the stream. Whether the stream is gaining or losing ground water flow cannot be determined because of inaccessibility of the stream and the lack of reliable streamfiow data. A flow value cannot be determined with such large uncertainty in the hydrologic data.
>
> With the current flow, Piinaau Stream exhibits a rich native species diversity, most of which was observed in Waialohe Pond. The benefits of flow increase to native species population and diversity are uncertain due to the presence of a waterfall above Waialohe Pond, which restricts upstream migration of certain native amphidromous species. Furthermore, the stream also offers a variety of recreational and aesthetic opportunities with the current flow. There are only two registered diversions currently diverting water on Piinaau, and neither has indicated a lack of water availability. Considering the current streamflow conditions and the uncertainty of the limited hydrologic data available for Piinaau Stream, the Commission proposes that the interim IFS be set at status quo.

(Exh. C-85, p. 33.)

301. CWRM staff also recommended that CWRM set an IIFS B of 5.50 cfs (3.56 mgd) at the lower reach of Palauhulu Stream near 80 feet elevation, upstream from confluence of Pi'ina'au and Palauhulu Streams (the location of the site PhL). The rationale for the recommendation was as follows:

> Under the current flow conditions, Palauhulu Stream offers a variety of recreational and aesthetic opportunities, including Waiokuna and Keaku Falls, which are located in the more accessible lower reaches of the stream. Regarding stream biota, the stream has rich native species diversity, which is mostly observed in Waialohe Pond. However, the presence of dewatered sections in the middle and lower reaches of the stream, possibly caused by upstream diversions, may affect habitat availability for native species. The stream currently supports taro cultivation in the Keanae peninsula (via the Keanae Flume), as well as cultivation of other crops and livestock. The stream also supports a number of domestic uses. Palauhulu Stream is an important source of irrigation water for

> EMI, with a total of five major diversions and five minor diversions on the stream and its tributaries.
>
> Staff believes that partial flow should be restored to the stream in order to balance the instream and noninstream uses of stream water. Flow restoration would increase the continuity of flow in the stream, which would enhance habitat availability and native species diversity. Restoration of flow in the stream would also benefit the surface water users downstream from Koolau Ditch. Furthermore, Keanae peninsula has the potential for more taro cultivation, as well as traditional and gathering practices, both of which increase surface water demand.

(Exh. C-85, p. 34.)

302. CWRM staff did not recommend setting a second IIFS near the stream mouth because under current conditions, the amount of water flowing from Pi'ina'au Stream and Palauhulu Stream into the estuary, Waialohe Pond, is deemed adequate. (Exh. C-85, p. 35.)

303. CWRM adopted CWRM staff's recommendation as to Pi'ina'au Stream and Palauhulu Stream at its September 24-25, 2008 meeting. (Exh. C-89, p. 31.)

304. Since 2010, EMI has not diverted Palauhulu Stream during low flows. (Hew, WDT, 2/10/15, at ¶ 2.)

f. <u>Instream values</u>

i. Maintenance of aquatic life and wildlife habitats

305. For Pi'ina'au Stream, the Hawai'i Stream Assessment classifies the aquatic resources as outstanding. Pi'ina'au was noted for the presence of 'o'opu alamo'o (*L. concolor*), 'o'opu nākea (*A. stamineus*), 'o'opu nōpili (*S. stimpsoni*), and hīhīwai (*N. granosa*), along with one other species from its defined Native Species Group Two. Pi'ina'au Stream rates high in comparison to other watersheds in Maui and statewide. DAR assigns Pi'ina'au 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:

> Fish – *Awaous guamensis*, *Eleotris sandwicensis*, *Kuhlia sp. Lentipes concolor*, *Sicyopterus stimpsoni*, and *Stenogobius hawaiiensis*

Crustaceans – *Atyoida bisulcata* and *Macrobrachium grandimanus*
Mollusks – *Ferrissia sharpi*, *Neritina vespertina* and *Neritina granosa*

(Pi'ina'au IFSAR § 4.0, p. 36; Exh. C-142, pp. 1-2.)

306. The estimated natural (undiverted) median baseflow of Palauhulu Stream is 3.40 cfs (2.20 mgd). The amount of flow in Palauhulu Stream needed to achieve H_{90} is 2.20 cfs (1.42 mgd). The estimated natural (undiverted) median baseflow of Pi'ina'au Stream is unknown, and therefore, the amount of flow in the stream needed to achieve H_{90} is also unknown. (Table attached to Gingerich WDT 10/31/14, p. 2; Exh. HO-1.)

ii. Outdoor recreational activities

307. The recreational resources of Pi'ina'au Stream were classified as outstanding by the Hawaii Stream Assessment's regional recreational committee. The Hawaii Stream Assessment identified opportunities for hiking, fishing, swimming, hunting, nature study, and scenic views related to Pi'ina'au Stream. Of the six, five were considered to be high-quality experiences. CWRM identified the following activities known to occur or observed at or near Pi'ina'au: pole and line fishing, spear fishing, throw netting, opihi picking, gill netting, and some specialized fisheries. (Pi'ina'au IFSAR § 5.0, p. 43.)

iii. Maintenance of ecosystems such as estuaries, wetlands, and stream vegetation

308. Riparian resources of Pi'ina'au Stream were classified as outstanding by the Hawaii Stream Assessment. In Pi'ina'au, there are three large management areas—Haleakala National park, Ko'olau Forest Preserve, and Waikamoi Preserve—which comprise over 85% of the hydrologic unit. Nearly 34% of Pi'ina'au is classified as seasonal, non-tidal palustrine wetlands occurring in the headwaters of the hydrologic unit. (Pi'ina'au IFSAR § 6.0, pp. 48, 50.)

iv. Aesthetic values

309. The headwaters of Pi'ina'au Stream originate in the lush tropical forests of the Waikamoi Preserve. Along with its tributary Palauhulu Stream, the waters flow northeasterly through miles of evergreen forests, most of which is part of the Ko'olau Forest Reserve. The streams are bordered by the steep sides of the Ke'anae Valley walls, altogether creating a picturesque view. A number of waterfalls are located along the streams, one on Pi'ina'au and ten on Palauhulu, most of which are immediately followed by a plunge pool. Waiokuna and Keaku Falls are among the waterfalls located in the more accessible lower reaches of Palauhulu Stream. A diverse collection of the native plants found in the Ke'anae Arboretum can be viewed in the lower reaches of Pi'ina'au Stream. Pi'ina'au and its tributary join near the coast and empty into the waters surrounding Ke'anae Peninsula. (Pi'ina'au IFSAR § 7.0, p. 55.)

v. Navigation

310. No navigation values are present. (Pi'ina'au IFSAR § 8.0, p. 57.)

vi. Instream hydropower generation

311. No instream hydropower generation occurs on Pi'ina'au Stream. (Pi'ina'au IFSAR § 9.0, p. 58.)

vii. Maintenance of water quality

312. Pi'ina'au Stream and Palauhulu Stream do not appear on the 2006 List of Impaired Waters in Hawai'i, Clean Water Act § 303(d). While some data exist for Pinaau Stream (and its "entire network"), there were not sufficient data for decision-making. Pi'ina'au Stream is classified as Class 2 from the coast to approximately 1,550 feet elevation. Palauhulu Stream is Class 2 from the coast to approximately 960 feet elevation. Above those elevations, both streams are Class 1. Marine waters at the mouth of the hydrologic unit of the entire Pi'ina'au hydrologic unit are Class AA waters. (Pi'ina'au IFSAR § 10.0, p. 60.)

viii. ***Conveyance of irrigation and domestic water supplies to downstream points of diversion***

313. There are a total of 14 registered diversions, of which 8 are non-EMI. Of the 8, four were declared for domestic, in part, with a total of five service connections. All 8 diversions are also utilized for irrigation of various crops and livestock, including the cultivation of taro. (Pi'ina'au IFSAR § 11.0, p. 62.)

ix. ***Protection of traditional and customary Hawaiian rights***

314. According to the 1990 Hawai'i Coastal Zone Management Program's *Hawaiian Fishpond Study for the Islands of Hawaii, Maui, Lanai, and Kauai*, the Waialohe fishponds still exists at the mouth of Pi'ina'au Stream. (Pi'ina'au IFSAR § 12.0, p. 74.)

g. <u>Kuleana users</u>

315. CWRM records for the hydrologic unit of Pi'ina'au indicate that there are a total of 14 registered diversions. Six of the diversions were declared for taro cultivation or other domestic purposes. (Pi'ina'au IFSAR § 12.0, p. 72.)

316. In Table No. 1 at page 10 of Nā Moku's Opening Brief, Nā Moku claims 29.695 acres of cultivable area in Ke'anae and a total estimated water need for taro (in addition to 64% base flow) of 2.97 – 8.91 mgd. This is said to be based on the Nā Moku TMK Spreadsheet and Exhibit A-140, which is a tax map with highlighted areas referencing certain parcels in Ke'anae.

317. The 29.695 acre estimate of cultivable area is the simple sum of the aggregate acreages for all the TMK parcels listed on A-137 from the 1-1-03 plat. No testimony or other information has been offered to quantify what percentage of each of these parcels actually contain lo'i as opposed to being house lots, constituting open space or being in other uses.

318. Palauhulu Stream is the sole water source for the taro cultivated in Ke'anae. There are a few lo'i in the Ke'anae Arboretum on land owned by the State of Hawai'i that are

irrigated directly from Pi'ina'au Stream above the elevation of the flume intake on Palauhulu Stream that serves Ke'anae. No person has come forward to assert a claim in this proceeding of appurtenant rights to use water from Pi'ina'au Stream. (Hew, WDT 1/27/15, at ¶ 29.)

319. Exhibit C-108 is a copy of an excerpt from a report published by the USGS in 2007 of a study conducted in 2006 entitled, "Water Use in Wetland Kalo Cultivation in Hawaii." Ke'anae was one of the loi complexes studied on Maui. As shown on in Figure 35 on page 57 of that report (the "***USGS 2007 Taro Water Report***"), the entire Ke'anae complex was 10.53 acres when studied.

320. Exhibits C-109 and 110 are copies of aerial photographs taken of Ke'anae on January 5, 2015. The configuration of the loi shown in these recent photographs is very similar to the schematic of the entire 10.53 acre Ke'anae lo'i system contained in Figure 35 of the USGS 2007 Taro Water Report.

321. Application of the 130,000 to 150,000 gad irrigation requirement for taro from the Nā Wai 'Ehā case to the 10.53 acre Ke'anae lo'i complex results in a taro water need of from 1.37 to 1.58 mgd. This is less than half of the current IIFS of 5.50 cfs (3.56 mgd) for Palauhulu Stream.

322. It appears from the evidence submitted in this proceeding that there is generally enough water collected from the flume intake on Palauhulu Stream above Ke'anae to meet the needs of the Ke'anae taro farmers. While there was some testimony regarding shortages of water during low flow conditions, there was also testimony indicating that there has been enough water to recently reopen patches that had been fallow. (Clark, Tr., 3/10/15, p. 126, l. 15 to p. 131, l. 12; Exh. A-168).

323. Since at least September 15, 2010, EMI has been releasing water into Palauhulu Stream from the Ko'olau Ditch, but the water is lost in the leaky sections of the streambed between the release point and the origin of Store Spring, which is the source of the water in Palauhulu Stream that supplies the Ke'anae lo'i complex. This was documented in a site visit that took place on September 15, 2010 attended by CWRM staff, Isaac and Gladys Kanoa, and EMI personnel. Exhibits C-111 and C-112 are photos taken during that site visit showing water being released just below the Ko'olau Ditch. The water being released constituted the entire flow of the stream on that date, and the sluice gate has remained open to the same setting ever since. Exhibit C-113 is a photo taken during that site visit of the last of several sinkholes in the streambed between Ko'olau Ditch and Store Spring. Exhibit C-114 is a copy taken during that site visit of the source of Store Spring. (Hew, WDT 1/27/15, ¶ 27.)

324. As a result of the loss into the streambed of the entire base flow of Palauhulu Stream between the Ko'olau Ditch and Store Spring, there is nothing more that can be done to increase the availability of water in the lower reaches during periods of low flows. At the current sluice gate setting, all of the low flows are already being released, but they do not reach Store Spring. Increasing the IIFS will not produce any more water in Palauhulu Stream at the flume intake to Ke'anae during periods of low flows. (Hew, WDT 1/27/15, ¶ 27.)

10. <u>Ohia (6054)</u>

a. <u>Physical features</u>

325. The hydrologic unit of Ohia is located north of Haleakala. It covers a small drainage area of 0.3 square miles from the 410 feet altitude to the sea. (Ohia IFSAR § 1.1 at 1.)

326. Ohia Stream is 0.6 miles in length, traversing north from its headwaters at Ohia Spring near the Hana Highway at 230 feet elevation to the ocean. (Ohia IFSAR § 1.1 at 1.)

b. <u>Diversions</u>

327. Ohia Stream is not diverted by any major surface water diversion system. (Ohia IFSAR § 3.2 at 26; Hew, WDT, 2/10/15, at ¶ 2.)

c. **<u>Gaging stations</u>**

328. There are no stream gaging stations within the Ohia hydrologic unit. (Ohia IFSAR § 3.3 at 26.)

d. **<u>Flow duration values</u>**

329. According to USGS, the natural median baseflow in the lower reach of Ohia Stream is 4.70 cfs (3.04 mgd). (Table attached to Gingerich WDT 10/31/14, p. 2; USGS Regression Study, p. 61 (Table 11).)

e. **<u>Previous IIFS recommendations, CWRM action, and implementation actions</u>**

330. In 2010, CWRM staff recommended that the IIFS for Ohia Stream remain as designated on October 8, 1988, at an estimated flow of 4.60 cfs (2.97 mgd) just above Hana Highway, near an altitude of 195 feet. (Exh. C-103, p. 22.)

331. At its May 25, 2010 meeting, CWRM decided to adopt CWRM staff's recommendation to not modify the existing IIFS for Ohia Stream of 4.60 cfs (2.97 mgd). (Exh. C-91, pp. 50, 52.)

f. **<u>Instream values</u>**

i. ***Maintenance of aquatic life and wildlife habitats***

332. The Hawaii Stream Assessment did not assess Ohia Stream. Native ‘o‘opu alamo‘o (*Lentipes concolor*), ‘ōpae kala‘ole (*Atyoida bisulcata*), and hīhīwai (*Neritina granosa*) were observed in Ohia Stream. During the more recent surveys, the ‘o‘opu alamo‘o and ‘ōpae kala‘ole were observed in the middle reach. Introduced species such as guppies (*Poecilia reticulata*) and river prawns (*Macrobrachium lar*) were observed in the stream as well. The poeciliid fishes dwell in the deep pools created above diversion structures and are known to

transmit parasites to native fishes. No insect survey was conducted in Ohia Stream. DAR assigns Ohia a total watershed rating of 4 out of 10, a total biological rating of 5 out of 10, and a combined overall rating of 5 out of 10. Native species observed in the stream include:

Fish – *Lentipes concolor*
Crustaceans – *Atyoida bisulcata*
Mollusks – *Neritina granosa*

(Ohia IFSAR § 4.0, pp. 34, 37; DAR Report on Ohia Stream, Maui, Hawai'i, October 2009, p. 6.)

333. The estimated natural (undiverted) median baseflow of Ohia Stream is 4.70 cfs (3.04 mgd). The amount of flow in Ohia Stream needed to achieve H_{90} is 3.00 cfs (1.94 mgd). (Table attached to Gingerich WDT 10/31/14, p. 2; Exh. HO-1.)

ii. Outdoor recreational activities

334. The recreational resources of Ohia Stream were classified as "substantial" by the Hawaii Stream Assessment's regional recreational committee. The HSA identified opportunities for fishing and scenic views related to Ohia Stream. Of the two, only scenic views was considered to be a high-quality experience. (Ohia IFSAR § 5.0, p. 43.)

iii. Maintenance of ecosystems such as estuaries, wetlands, and stream vegetation

335. Riparian resources of Ohia Stream were not classified by the Hawaii Stream Assessment. About 2% of the hydrologic unit lies within the Pauwalu Point Wildlife Sanctuary. There are no palustrine wetlands in the Ohia hydrologic unit. The density of threatened and endangered plant species is low in the entire unit. (Ohia IFSAR § 6.0, pp. 46, 47, 48.)

iv. Aesthetic values

336. Ohia Stream is only 0.6 miles in length that is fed by Ohia Spring near Hana Highway. The stream is surrounded by mainly alien forests with scattered native Ohia forests

and Uluhe shrub lands. The hydrologic unit of Ohia does not lie within any forest reserve or preserve. The east end of the hydrologic unit is Pauwlau Point, which offers great views of the Hahaha Bay, and two islets of the Mokumana State Seabird Sanctuary. (Ohia IFSAR § 7.0, p. 51.)

v. Navigation

337. There are no navigation values present. (Ohia IFSAR § 8.0, p. 53.)

vi. Instream hydropower generation

338. Instream hydropower generation does not occur on Ohia Stream. (Ohia IFSAR § 9.0, p. 54.)

vii. Maintenance of water quality

339. Ohia Stream is a newly listed stream on the 2006 List of Impaired Waters in Hawai'i, Clean Water Act § 303(d). Data indicated that turbidity, total nitrogen, total phosophorus, nitrite and nitrate nitrogen exist as visual listing from 2001 to 2004. Trash was recorded as one of the other pollutants in the stream. According to the available data, Ohia Stream is listed as category 5 as having one or more designated use non-attainments or water quality impairment. It is also a low priority stream for initiating TDML development. Ohia Stream is classified as Class 2 inland waters in which the stream is protected for uses such as recreational purposes, support of aquatic life, and agricultural water supplies. It should be noted that the conservation subzone map utilized for this interpretation is general and elevations are not exact. It should also be noted that there is no direct relationship between elevation and attainment of water quality standards. Marine waters at the mouth of the hydrologic unit of Ohia are Class AA waters. (Ohia IFSAR § 10.0, pp. 57, 58.)

viii. Conveyance of irrigation and domestic water supplies to downstream points of diversion

340. There is only one registered diversion on Ohia stream by Hokoana BK, which diverts water for the purpose of irrigating 2.09 acres of taro, along with domestic and landscaping uses for a house on the property. The DOH Safe Drinking Water Branch does not currently regulate any public water systems in the hydrologic unit of Ohia. (Ohia IFSAR § 11.0, p. 60.)

ix. Protection of traditional and customary Hawaiian rights

341. According to the 1990 Hawai'i Coastal Zone Management Program's *Hawaiian Fishpond Study for the Islands of Hawaii, Maui, Lanai, and Kauai*, there are no fishponds present in the hydrologic unit of Ohia. (Ohia IFSAR § 12.0, p. 78.)

g. Kuleana users

342. CWRM records for the hydrologic unit of Ohia indicate that there is only one registered diversions for 2.09 acres of taro cultivation. (Ohia IFSAR § 12.0, p. 71.)

11. Waiokamilo (6055)

a. Physical features

343. The hydrologic unit of Waiokamilo is located on the northeast slope of Haleakala. It covers an area of 2.45 square miles from the slopes of Haleakala at 4,891 feet elevation to the sea. (Waiokamilo IFSAR § 1.0, p. 1.)

344. Waiokamilo Stream is 4.4 miles in length, traversing in a northeasterly direction from its headwaters originating in the Ko'olau Forest Reserve to Waiokamilo Falls before entering the ocean. A tributary to the Waiokamilo Stream is Kualani Stream. (Waiokamilo IFSAR § 1.0, p. 1.)

b. Diversions

345. EMI ceased all diversions within the Waiokamilo hydrologic unit after the Board of Land and Natural Resources ruled in March 2007 that EMI should release 6 mgd from Waiokamilo Stream. (Hew, WDT, 12/30/14, at ¶ 33; Hew, WDT, 1/27/15, at ¶ 35; Exh. C-83.)

c. **Gaging stations**

346. There is no USGS continuous-record stream gaging station in the hydrologic unit of Waiokamilo. (Waiokamilo IFSAR § 3.0, p. 29.)

d. **Flow duration values**

347. Waiokamilo Stream is generally a losing stream. The stream is dry immediately downstream of Ko'olau Ditch. The stream then gains about 3.80 mgd from Akeke (Banana) Spring. Thereafter, the stream loses flow to ground water, minor diversions, and a known losing stretch near Dams 2 and 3. (Exh. C-85, p. 40.)

348. According to USGS, the natural median baseflow in the upper reach of Waiokamilo Stream directly downstream of the Ko'olau Ditch is 3.90 cfs (2.10 mgd); at the middle reach it is 6.10 cfs (3.28 mgd); and at the lower reach it is 8.70 cfs (4.68 mgd). (Table attached to Gingerich WDT 10/31/14, p. 2; USGS Regression Study, p. 61 (Table 11).)

e. **Previous IIFS recommendations, CWRM action, and implementation actions**

349. In 2008, CWRM staff recommended that CWRM set an IIFS A of 4.90 cfs (3.17 mgd) at the lower reach of Waiokamilo Stream at USGS gaging station 16521300 near Dam 3. This location is downstream of Ko'olau Ditch, but upstream of the confluence of Waiokamilo and Kualani (Hamau) Streams. The rationale for the recommendation was as follows:

> Under the current flow conditions, Waiokamilo Stream offers limited recreational and aesthetic opportunities. Some native species were observed in the middle reaches of the stream, while many sites with adequate water depth were uninhabited, probably due to the terminal waterfall, Waiokilo Falls, restricting upstream migration of certain native amphidromous species. The presence of dewatered sections in the lower reaches of the stream, possibly caused by upstream diversions, may affect habitat availability for native species. However,

the observation of native species in the middle reaches may be through other water pathways (i.e., taro loi and auwai).

The stream currently supports a large portion of the taro cultivation occurring in Wailua Valley, as well as the cultivation of other crops and raising of livestock. Gathering and other traditional practices are also components of the hydrologic unit. Water is apparently still diverted for domestic uses; however, the area is served by a county water system. EMI has a total of four major diversions and 24 minor diversions on the stream and its tributaries. However, following the BLNR's interim order to release 6 million gallons of water per day into the stream, EMI has stopped diverting water from Waiokamilo Stream and its tributaries since July of 2007.

Staff believes that restoration of flow in the stream would greatly benefit the surface water users downstream from Koolau Ditch, particularly domestic users and taro farmers in Wailua Valley. Currently, the taro farmers rely heavily on water diverted from Waiokamilo and Kualani Streams into the Lakini system, which then feeds two of the larger loi complexes in Wailua Valley. With relatively large sections of Waiokamilo Stream losing flow underground, the amount of water reaching downstream areas is limited.

(Exh. C-85, p. 44.)

350. CWRM staff proposed IIFS for Kualani Stream at status quo. The rationale for the recommendation was as follows:

The proposed interim IFS for Kualani (Hamau) Stream is status quo. This means the flow in the stream is to remain in the current condition, without increases in the amount of water diverted from the stream for noninstream uses. The flow in the stream may change due to climate variability, including the effects of drought or periods of higher than normal rainfall.

At the present time, there are very limited hydrologic and biological data available for Kualani Stream. The only flow measurement available is that downstream from the confluence of Waiokamilo and Kualani Stream near 250 feet elevation, the stream is reported (in a 1999 USGS study) to gain 1.28 cfs (0.83 mgd) from Kualani Stream. This is a point-in-time measurement made on May 11, 1999 and does not reflect the average gain in streamflow. With the lack of reliable hydrologic data, a flow value cannot be determined as an interim IFS proposal for Kualani Stream. The geographical location of Kualani Stream is also questionable. Location of Kualani Stream depicted on the maps in the IFSAR is based on a map that EMI had provided. However, during the September 3, 2008 Commission meeting, Garret Hew, manager of EMI, indicated that the location of Kualani Stream on the EMI map is inaccurate and that his staff is in the process of revising the map. Regarding stream biota, no aquatic or insect surveys were conducted to determine the biological integrity of the stream under the current

> flow conditions. Therefore, an interim IFS cannot be proposed without balancing the importance of stream biota with other instream and noninstream uses.
>
> Based on the information collected in public comments, the surface water diversion registration database, and site visits, the only use for Kualani Stream is that it serves as a conduit for the Lakini auwai system. As illustrated in Section D, Simplified Diagrams, water from Waiokamilo Stream is diverted into the Lakini system, and then joins with Kualani Stream before reaching Dam 1, after which it is diverted for taro cultivation in the Lakini taro patches and in Wailua Valley further downstream. During the site visits, staff did not visit Dam 1 because it is located in the lower reaches of Kualani Stream, and access, which is through private property, was denied. Thus, further assessment of the flow conditions in the stream could not be conducted.

(Exh. C-85, p. 45.)

351. CWRM adopted CWRM staff's recommendation as to Waiokamilo Stream and Kualani Stream at its September 24-25, 2008 meeting. (Exh. C-89, p. 31.)

f. **<u>Instream values</u>**

*i. **Maintenance of aquatic life and wildlife habitats***

352. The Hawaii Stream Assessment classifies the aquatic resources of Waiokamilo Stream as "unknown." Waiokamilo Stream rates average in comparison to other watersheds in Maui and statewide. DAR assigns Waiokamilo a total watershed rating of 7 out of 10, a total biological rating of 3 out of 10, and a combined overall rating of 5 out of 10. Native species observed in the stream include:

> Fish – *Awaous guamensis*
> Crustaceans – *Atyoida bisulcata*
> Mollusks – No native mollusks

(Waiokamilo IFSAR § 4.2, p. 42; DAR Report on Waiokamilo Stream, Maui, Hawai'i, June 2008, pp. 1-2.)

353. The estimated natural (undiverted) median baseflow of Waiokamilo Stream is 3.90 cfs (2.52 mgd). The amount of flow in Waiokamilo Stream needed to achieve H_{90} is 2.50 cfs (1.62 mgd). (Table attached to Gingerich WDT 10/31/14, p. 2; Exh. HO-1.)

ii. Outdoor recreational activities

354. The recreational resources of Waiokamilo Stream were classified as outstanding by the Hawai'i Stream Assessment's regional recreational committee. The Hawaii Stream Assessment identified opportunities for fishing, hunting, swimming, and scenic views related to Waiokamilo Stream. Three were considered high-quality experiences (hunting and scenic view, air and ocean). (Waiokamilo IFSAR § 5.0, p. 40.)

iii. Maintenance of ecosystems such as estuaries, wetlands, and stream vegetation

355. Riparian resources of Waiokamilo Stream were not classified by the Hawaii Stream Assessment. Nearly 75% of the hydrologic unit of Waiokamilo falls within the Ko'olau Forest Reserve. Nearly 46% of Waiokamilo is classified as seasonal, non-tidal palustrine wetlands occurring in the headwaters of the hydrologic unit. (Waiokamilo IFSAR § 6.0, pp. 44-46.)

iv. Aesthetic values

356. The headwaters of Waiokamilo Stream originate in the lush tropical forests of the Ko'olau Forest Reserve. Along with its tributary Kualani Stream, they flow northeasterly through the evergreen forests that cover a majority of the drainage basin. Of the two waterfalls along Waiokamilo Stream, Waiokilo Falls is located near the coast. Wailua Valley State Wayside Lookout is located at about 430 ft elevation and provides a picturesque view of the upper basin as well as the lower basin where the stream empties into the ocean. (Waiokamilo IFSAR § 7.0, p. 52.)

v. Navigation

357. No navigation values are present. (Waiokamilo IFSAR § 8.0, p. 54.)

vi. Instream hydropower generation

358. No instream hydropower generation occurs on Waiokamilo Stream. (Waiokamilo IFSAR § 9.0, p. 55.)

vii. Maintenance of water quality

359. Waiokamilo Stream and Kualani Stream do not appear on the 2006 List of Impaired Waters in Hawai'i, Clean Water Act § 303(d). While some data exist for Waiokamilo Stream (and its "entire network"), there were not sufficient data for decision-making. Waiokamilo Stream is Class 2 from the coast to approximately 1,550 feet elevation. Above that elevation, it is Class 1. Kualani Stream is Class 2. Marine waters at the mouth of the hydrologic unit of Waiokamilo are Class AA waters. (Waiokamilo IFSAR § 10.0, p. 57.)

viii. Conveyance of irrigation and domestic water supplies to downstream points of diversion

360. There are a total of 19 registered diversions on Waiokamilo Stream, of which 15 are non-EMI. Eleven diversions divert water for domestic or irrigation purposes, in part, with a total of eight service connections. Fifteen diversions are utilized for irrigation of various crops and livestock, including the cultivation of taro. (Waiokamilo IFSAR § 11.0, p. 59.)

ix. Protection of traditional and customary Hawaiian rights

361. According to the 1990 Hawai'i Coastal Zone Management Program's *Hawaiian Fishpond Study for the Islands of Hawaii, Maui, Lanai, and Kauai,* the Puu Polu fishpond exists towards the northern portion of the hydrologic unit near the ocean. (Waiokamilo IFSAR § 12.0, p. 69.)

g. <u>Kuleana users</u>

362. CWRM records for the hydrologic unit of Waiokamilo indicate that there are a total of 19 registered diversions, of which 11 were declared for taro cultivation. (Waiokamilo IFSAR § 12.0, p. 67.)

363. In Table No. 1 at page 10 of Nā Moku's Opening Brief, Na Moku claims 90.992 acres of cultivable area and a total estimated water need for taro (in addition to 64% base flow) of 9.1 – 27.3 mgd in "Wailua." This is an area that encompasses two separate hydrologic units, Waiokamilo and Wailuanui. This is said to be based on the Nā Moku TMK Spreadsheet and Exhibit A-142, which is a combined set of three tax maps (plats 1-1-04, 05 and 06) with highlighted areas referencing certain parcels in Wailuanui.

364. The 90.992 acres for which Nā Moku claimed a need for water for taro was arrived at by simply adding the total acreage of TMK parcels listed on the Na Moku TMK Spreadsheet within the 1-1-04 plat, the 1-1-05 plat and the 1-1-06 plat without taking into account what portion of those parcels have ever been or are currently cultivated with taro. There was also no breakdown provided of which of these parcels are claimed to be served by Waiokamilo Stream and which are claimed to be served by Wailuanui Stream.

365. To the extent Nā Moku is claiming that these parcels have appurtenant or riparian rights to receive water from Waiokamilo Stream and Kualani Stream, these streams are not being diverted by EMI. EMI has provided testimony and photographic evidence that, following the BLNR's 2007 ruling, EMI sealed all of its diversion works and structures that previously diverted water from this hydrologic unit into the Ko'olau Ditch. This has also been confirmed by CWRM staff following a series of field investigations. (Hew, WDT 1/27/15, ¶ 35; Hew, Tr., 3/17/15, p. 128, l. 7 to p. 129, l. 10; Exh. C-52, pp. 56-67; Exh. C-147, pp. 84-96.)

366. Inasmuch as EMI has agreed to the setting and implementation of an IIFS that would preclude EMI from diverting any water from the entirety of the hydrologic unit of Waiokamilo, it is unnecessary to make any more specific findings, individually or in the

aggregate, regarding the water rights or needs of the farmers who irrigate their taro and other crops from Waiokamilo Stream and Kualani Stream.

12. Wailuanui (6056)

a. Physical features

367. The hydrologic unit of Wailuanui is located on the northeast slope of Haleakala. It covers an area of 6 square miles from the upper slopes of Haleakala at 8,891 feet elevation to the sea. (Wailuanui IFSAR § 1.0 at 1.)

368. Wailuanui Stream is 6.4 miles in length with two main tributaries, West Wailuanui and East Wailuanui. Wailuanui Stream is also known as Waikani stream. (Wailuanui IFSAR § 1.0, p. 1; Hew, WDT, 2/10/15, ¶ 2.)

b. Diversions

369. EMI operates diversions on Wailuanui Stream and it tributaries at the Ko'olau Ditch. (Wailuanui IFSAR § 13.0, p. 77.)

c. Gaging stations

370. Three inactive USGS continuous-record stream gaging stations are located along Wailuanui Stream and its tributaries. (Wailuanui IFSAR § 3.0, p. 28.)

A. Station 16521000 is located at 620 feet elevation in Wailuanui Stream, and was active from1932 to 1936 and 1939 to1947. (Wailuanui IFSAR § 3.0, pp. 27-28 (Table 3-1).)

B. Station 16519000 is at 1,268 feet elevation in the lower reach of West Wailuanui Stream, and was active from 1914 to 1917 and 1922 to 1958. (Wailuanui IFSAR § 3.0, pp. 27-28 (Table 3-2).)

C. Station 16520000 is at 1,287 feet elevation in the lower reach of East Wailuanui Stream, and was active from 1915 to 1917 and 1923 to 1957. (Wailuanui IFSAR § 3.0, pp. 27-28, (Table 3-3).)

d. Flow duration values

371. According to USGS, the natural median baseflow at the upper reach of West Wailuanui Stream directly downstream of Ko'olau Ditch is 2.50 cfs (1.35 mgd); at the upper reach of East Wailuanui Stream directly downstream of Ko'olau Ditch it is 2.00 cfs (1.08 mgd); at the middle reach, below the confluence of West and East Wailuanui Streams and above Waikani Falls, it is 6.10 cfs (3.28 mgd). (Table attached to Gingerich WDT 10/31/14, p. 2; USGS Regression Study, p. 60 (Table 11) and p. 65 (Table 12).)

e. Previous IIFS recommendations, CWRM action, and implementation actions

372. In 2008, CWRM staff recommended that CWRM set an IIFS of 3.05 cfs (1.97 mgd) at the lower reach of Wailuanui Stream near inactive USGS gaging station 16521000 at 620 feet elevation. The location of the proposed IIFS is downstream of Ko'olau Ditch, below the confluence of the tributaries, East and West Wailuanui Streams. The rationale of the recommendation was as follows:

> Under the current flow conditions, Wailuanui Stream offers a variety of recreational and aesthetic opportunities, including Waikani Falls, which is located in the more accessible lower reaches of the stream. Regarding stream biota, the stream has rich native species diversity and lacks many of the commonly introduced species. However, the presence of dewatered sections in the middle and lower reaches of the stream, possibly caused by upstream diversions, may affect habitat availability for native species. The stream currently supports approximately a quarter of the taro cultivation occurring in Wailua Valley, as well as the cultivation of other crops and livestock. Wailuanui Stream is an important source of irrigation water for EMI, with a total of four major diversions and three minor diversions on the stream and its tributaries.
>
> Staff believes that flow should be partially restored to the stream in order to balance the instream and noninstream uses of stream water. Flow restoration would increase the continuity of flow in the stream, which would further enhance habitat availability and help build a robust native species dominated community. Restoration of flow in the stream would also benefit the surface water users downstream from Koolau Ditch, particularly the taro farmers in Wailua Valley. Furthermore, gathering and other traditional practices occurring in downstream reaches increase instream flow demands.

(Exh. C-85, p. 54.)

373. CWRM adopted CWRM staff's recommendation as to Wailuanui Stream at its September 24-25, 2008 meeting. (Exh. C-89, p. 54.)

374. Following the 2008 IIFS decision, as documented by CWRM staff in a series of Field Investigation Reports, EMI ceased operating its minor diversions on Wailuanui Stream and its tributaries and, in consultation and coordination with CWRM staff, arrived at sluice gate settings on the two major diversions it operates, one on East Wailuanui Stream and one on West Wailuanui Stream, that would allow enough water to pass through to the IIFS measurement point below to satisfy the IIFS before any water is taken into the Ko'olau Ditch. (Hew, Tr., 3/17/15, p. 150, l. 6 to p. 152, l. 6.; Exh. C-147, pp. 79-82, 98-110.)

375. Flow measurements from a gauge station at the IIFS point subsequently installed and monitored by CWRM staff indicates that, except during relative infrequent periods of very low rainfall, the IIFS for Wailuanui Stream is being met or exceeded. When the IIFS is not being met, however, the entire stream flows are passing through the openings in the sluice gates and no water is being diverted by EMI. (Uyeno, 12/18/14 written report, p. 30; Hew, Tr., 3/17/15, p. 149, l. 5 to p. 152, l. 6.)

f. <u>Instream values</u>

i. Maintenance of aquatic life and wildlife habitats

376. The Hawaii Stream Assessment classifies the aquatic resources of Wailuanui Stream as outstanding. Wailuanui Stream rates average in comparison to other watersheds in Maui and statewide. DAR assigns Wailuanui a total watershed rating of 7 out of 10, a total biological rating of 8 out of 10, and a combined overall rating of 8 out of 10. Native species observed in the stream include:

Fish – *Awaous guamensis, Eleotris sandwicensis, Kuhlia sp., Lentipes concolor,* and *Sicyopterus stimpsoni*
Crustaceans – *Atyoida bisulcata* and *Macrobrachium grandimanus*
Mollusks – *Neritina granosa* and *Neritina vespertina*

(Wailuanui IFSAR § 4.0, p. 35; DAR Report on Wailuanui Stream, Maui, Hawai'i, June 2008, pp. 1-2.)

377. The estimated natural (undiverted) median baseflow of Wailuanui Stream is 4.50 cfs (2.91 mgd). The amount of flow in Wailuanui Stream needed to achieve H_{90} is 2.90 cfs (1.87 mgd). (Table attached to Gingerich WDT 10/31/14, p. 2; Exh. HO-1.)

ii. Outdoor recreational activities

378. The recreational resources of Wailuanui Stream were classified as outstanding by the Hawaii Stream Assessment's regional recreational committee. The HAS identified opportunities for fishing, hunting, swimming, and scenic views related to Wailuanui Stream. Of a total of seven experiences, five were considered to be a high-quality experience. CWRM identified the following activities that were known to occur or observed at or near Wailuanui (Wailua Nui Bay): gill netting, throw netting, torch fishing, pole and line fishing, and board surfing. (Wailuanui IFSAR § 5.0, pp. 43-44.)

iii. Maintenance of ecosystems such as estuaries, wetlands, and stream vegetation

379. Riparian resources of Wailuanui Stream were classified as substantial by the Hawaii Stream Assessment. In Wailuanui, there are three large management areas (Haleakala National Park, Ko'olau Forest Reserve, and Waikamoi Preserve) which comprise over 80% of the hydrologic unit. Approximately 27% of Wailuanui is classified as seasonal, non-tidal palustrine wetlands occurring in the central portion of the hydrologic unit. (Wailuanui IFSAR § 6.0, pp. 48, 49, 51.)

iv. Aesthetic values

380. The headwaters of Wailuanui Stream originate in the lush tropical forests of the Ko'olau Forest Reserve. Along with its tributaries West and East Wailuanui Streams, they flow northeasterly through the evergreen forests that cover a majority of the drainage basin. A number of waterfalls are located along the streams, three on each of the tributaries and six on the main channel, most of which are immediately followed by a plunge pool. Waikani Falls is among the waterfalls located in the more accessible lower reaches of Wailuanui Stream. A lookout point is located about 250 feet elevation that provides a picturesque view of the upper basin and the lower basin where Wailuanui Stream empties into Wailua Nui Bay. (Wailuanui IFSAR § 7.0, p. 56.)

v. Navigation

381. No navigation values are present. (Wailuanui IFSAR § 8.0, p. 58.)

vi. Instream hydropower generation

382. No instream hydropower generation occurs on Wailuanui Stream. (Wailuanui IFSAR § 9.0, p. 59.)

vii. Maintenance of water quality

383. Wailuanui Stream (both tributaries) does not appear on the 2006 List of Impaired Waters in Hawai'i, Clean Water Act § 303(d). It appears that no data were available for Wailuanui Stream. Wailuanui Stream is Class 2 from the coast to approximately 1,380 feet elevation, excepting for a small area near the confluence with East Wailuanui Stream, where it is Class 1. Above 1,380 feet elevation, West Wailuanui Stream is Class 1. East Wailuanui Stream is Class 2 from the coast to approximately 1,000 feet elevation. above that elevation, it is Class 1. Marine waters at the mouth of the entire hydrologic unit of Wailuanui are Class AA waters. (Wailuanui IFSAR § 10.0, p. 61.)

viii. Conveyance of irrigation and domestic water supplies to downstream points of diversion

384. Four out of 7 diversions were registered under EMI. Of the three non-EMI diversions, none was declared for domestic purposes. Two registered diversions divert water for domestic or irrigation purposes. One diversion declared by MDWS diverts water for municipal use. (Wailuanui IFSAR § 11.0, p. 63; Exh. C-100, p. 52.)

ix. Protection of traditional and customary Hawaiian rights

385. According to the 1990 Hawai'i Coastal Zone Management Program's *Hawaiian Fishpond Study for the Islands of Hawaii, Maui, Lanai, and Kauai,* there are no fishponds in the hydrologic unit of Wailuanui. (Wailuanui IFSAR § 12.0, p. 75.)

g. Kuleana users

386. CWRM records for the hydrologic unit of Wailuanui indicate that there are two registered diversions declared for taro cultivation. (Wailuanui IFSAR § 11.0, p. 75.)

387. The 2007 USGS Taro Water Report included findings regarding water use in what it referred to as the "Wailua (Waikani) complex" which is the loi system that is irrigated solely with water from Wailuanui Stream. As of the summer of 2006, this system comprised 2.80 acres as shown Figure 32 on page 54. This system was being cultivated at that time by Norman "Bush" Martin and Joseph "Kimo" Day with water drawn from the pond below Waikani Falls on Wailuanui Stream. (Hew, WDT 1/27/15, ¶ 36; Exh. C-108.)

388. The amount of water available from Waikani pond increased following the releases of stream flow to comply with the 2008 IIFS decision due to the closing of EMI's minor diversions and the opening of the sluice gates on the major diversions operated on East Wailuanui Stream and West Wailuanui Stream. EMI estimates that, since Wailuanui Stream is a gaining stream below the IIFS point, this has resulted in a consistent flow of from 2 to 3 mgd

entering the pond below Waikani Falls (and much more during rain events). (Hew, WDT 1/27/15, ¶ 37.)

389. In spite of this increased flow to Waikani Pond after 2008, the lo'i system that was previously being cultivated with water from Waikani Pond was no longer in operation as of the date of the hearings held herein. Mr. Day testified in paragraph 5 of his declaration that he stopped farming "about four years ago." Mr. Martin testified that he has temporarily cut back on his taro cultivation while he works on addressing needed improvements to the pipe intake at the head of the 'auwai that brings water from Waikani pond to the Waikani lo'i complex. Mr. Clark testified that he has been assisting Mr. Martin in evaluating the needed repairs, which involve the removal of rocks that may have become lodged in a buried section of the pipe 'auwai 100 feet or more from the intake. From these photos, the area previously irrigated with Wailuanui Stream water appears to now be substantially, if not entirely, removed from taro production. (Hew, WDT 1/27/15, ¶ 38; Martin, Tr., 3/9/15, p. 185, l. 3 to p. 189, l. 18; Clark, Tr. 3/10/15, p. 113, l. 18 to p. 117, l. 20.)

390. Application of the 130,000 to 150,000 gad irrigation requirement for taro from the Nā Wai 'Ehā case to the 2.80 acres that were being irrigated from Waikani Pond in 2006 results in a taro water need of from 0.36 to 0.42 mgd. Since this is far less than the 2-3 mgd that has been available for the past six years, it appears that the supply of irrigation water to the area served by Waikani Pond is much greater than needed. The current IIFS setting for Wailuanui Stream, therefore, allows more than enough stream flow to reach Waikani pond to service taro cultivation in the areas that have been irrigated with Wailuanui Stream water in the recent past.

391. To the extent that Nā Moku has identified parcels of land owned by its members in the vicinity of Wailuanui Stream that may have previously been irrigated with Wailuanui

Stream water, and which may have appurtenant rights to claim some amount of water on that basis, the record does not include an adequate breakdown of the parcels and acreage involved to support any detailed findings to that effect. Under current conditions, however, if the infrastructure challenge of conveying water from Waikani Pond to the areas sought to be irrigated can be solved, there is enough water available to more than double the acreage that has recently been irrigated without dewatering the stretch between Waikani pond and the seaward terminus of Wailunanui Stream.

392. Further, since the current IIFS setting for Wailuanui Stream is occasionally not met when stream flows are low, increasing the IIFS will not result in any greater amount of water being available during low flows since, during such periods, no water is being diverted by EMI.

393. The adequacy of the IIFS to meet the needs for taro cultivation are demonstrated by the hydrograph for Wailuanui Stream for the period of March 23, 2011 to September 23, 2014, which shows that the flow in Wailuanui Stream exceeds the IIFS of 3.05 cfs (2.97 mgd) the vast majority of the time, often by a very large quantity. (Uyeno, 12/18/14 written report, p. 30.)

13. <u>West Wailuaiki (6057)</u>

a. <u>Physical features</u>

394. The hydrologic unit of West Wailuaiki is located northeast of Haleakala. It covers an area of 4.1 square miles from the upper slopes of Haleakala at 8,860 feet elevation to the sea. (West Wailuaiki IFSAR § 1.1, p. 1.)

395. West Wailuaiki Stream is 6.9 miles in length, traversing north from its headwater at the 6,000 feet altitude to the ocean. (West Wailuaiki IFSAR § 1.1, p. 1.)

b. <u>Diversions</u>

396. EMI operates a diversion on West Wailuaiki Stream at the Ko'olau Ditch. (West Wailuaiki IFSAR § 13.1, p. 94.)

c. **Gaging stations**

397. West Wailuaiki Stream has one active USGS continuous record stream gaging station (station 16518000) located upstream of Ko'olau Ditch at 1,343 feet altitude. The gaging station is currently in operation, and has streamflow record for at least 90 years. Since the station is located upstream of the ditch, streamflow records reflect flows under natural (undiverted) conditions. (West Wailuaiki IFSAR § 3.3, p. 29.)

d. **Flow duration values**

398. According to USGS, the natural median baseflow at the upper reach of West Wailuaiki Stream directly downstream of the Ko'olau Ditch is 6.00 cfs (3.23 mgd); at the middle reach it is 6.80 cfs (3.66 mgd); and at the lower reach it is 7.20 cfs (3.87 mgd). (Table attached to Gingerich WDT 10/31/14, p. 1; USGS Regression Study, p. 60 (Table 11) and p. 65 (Table 12).)

e. **Previous IIFS recommendations, CWRM action, and implementation actions**

399. In 2010, CWRM staff recommended that one measurable IIFS be established for West Wailuaiki Stream at an estimated flow of 3.80 cfs (2.46 mgd) below all EMI diversions and just above Hana Highway, near an altitude of 1,235 feet. (Exh. C-103, p. 22.)

400. CWRM staff recommended flow restoration for West Wailuaiki Stream because it, along with East Wailuaiki Stream, would result in the most biological return from additional flow. The presence of an estuary in both streams further enhances the biological diversity of the stream. In addition, CWRM staff noted that flow restoration would provide increased opportunities for traditional gather that area residents currently want to practice. (Exh. C-103, p. 19.)

401. In 2010, DAR recommended the release of a total of 3.50 cfs (1.88 mgd) into West Wailuaiki Stream during the wet season to provide for minimum habitat flows for native species and 0.40 cfs (0.26 mgd) during the dry season to provide connectivity for such species. DAR also recommended modifications to the K-17 Ko'olau Ditch diversion structure. DAR estimated that the recommended restoration actions on West Wailuaiki Stream would result in the creation of over 2.2 km of additional habitat for native species. DAR ranked West Wailuaiki Stream second in priority among the streams it recommended for restoration. (Appendix C to Higashi, WDT, p. 6.)

402. At its May 25, 2010 meeting, CWRM adopted CWRM staff's recommendation to establish an IIFS for West Wailuaiki Stream of 3.80 cfs (2.46 mgd) during the wet season and adopted DAR's recommendation to establish an IIFS of 0.40 cfs (0.26 mgd) during the dry season at an altitude of 1,235 feet, just above Hana Highway. (Exh. C-91, pp. 49-50, 52.)

403. In consultation with DAR, EMI has modified its diversion structure on West Wailuaiki Stream at the Ko'olau Ditch intake by installing a pipe along the left bank of the stream from atop the waterfall to drop water onto the top of the diversion dam nearest to the left bank. (Higashi, Tr., 3/16/15, p. 210, ll. 15-16; Exh. C-147, pp. 265-67 (FIR FI2011042601).)

f. <u>Instream values</u>

i. Maintenance of aquatic life and wildlife habitats

404. <u>Maintenance of aquatic life and wildlife habitats</u>. For West Wailuaiki Stream, the Hawaii Stream Assessment classifies the aquatic resources as "moderate", meaning a fair amount of native species were present. A number of native stream animals were observed in West Wailuaiki Stream, including 'o'opu nākea (*Awaous guamensis*), 'o'opu nōpili (*Sicyopterus stimpsoni*), 'o'opu akupa (*Eleotris sandwicensis*), 'o'opu alamo'o (*Lentipes concolor*), 'ōpae kala'ole (*Atyoida bisulcata*), and hīhīwai (*Neritina granosa*). During the more recent surveys,

these stream animals except the ‘o‘opu alamo‘o and ‘ōpae kala‘ole were observed in the middle reach at water temperatures of 20.9°C and 22.1°C. A cast net sampling of the stream mouth and shoreline at West Wailuaiki resulted in a total catch of 34 fishes and invertebrates. The most dominant catch was aholehole (*Kuhlia xenura*), which were found in the lower salinity areas (i.e., stream mouth). The endemic Hawaiian surf fish (*Iso hawaiiensis*) were found in areas with higher salinity, typically the shoreline. Other species found included uouoa (*Neomyxus leuciscus*) and tiger shrimp (*Palaemon pacificus*). West Wailuaiki Stream rates high in comparison to other watersheds in Maui and statewide. DAR assigns West Wailuaiki a total watershed rating of 7 out of 10, a total biological rating of 7 out of 10, and a combined overall rating of 8 out of 10. Native species observed in the stream include:

> Fish – *Awaous guamensis*, *Eleotris sandwicensis*, *Gobiid sp.*, *Lentipes concolor*, *Kuhlia sp.*, *Kulhia xenura*, and *Sicyopterus stimpsoni*
> Crustaceans – *Atyoida bisulcata*, *Metopograpsus thukuhar*
> Insects – *Telmatogen* sp.
> Mollusks – *Ferrissia sharpi* and *Neritina granosa*
> Sponge – *Heteromeyenia baileyi*

(West Wailuaiki IFSAR § 4.2, pp. 39, 43 and § 4.4, p. 43; DAR Report on West Wailuaiki Stream, Maui, Hawai‘i, October 2009, p. 6.)

405. The estimated natural (undiverted) median baseflow of West Wailuaiki Stream is 6.00 cfs (3.88 mgd). The amount of flow in West Wailuaiki Stream needed to achieve H_{90} is 3.80 cfs (2.46 mgd). (Table attached to Gingerich WDT 10/31/14, p. 1; Exh. HO-1.)

ii. Outdoor recreational activities

406. The recreational resources of West Wailuaiki Stream were classified as "outstanding" by the Hawaii Stream Assessment's regional recreational committee. The Hawaii Stream Assessment identified opportunities for hiking, fishing, hunting, swimming, and scenic

views related to West Wailuaiki Stream. Of the five, only scenic views was considered to be a high-quality experience. (West Wailuaiki IFSAR § 5.0, pp. 51, 53.)

iii. Maintenance of ecosystems such as estuaries, wetlands, and stream vegetation

407. Riparian resources of West Wailuaiki Stream were classified as "substantial" by the Hawaii Stream Assessment. About 71% of the West Wailuaiki hydrologic unit lies within the Ko'olau Forest Reserve, 18% within the Waikamoi Preserve, and only 1% within the Haleakala National Park. Approximately 59% of West Wailuaiki is classified as non-tidal palustrine wetlands occurring in the upper slopes of the hydrologic unit. (West Wailuaiki IFSAR § 6.0, pp. 55-57.)

iv. Aesthetic values

408. West Wailuaiki Stream is fed by lush native communities of Ohia forests and forested wetlands that dominate the upper and intermediate slopes of the hydrologic unit. Vegetation surrounding the lower reaches of West Wailuaiki Stream is predominately alien forests. The hydrologic unit lies within the Waikamoi Preserve in the upper elevations, and the Ko'olau Forest Reserve in the intermediate and lower elevations. A number of waterfalls are located along the lower reaches of the stream, one of which can be seen from Hana Highway. The stream empties into Wailua Iki Bay, where a number of coastal activities are enjoyed by the locals as well as the general public. (West Wailuaiki IFSAR § 7.0, p. 63.)

v. Navigation

409. No navigation values are present. (West Wailuaiki IFSAR § 8.0, p. 65.)

vi. Instream hydropower generation

410. HC&S operates three run-of-river hydroelectric facilities on the Wailoa Ditch, which is supplied with water from several sources including West Wailuaiki Stream. (West Wailuaiki IFSAR § 9.0, p. 66.)

vii. Maintenance of water quality

411. West Wailuaiki Stream appears on the 2006 List of Impaired Waters in Hawai'i, Clean Water Act § 303(d). While some data exist for West Wailuaiki Stream, there were not sufficient data for decision-making; therefore, no decision was made pertaining to the attainment of water quality standards or the applicable designated uses. West Wailuaiki Stream is classified as Class 1b inland waters from its headwaters to approximately 1,400 feet elevation, as the surrounding land is in the conservation subzone "protective" and the stream also lies in the Ko'olau Forest Reserve. From there down to about 100 feet elevation, West Wailuaiki Stream is classified as Class 1a inland waters because the stream lies in the Ko'olau Forest Reserve. From there to the sea, it is classified as Class 2 inland waters. Marine waters at the mouth of the hydrologic unit of West Wailuaiki are Class AA waters. (West Wailuaiki IFSAR § 10.0, pp. 70-71.)

viii. Conveyance of irrigation and domestic water supplies to downstream points of diversion

412. One EMI diversion diverts water for domestic or irrigation purposes. The DOH Safe Drinking Water Branch does not currently regulate any public water systems in the hydrologic unit of West Wailuaiki. (West Wailuaiki IFSAR § 11.0, p. 73.)

ix. Protection of traditional and customary Hawaiian rights

413. According to the 1990 Hawai'i Coastal Zone Management Program's *Hawaiian Fishpond Study for the Islands of Hawaii, Maui, Lanai, and Kauai,* there are no fishponds in the hydrologic unit of West Wailuaiki. (West Wailuaiki IFSAR § 12.0, p. 90.)

g. **Kuleana users**

414. CWRM records for the hydrologic unit of West Wailuaiki indicate that there are no registered diversions declared for taro cultivation or other domestic purposes. (West Wailuaiki IFSAR § 12.0, p. 84.)

14. East Wailuaiki (6058)

a. **Physical features**

415. The hydrologic unit of East Wailuaiki is located northeast of Haleakala. It covers an area of 3.5 square miles from the upper slopes of Haleakala at 8,500 feet elevation to the sea. (East Wailuaiki IFSAR § 1.1, p. 1.)

416. East Wailuaiki Stream is 7.1 miles in length, traversing north from its headwater at the 6,350 feet altitude to the ocean. East Wailuaiki Stream has one tributary that branches west from the main stream at the 1,540 feet altitude and it is headed at the 3,300 feet altitude. (East Wailuaiki IFSAR § 1.1, p. 1.)

b. **Diversions**

417. EMI operates a diversion on East Wailuaiki Stream at the Ko'olau Ditch. (East Wailuaiki IFSAR § 13.1, p. 95.)

c. **Gaging stations**

418. East Wailuaiki Stream has one inactive USGS continuous-record stream gaging station (16517000), located upstream of Ko'olau Ditch at the 1,343 feet altitude. The gaging station has streamflow record for at least 37 years. Since the station is located upstream of the ditch, streamflow records reflect flows under natural (undiverted) conditions. (East Wailuaiki IFSAR § 3.3, p. 29.)

d. **Flow duration values**

419. According to USGS, the natural median baseflow at the upper reach of East Wailuaiki Stream directly downstream of the Ko'olau Ditch is 5.80 cfs (3.12 mgd); at the middle reach it is 6.80 cfs (3.66 mgd); and at the lower reach it is 7.20 cfs (3.87 mgd). (Table attached to Gingerich WDT 10/31/14, p. 1; USGS Regression Study, p. 60 (Table 11) and p. 64 (Table 12).)

e. **Previous IIFS recommendations, CWRM action, and implementation actions**

420. In 2010, CWRM staff recommended that one measurable IIFS be established for East Wailuaiki Stream at an estimated flow of 3.70 cfs (2.40 mgd) below all EMI diversions and just above Hana Highway, near an altitude of 1,235 feet. (Exh. C-103, p. 22.)

421. CWRM staff recommended flow restoration for East Wailuaiki Stream because it, along with West Wailuaiki Stream, would result in the most biological return from additional flow. The presence of an estuary in both streams further enhances the biological diversity of the stream. In addition, CWRM staff noted that flow restoration would provide increased opportunities for traditional gathering that area residents currently want to practice. (Exh. C-103, p. 19.)

422. In 2010, DAR recommended the release of a total of 3.20 cfs (2.07 mgd) into East Wailuaiki Stream during the wet season to provide for minimum habitat flows for native species and 0.20 cfs (0.13 mgd) during the dry season to provide connectivity for such species. DAR also recommended modifications to the K-16 Ko'olau Ditch diversion structure. DAR estimated that the recommended restoration actions on East Wailuaiki Stream would result in the creation of over 2.4 km of additional habitat for native species. DAR ranked East Wailuaiki Stream first in priority among the streams it recommended for restoration. (Appendix C to Higashi, WDT, p. 5.)

423. At its May 25, 2010 meeting, CWRM adopted CWRM staff's recommendation to establish an IIFS for East Wailuaiki Stream of 3.70 cfs (2.40 mgd) during the wet season and adopted DAR's recommendation to establish an IIFS of 0.20 cfs (0.13 mgd) during the dry season at an altitude of 1,235 feet, just above Hana Highway. (Exh. C-91, pp. 49-50, 52.)

424. In consultation with DAR, EMI has modified its diversion structure on East Wailuaiki Stream at the Ko'olau Ditch intake by installing a pipe along the right bank of the stream from a section of the stream higher in elevation than the height of the diversion dam to drop water onto the top of the diversion dam approximately 5 feet from the right bank. (Higashi, Tr., 3/16/15, p. 210, ll. 13-14; Exh. C-147, pp. 265-67 (FIR FI2011042601).)

f. <u>Instream values</u>

i. Maintenance of aquatic life and wildlife habitats

425. For East Wailuaiki Stream, the Hawaii Stream Assessment classifies the aquatic resources as "moderate", meaning a fair amount of native species were present. A number of native stream animals were observed in East Wailuaiki Stream, including 'o'opu nākea (*Awaous guamensis*), 'o'opu nōpili (*Sicyopterus stimpsoni*), 'o'opu akupa (*Eleotris sandwicensis*), 'o'opu alamo'o (*Lentipes concolor*), 'ōpae kala'ole (*Atyoida bisulcata*), and hīihīwai (*Neritina granosa*). During the more recent surveys, these stream animals except the 'ōpae kala'ole were observed in the middle reach at water temperatures of 20.6°C and 22.4°C. The 'ōpae kala'ole dominated the upper reach above the ditch at water temperatures of 18.9°C. A cast net sampling of the stream mouth and shoreline at East Wailuaiki resulted in a total catch of 116 fishes and invertebrates. The most dominant catch was uouoa (*Neomyxus leuciscus*), which were found in high surge and white water. Other species found included Iao (*Atherinomorus insularum*), nehu (*Encrasicholina purpurea*), ahole'hole (*Kuhlia xenura*), and tiger shrimp (*Palaemon pacificus*). A school of striped mullet (*Mugil cephalus*) were seen along the shoreline but not captured

during sampling. East Wailuaiki Stream rates high in comparison to other watersheds in Maui and statewide. DAR assigns East Wailuaiki a total watershed rating of 7 out of 10, a total biological rating of 7 out of 10, and a combined overall rating of 8 out of 10. Native species observed in the stream include:

> Fish – *Awaous guamensis*, *Eleotris sandwicensis*, *Kulhia xenura*, and *Sicyopterus stimpsoni*
> Crustaceans – *Atyoida bisulcata*
> Insects – *Anax junius*, *Anax* sp., *Anax strenuous*, *Limonia grimshawi*, *Limonia Jacobus*, *Megalagrion blackburni*, *Megalagrion calliphya*, *Megalagrion* sp., *Procanacae acuminate*, *Procanace confuse*, *Saldula exulans*, *Scatella cilipes*, *Scatella clavipes*, *Scatella femoralis*, *Telmatogeton abnormis*, *Telmatogen* sp.
> Mollusks – *Ferrissia sharpi* and *Neritina granosa*
> Sponge – *Heteromeyenia baileyi*

(East Wailuaiki IFSAR § 4.2, pp. 39, 43 and § 4.4, p. 43; DAR Report on East Wailuaiki Stream, Maui, Hawai'i, October 2009, p. 6.)

426. The estimated natural (undiverted) median baseflow of East Wailuaiki Stream is 5.80 cfs (3.75 mgd). The amount of flow in East Wailuaiki Stream needed to achieve H_{90} is 3.70 cfs (2.39 mgd). (Table attached to Gingerich WDT 10/31/14, p. 1; Exh. HO-1.)

ii. Outdoor recreational activities

427. The recreational resources of East Wailuaiki Stream were classified as "outstanding" by the Hawaii Stream Assessment's regional recreational committee. The Hawaii Stream Assessment identified opportunities for hiking, fishing, hunting, swimming, and scenic views related to East Wailuaiki Stream. Of the five, only scenic views were considered to be a high-quality experience. (East Wailuaiki IFSAR § 5.0, p. 52.)

iii. Maintenance of ecosystems such as estuaries, wetlands, and stream vegetation

428. Riparian resources of East Wailuaiki Stream were classified as "outstanding" by the Hawaii Stream Assessment. About 78% of the East Wailuaiki hydrologic unit lies within the

Ko'olau Forest Reserve, 10% within the Waikamoi Preserve, and only 3% within the Haleakala National Park. Approximately 66% of East Wailuaiki is classified as non-tidal palustrine wetlands occurring in the upper slopes of the hydrologic unit. (East Wailuaiki IFSAR § 6.0, pp. 56-59.)

iv. Aesthetic values

429. East Wailuaiki Stream is fed by lush native communities of Ohia forests and forested wetlands that dominate the upper and intermediate slopes of the hydrologic unit. Vegetation surrounding the lower reaches of East Wailuaiki Stream is predominately alien forests. The hydrologic unit lies within the Waikamoi Preserve in the upper elevations, and the Ko'olau Forest Reserve in the intermediate and lower elevations. A number of waterfalls are located along the lower reaches of the stream, one of which can be seen from Hana Highway. The stream empties into Wailua Iki Bay, where a number of coastal activities are enjoyed by the locals as well as the general public. The easternmost end of the hydrologic unit is Papiha Point, which offers a great view of Wailua Iki Bay and Makoloaka Island. (East Wailuaiki IFSAR § 7.0, p. 64.)

v. Navigation

430. No navigation values are present. (East Wailuaiki IFSAR § 8.0, p. 66.)

vi. Instream hydropower generation

431. HC&S operates three run-of-river hydroelectric facilities on the Wailoa Ditch, which is supplied with water from several sources including East Wailuaiki Stream. (East Wailuaiki IFSAR § 9.0, p. 67.)

vii. Maintenance of water quality

432. East Wailuaiki Stream appears on the 2006 List of Impaired Waters in Hawai'i, Clean Water Act § 303(d). While some data exist for East Wailuaiki Stream, there were not

sufficient data for decision-making; therefore, no decision was made pertaining to the attainment of water quality standards or the applicable designated uses. East Wailuaiki Stream is classified as Class 1b inland waters from its headwaters to approximately 1,400 feet elevation, as the surrounding land is in the conservation subzone "protective" and the stream also lies in the Ko'olau Forest Reserve. From there to the sea, East Wailuaiki Stream is classified as Class 2 inland water. Marine waters at the mouth of the hydrologic unit of East Wailuaiki are Class AA waters. (East Wailuaiki IFSAR § 10.0, pp. 71-72.)

viii. Conveyance of irrigation and domestic water supplies to downstream points of diversion

433. No diversions other than EMI diversions diverts water for irrigation purposes. The DOH Safe Drinking Water Branch does not currently regulate any public water systems in the hydrologic unit of East Wailuaiki. (East Wailuaiki IFSAR § 11.0, p. 74.)

ix. Protection of traditional and customary Hawaiian rights

434. According to the 1990 Hawai'i Coastal Zone Management Program's *Hawaiian Fishpond Study for the Islands of Hawaii, Maui, Lanai, and Kauai,* there are no fishponds in the hydrologic unit of East Wailuaiki. (East Wailuaiki IFSAR § 12.0, p. 91.)

g. Kuleana users

435. CWRM records for the hydrologic unit of East Wailuaiki indicate that there are no registered diversions declared for taro cultivation or other domestic purposes. (East Wailuaiki IFSAR § 12.0, p. 85.)

15. Kopili'ula (6059)

a. Physical features

436. The hydrologic unit of Kopili'ula is located northeast of Haleakala. It covers an area of 5.2 square miles from the upper slopes of Haleakala at 8,200 feet elevation to the sea. (Kopili'ula IFSAR § 1.1, p. 1.)

437. Kopili'ula Stream is 7.6 miles in length, traversing north from its headwater at the 7,700 feet altitude to the ocean. Kopili'ula Stream has one tributary, Puakaa Stream, that branches east from the main stream at the 77 feet altitude and is headed at the 2,000 feet altitude. (Kopili'ula IFSAR § 1.1, p. 1; § 3.3, p. 28.)

b. Diversions

438. EMI operates a diversion on Kopili'ula Stream at the Ko'olau Ditch. (Kopili'ula IFSAR § 13.1, p. 98.)

439. Kopili'ula Stream is used to convey water from one ditch section to another. (Exh. C-103, p. 20.)

440. EMI operates a diversion on Puakaa Stream at the Ko'olau Ditch. (Kopili'ula IFSAR § 13.1, p. 102.)

c. Gaging stations

441. Kopili'ula Stream has one inactive USGS continuous-record stream gaging station (station 16516000), located upstream of Ko'olau Ditch at the 1,292 feet altitude. The gage was active from 1914 to 1917 and 1922 to 1958. (Kopili'ula IFSAR § 3.3, p. 29.)

d. Flow duration values

442. According to USGS, the natural median baseflow at the upper reach of Kopili'ula Stream directly downstream of the Ko'olau Ditch is 5.00 cfs (2.69 mgd); at the middle reach it is 6.50 cfs (3.50 mgd); and at the lower reach it is 9.50 cfs (5.11 mgd). (Table attached to Gingerich WDT 10/31/14, p. 1; USGS Regression Study, p. 60 (Table 11) and p. 64 (Table 12).)

e. Previous IIFS recommendations, CWRM action, and implementation actions

443. In 2010, CWRM staff recommended that the IIFS for Kopili'ula Stream remain as designated on October 8, 1988, at an estimated flow of 0.50 cfs (0.32 mgd) below all EMI diversions and just above Hana Highway, near an altitude of 1,270 feet. CWRM staff also recommended that the IIFS for Puakaa Stream remain as designated on October 8, 1988, at an estimated flow of 0.60 cfs (0.39 mgd) below all EMI diversions and just above Hana Highway, near an altitude of 1,235 feet. (Exh. C-103, p. 22.)

444. CWRM staff did not recommend flow restoration for Kopili'ula Stream because it is used for conveyance of water from one section of ditch to another. Flow restoration is not recommended for conveyance streams because more water may exist in the portion of stream used for conveyance than would naturally occur. Moreover, commingled water exists for a considerable distance upstream of the diversion structures on the stream. CWRM staff believes that any IIFS should be based solely on the surface available within the given hydrologic unit. Any modification to the existing diversion infrastructure on the stream would result in more water being released than naturally occurs. (Exh. C-103, p. 20.)

445. CWRM staff did not recommend flow restoration for Puakaa Stream because the amount of habitat unit gain in the stream is only 300 meters compared to over 1,200 meters in Hanawī Stream. The cost and effort to modify the diversion to allow for connectivity is better spent in Hanawī Stream than Puakaa Stream. (Exh. C-103, p. 20.)

446. In 2010, DAR recommended the release of a total of 3.00 cfs (1.61 mgd) into Kopili'ula Stream during the wet season to provide for minimum habitat flows for native species and 0.20 cfs (0.13 mgd) during the dry season to provide connectivity for such species. DAR also recommended modifications to the K-15 Ko'olau Ditch diversion structure and the K-14 Ko'olau Ditch diversion structure on the Puakaa tributary. DAR did not recommend flow

restoration for Puakaa Stream. DAR estimated that the recommended restoration actions on Kopili'ula Stream and Puakaa Stream would result in the creation of over 2.0 km of additional habitat for native species. DAR ranked Kopili'ula Stream fifth in priority among the streams it recommended for restoration. (Appendix C to Higashi, WDT, p. 9.)

447. At its May 25, 2010 meeting, CWRM decided to adopt CWRM staff's recommendation to not modify the existing IIFS for Kopili'ula Stream of 0.50 cfs (0.32 mgd) and to not modify the existing IIFS for Puakaa Stream of 0.60 cfs (0.39 mgd). (Exh. C-91, pp. 50, 52.)

f. **Instream values**

i. Maintenance of aquatic life and wildlife habitats

448. For Kopili'ula Stream, the Hawaii Stream Assessment classifies the aquatic resources as "moderate", meaning a fair amount of native species were present. A number of native stream animals were observed in Kopili'ula Stream, including 'o'opu nākea (*Awaous guamensis*), 'o'opu nōpili (*Sicyopterus stimpsoni*), 'o'opu akupa (*Eleotris sandwicensis*), 'o'opu alamo'o (*Lentipes concolor*), 'ōpae kala'ole (*Atyoida bisulcata*), and hīhīwai (*Neritina granosa*). During the more recent surveys, the 'ōpae kala'ole was only observed in the upper reach above the ditch. The 'o'opu nākea, 'o'opu nōpili, and hīihīwai were observed in the middle and lower reaches, whereas the 'o'opu alamo'o was observed in the upper and lower reaches. All these stream animals except the 'o'opu akupa were observed in the lower, middle, and upper reaches in past surveys. The estuary in Kopili'ula was relatively small compared to other estuaries surveyed in East Maui, and not much estuarine habitat was available. A recent cast net sampling of the stream mouth resulted in only one specimen of Hawaii surf fish (*Iso hawaiiensis*), which usually inhabit areas with high salinity. Kopili'ula Stream rates high in comparison to other watersheds in Maui and statewide. DAR assigns Haipuaena a total watershed rating of 8 out of

10, a total biological rating of 7 out of 10, and a combined overall rating of 8 out of 10. Native species observed in the stream include:

> Fish – *Awaous guamensis*, *Eleotris sandwicensis*, *Lentipes concolor*, *Kulhia xenura*, and *Sicyopterus stimpsoni*
> Crustaceans – *Atyoida bisulcata*
> Insects – *Telmatogen* sp..
> Mollusks – *Neritina granosa*
> Sponge – *Heteromeyenia baileyi*

(Kopili'ula IFSAR § 4.2, pp. 41 and § 4.4, p. 46; DAR Report on Kopili'ula Stream, Maui, Hawai'i, October 2009, p. 6.)

449. The estimated natural (undiverted) median baseflow of Kopili'ula Stream is 5.00 cfs (3.23 mgd). The amount of flow in Kopili'ula Stream needed to achieve H_{90} is 3.20 cfs (2.07 mgd). (Table attached to Gingerich WDT 10/31/14, p. 1; Exh. HO-1.)

450. The estimated natural (undiverted) median baseflow of Puakaa Stream is 1.10 cfs (0.71 mgd). The amount of flow in Puakaa Stream needed to achieve H_{90} is 0.70 cfs (0.45 mgd). (Table attached to Gingerich WDT 10/31/14, p. 1; Exh. HO-1.)

ii. Outdoor recreational activities

451. The recreational resources of Kopili'ula Stream were classified as substantial by the Hawaii Stream Assessment's regional recreational committee. The Hawaii Stream Assessment identified opportunities for fishing, hunting, swimming, and scenic views related to Kopili'ula Stream. None were considered to be a high-quality experience. (Kopili'ula IFSAR § 5.0, p. 54.)

iii. Maintenance of ecosystems such as estuaries, wetlands, and stream vegetation

452. Riparian resources of Kopili'ula Stream were classified as outstanding by the Hawai'i Stream Assessment. About 61% of the unit lies within the Ko'olau Forest Reserve, 25% within the Hanawī Natural Area Reserve, 6% within Haleakala National Park, and only 2%

within the Waikamoi Preserve. Approximately 62% of Kopili'ula is classified as non-tidal palustrine wetlands occurring in the intermediate and upper slopes of the hydrologic unit. (Kopili'ula IFSAR § 5.0, pp. 58, 59, 61.)

iv. Aesthetic values

453. Kopili'ula Stream is fed by lush native communities of Ohia forests and forested wetlands that dominate the upper and intermediate slopes of the hydrologic unit. Vegetation surrounding the lower reaches of Kopili'ula Stream is predominately alien forests. The surrounding vegetation for Puakaa Stream is also predominately alien forests. A number of waterfalls are located along the lower reaches of the Kopili'ula and Puakaa streams, and one of the waterfalls on Kopili'ula Stream can be seen from Hana Highway. The hydrologic unit lies within four forest reserves, Haleakala National Park, Waikamoi Preserve, Ko'olau Forest Reserve, and Hanawī Natural Area Reserve. Located in the westernmost end of the hydrologic unit is Papiha Point, which offers a view of Makoloaka Island. (Kopili'ula IFSAR § 7.0, p. 67.)

v. Navigation

454. There are no navigation values present. (Kopili'ula IFSAR § 8.0, p. 69.)

vi. Instream hydropower generation

455. HC&S operates three run-of-river hydroelectric facilities on the Wailoa Ditch, which is supplied with water from several sources including Kopili'ula Stream and Puakaa Stream. (Kopili'ula IFSAR § 9.0, p. 70.)

vii. Maintenance of water quality

456. Kopili'ula Stream appears on the 2006 List of Impaired Waters in Hawai'i, Clean Water Act § 303(d). While some data exist for Kopili'ula Stream, there were not sufficient data for decision-making; therefore, no decision was made pertaining to the attainment of WQS or the applicable designated uses. Kopili'ula Stream is classified as Class 1b inland waters from its

headwaters to approximately 1,300 feet elevation, as the surrounding land is in the conservation subzone "protective", and the stream also lies in the Ko'olau Forest Reserve, excepting the 0.2 miles at the west tributary headwater that lies in the Waikamoi Preserve and it is classified as Class 1a inland waters because, while not in the protective subzone, the stream lies in the Ko'olau Forest Reserve. From there to the sea, it is classified as Class 2 inland waters. Marine waters at the mouth of the hydrologic unit of Kopili'ula are Class AA waters. (Kopili'ula IFSAR § 10.0, pp. 75-76.)

viii. Conveyance of irrigation and domestic water supplies to downstream points of diversion

457. No non-EMI diversions divert water for domestic or irrigation purposes. The DOH Safe Drinking Water Branch does not currently regulate any public water systems in the hydrologic unit of Kopili'ula. (Kopili'ula IFSAR § 11.0, p. 78.)

ix. Protection of traditional and customary Hawaiian rights

458. According to the 1990 Hawai'i Coastal Zone Management Program's *Hawaiian Fishpond Study for the Islands of Hawaii, Maui, Lanai, and Kauai*, there are no fishponds present in the hydrologic unit of Kopili'ula. (Kopili'ula IFSAR § 12.0, p. 89.)

g. Kuleana users

459. CWRM records for the hydrologic unit of Kopili'ula indicate that no registered diversions were declared for taro cultivation or other domestic purposes. (Kopili'ula IFSAR § 12.0, p. 89.)

16. Waiohue (6060)

a. Physical features

460. The hydrologic unit of Waiohue is located northeast of Haleakala. It covers an area of 0.8 square miles from the lower slopes of Haleakala at 2,800 feet elevation to the sea. (Waiohue IFSAR § 1.1, p. 1.)

461. Waiohue Stream is 2.6 miles in length, traversing north from its headwater at the 2,250 feet altitude to the ocean. (Waiohue IFSAR § 1.1, p. 1.)

b. <u>Diversions</u>

462. EMI operates a diversion on Waiohue Stream at the Ko'olau Ditch. (Waiohue IFSAR § 13.1, p. 94.)

c. <u>Gaging stations</u>

463. There is one inactive USGS continuous-record stream gaging station located on Waiohue Stream upstream of Ko'olau Ditch at the 1,316 feet altitude. (Waiohue IFSAR § 3.3, p. 28.)

d. <u>Flow duration values</u>

464. According to USGS, the natural median baseflow at the upper reach of Waiohue Stream directly downstream of the Ko'olau Ditch is 5.00 cfs (2.69 mgd); at the middle reach it is 6.00 cfs (3.23 mgd); and at the lower reach it is 9.50 cfs (5.11 mgd). (Table attached to Gingerich WDT 10/31/14, p. 1; USGS Regression Study, p. 60 (Table 11).)

e. <u>Previous IIFS recommendations, CWRM action, and implementation actions</u>

465. In 2010, CWRM staff recommended that one measurable IIFS be established for Waiohue Stream at an estimated flow of 3.20 cfs (2.10 mgd) below all EMI diversions and just above Hana Highway, near an altitude of 1,195 feet. (Exh. C-103, p. 23.)

466. CWRM staff proposed Waiohue for flow restoration because the presence of an estuary further enhances the biological diversity of the stream. Moreover, based on data

provided by NHLC, 25 residents testified to gathering vegetation and stream animals in Waiohue Stream. (Exh. C-103, p. 19.)

467. In 2010, DAR recommended the release of a total of 2.70 cfs (1.45 mgd) into Waiohue Stream during the wet season to provide for minimum habitat flows for native species and 0.10 cfs (0.06 mgd) during the dry season to provide connectivity for such species. DAR also recommended modifications to the K-13 intake into Ko'olau Ditch. DAR estimated that the recommended restoration actions on Waiohue Stream would result in the creation of an additional 1.5 km of additional habitat for native species. DAR ranked Waiohue Stream seventh in priority among the streams it recommended for restoration. (Appendix C to Higashi, WDT, p. 11.)

468. At its May 25, 2010 meeting, CWRM adopted CWRM staff's recommendation to establish an IIFS for Waiohue Stream of 3.20 cfs (2.10 mgd) during the wet season and adopted DAR's recommendation to establish an IIFS of 0.10 cfs (0.06 mgd) during the dry season at an altitude of 1,195 feet, just above Hana Highway. (Exh. C-91, pp. 49-50, 52.)

469. In consultation with DAR, EMI has modified its diversion structure on Waiohue Stream at the Ko'olau Ditch intake by constructing a 2-inch pipe along a stream bank that diverts water from a development tunnel in order to drop water onto the top of the diversion dam so that water would spill on the mauka and makai sides of the dam. (Higashi, Tr., 3/16/15, p. 210, ll. 9-10; Hew, Tr., 3/17/15, p. 152, l. 15 to p. 153, l. 1; Exh. C-147, pp. 265-67 (FIR FI2011042601).)

f. <u>Instream values</u>

i. Maintenance of aquatic life and wildlife habitats

470. For Waiohue Stream, the Hawaii Stream Assessment classifies the aquatic resources as "outstanding", meaning a diversity of native species were present. A number of native stream animals were observed in Waiohue Stream, including 'o'opu nākea (*Awaous*

guamensis), ‘o‘opu nōpili (*Sicyopterus stimpsoni*), ‘o‘opu akupa (*Eleotris sandwicensis*), ‘ōpae kala‘ole (*Atyoida bisulcata*), and hīihīwai (*Neritina granosa*). During the most recent surveys, ‘o‘opu nōpili was observed near the stream mouth at a water temperature of 20.5 degree Celsius. ‘o‘opu nākea and hīhīwai were observed in the upper reach near the ditch. The only species recorded in the upper reach above the ditch was ‘ōpae kala‘ole. Water temperatures dropped by almost 3 degrees from the lower reach to the upper reach above the ditch. The poeciliid fishes dwell in the deep pools created above diversion structures and are known to transmit parasites to native fishes. A cast net sampling of the stream mouth and shoreline at Waiohue resulted in catches of aholehole (*Kuhlia xenura*) and Kupipi (*Abudefduf sordidus*). The most dominant catch was aholehole (*Kuhlia xenura*), which were found in areas with varying salinity. The stream had minimal flow entering the ocean during the survey. Waiohue Stream rates high in comparison to other watersheds in Maui and statewide. DAR assigns Waiohue a total watershed rating of 7 out of 10, a total biological rating of 8 out of 10, and a combined overall rating of 7 out of 10. Native species observed in the stream include:

> Fish – *Awaous guamensis*, *Eleotris sandwicensis*, *Kuhlia sandwicensis*, *Kuhlia* sp., *Kulhia xenura*, *Lentipes concolor*, *Mugil cephalus*, *Sicyopterus stimpsoni*, *Stenogobius hawaiiensis*
> Crustaceans – *Amphipod asp.*, *Atyoida bisulcata* and *Macrobrachium grandimanus*
> Insects – *Anax junius*, *Megalagrion* sp. and *Telmatogen* sp.
> Mollusks – *Ferrissia sharpi*, *Nerita picea*, *Neritina granosa*, *Neritid* sp. and *Neritina vespertina*

(Waiohue IFSAR § 4.2, pp. 42 and § 4.4, p. 46; DAR Report on Waiohue Stream, Maui, Hawai‘i, October 2009, p. 6.)

471. The estimated natural (undiverted) median baseflow of Waiohue Stream is 5.00 cfs (3.23 mgd). The amount of flow in Waiohue Stream needed to achieve H_{90} is 3.20 cfs (2.07 mgd). (Table attached to Gingerich WDT 10/31/14, p. 1; Exh. HO-1.)

ii. Outdoor recreational activities

472. The recreational resources of Waiohue Stream were classified as outstanding by the Hawaii Stream Assessment's regional recreational committee. The Hawaii Stream Assessment identified opportunities for camping, hiking, fishing, swimming, parks, and scenic views related to Waiohue Stream. Of these six, only parks were not considered to be a high-quality experience. (Waiohue IFSAR § 5.0, p. 52.)

iii. Maintenance of ecosystems such as estuaries, wetlands, and stream vegetation

473. Riparian resources of Waiohue Stream were not classified by the Hawaii Stream Assessment. About 83% of the unit lies within the Ko'olau Forest Reserve, 10% within the Hanawī Natural Area Reserve, and less than 1% within the Puaa Kaa State Wayside. Approximately 32% of Waiohue is classified as non-tidal palustrine wetlands occurring in the upper slopes of the hydrologic unit. (Waiohue IFSAR § 6.0, pp. 56-58.)

iv. Aesthetic values

474. Waiohue Stream is fed by lush native communities of Ohia forests and forested wetlands that dominate the upper and intermediate slopes of the hydrologic unit. Vegetation surrounding the lower reaches of Waiohue Stream is predominately alien forests. A number of waterfalls are located along the lower reach of the Waiohue Stream, and one of the waterfalls can be seen from Hana Highway and one can be seen from the Puaa Kaa State Wayside. The hydrologic unit lies within two forest reserves, Ko'olau Forest Reserve and Hanawī Natural Area Reserve. Mokuhuki Island can be viewed from the coast. Waiohue Bay is a popular fishing location. (Waiohue IFSAR § 7.0, p. 64.)

v. Navigation

475. No navigation values are present. (Waiohue IFSAR § 8.0, p. 66.)

vi. Instream hydropower generation

476. HC&S operates three run-of-river hydroelectric facilities on the Wailoa Ditch, which is supplied with water from several sources including Waiohue Stream. (Waiohue IFSAR § 9.0, p. 67.)

vii. Maintenance of water quality

477. Waiohue Stream does not appear on the 2006 List of Impaired Waters in Hawai'i, Clean Water Act § 303(d). Waiohue Stream is classified as Class 1b inland waters from its headwaters to approximately 1,250 feet elevation, as the surrounding land is in the conservation subzone "protective." The stream also lies in the Ko'olau Forest Reserve and the Hanawī Natural Area Reserve in the headwaters. Between the 1,250 feet and 100 feet altitudes, the stream is classified as Class 1a inland waters because, while not in the protective subzone, the stream lies in the Ko'olau Forest Reserve. From there to the sea, it is classified as Class 2 inland waters. Marine waters at the mouth of the hydrologic unit of Waiohue are Class AA waters. (Waiohue IFSAR § 10.0, pp. 71-72.)

viii. Conveyance of irrigation and domestic water supplies to downstream points of diversion

478. One non-EMI diversion registered by the State Division of State Parks provides non-potable water to the comfort station at the Puaa Kaa State Wayside. The DOH Safe Drinking Water Branch does not currently regulate any public water systems in the hydrologic unit of Waiohue. (Waiohue IFSAR § ,11.0 pp. 74-75.)

ix. Protection of traditional and customary Hawaiian rights

479. According to the 1990 Hawai'i Coastal Zone Management Program's *Hawaiian Fishpond Study for the Islands of Hawaii, Maui, Lanai, and Kauai*, there are no fishponds present in the hydrologic unit of Waiohue. (Waiohue IFSAR § 12.0, p. 91.)

g. **Kuleana users**

480. CWRM records for the hydrologic unit of Waiohue indicate that no registered diversions were declared for taro cultivation or other domestic purposes. (Waiohue IFSAR § 12.0, p. 85.)

17. Pa'akea (6061)

a. **Physical features**

481. The hydrologic unit of Pa'akea is located northeast of Haleakala. It covers an area of 1 square mile from the lower slopes of Haleakala at 4,100 feet elevation to the sea. (Paakea IFSAR § 1.1, p. 1.)

482. Pa'akea Stream is 1.8 miles in length, traversing north from its headwater at the 1,800 feet altitude to the ocean. (Waiohue IFSAR § 1.1, p. 1.)

b. **Diversions**

483. EMI operates a diversion on Pa'akea Stream at the Ko'olau Ditch. (Pa'akea IFSAR § 13.1, p. 94.)

c. **Gaging stations**

484. There is one inactive USGS continuous-record stream gaging station (16514000) located on Pa'akea Stream downstream of Ko'olau Ditch at the 650 feet altitude. The station has streamflow record for at least 14 years. (Pa'akea IFSAR § 3.3, p. 30.)

d. **Flow duration values**

485. According to USGS, the natural median baseflow at the upper reach of Pa'akea Stream directly downstream of the Ko'olau Ditch is 0.90 cfs (0.48 mgd); at the middle reach it is 4.70 cfs (2.53 mgd); and at the lower reach it is 5.50 cfs (2.96 mgd). (Table attached to Gingerich WDT 10/31/14, p. 1; USGS Regression Study, p. 60 (Table 11) and p. 64 (Table 12).)

e. **Previous IIFS recommendations, CWRM action, and implementation actions**

486. In 2010, CWRM staff recommended that the IIFS for Pa'akea Stream remain as designated on October 8, 1988, at an estimated flow of 1.50 cfs (0.97 mgd) below all EMI diversions and just above Hana Highway, near an altitude of 1,265 feet. (Exh. C-103, p. 23.)

487. CWRM staff did not recommend flow restoration for Pa'akea Stream because restoration of additional flow would not result in significant biological return in this stream. (Exh. C-103, p. 20).

488. Pa'akea Stream was not among the streams recommended for restoration by DAR in 2010.

489. At its May 25, 2010 meeting, CWRM decided to adopt CWRM staff's recommendation to not modify the existing IIFS for Pa'akea Stream of 1.50 cfs (0.97 mgd). (Exh. C-91, pp. 50, 52.)

f. <u>Instream values</u>

i. Maintenance of aquatic life and wildlife habitats

490. For Pa'akea Stream, the Hawaii Stream Assessment classifies the aquatic resources as "moderate", meaning a fair amount of native species were present. A number of native stream animals were observed in Pa'akea Stream, including 'o'opu nākea (*Awaous guamensis*), 'o'opu nōpili (*Sicyopterus stimpsoni*), 'o'opu akupa (*Eleotris sandwicensis*), 'o'opu alamo'o (*Lentipes concolor*), 'ōpae kala'ole (*Atyoida bisulcata*), and hīhīwai (*Neritina granosa*). During the most recent surveys, only the 'ōpae kala'ole was observed in the upper reach above the ditch. The 'o'opu akupa, 'o'opu nōpili, hīhīwai, and postlarvae were observed inside the first plunge pool as well lower reach leading to the ocean. Above the first waterfall, 'o'opu nākea, 'o'opu nōpili, oopy alamo'o, and hīhīwai were observed. Introduced species such as river prawns (*Macrobrachium lar*) were observed in the lower and middle reaches of the stream. The estuary in Pa'akea was relatively small compared to other estuaries surveyed in east Maui, and not much

estuarine habitat was available. A cast net sampling of the stream mouth resulted in a total of eight catches, including aholehole (*Kuhlia xenura*), Christmas wrasse (*Thalassoma trilobatum*), and Iao (*Atherinomorus insularum*). The stream had minimal flow entering the ocean at the time of the survey. Pa'akea Stream rates medium in comparison to other watersheds in Maui and statewide. DAR assigns Pa'akea a total watershed rating of 6 out of 10, a total biological rating of 6 out of 10, and a combined overall rating of 5 out of 10. Native species observed in the stream include:

> Fish – *Awaous guamensis*, *Eleotris sandwicensis*, *Kulhia xenura*, *Lentipes concolor*, *Mugil cephalus* and *Sicyopterus stimpsoni*
> Crustaceans – *Atyoida bisulcata*
> Snails – *Neritina granosa*

(Pa'akea IFSAR § 4.2, pp. 41 and § 4.4, p. 46; DAR Report on Pa'akea Stream, Maui, Hawai'i, October 2009, p. 6.)

491. The estimated natural (undiverted) median baseflow of Pa'akea Stream is 0.90 cfs (0.58 mgd). The amount of flow in Pa'akea Stream needed to achieve H_{90} is 0.58 cfs (0.37 mgd). (Table attached to Gingerich WDT 10/31/14, p. 1; Exh. HO-1.)

ii. Outdoor recreational activities

492. The recreational resources of Pa'akea Stream were classified as substantial by the Hawaii Stream Assessment's regional recreational committee. The Hawaii Stream Assessment identified opportunities for fishing, and it was considered to be a high-quality experience. (Pa'akea IFSAR § 5.0, p. 52.)

iii. Maintenance of ecosystems such as estuaries, wetlands, and stream vegetation

493. Riparian resources of Pa'akea Stream were not classified by the Hawai'i Stream Assessment. About 54% of the unit lies within the Hanawī Natural Area Reserve, and 20% within the Ko'olau Forest Reserve. Approximately 61% of Pa'akea is classified as non-tidal

palustrine wetlands occurring in the upper slopes of the hydrologic unit. (Pa'akea IFSAR § 6.0, pp. 56-58.)

iv. Aesthetic values

494. Pa'akea Stream is fed by lush native communities of Ohia forests and forested wetlands that dominate the upper and intermediate slopes of the hydrologic unit. Vegetation surrounding the lower reaches of Pa'akea Stream is predominately alien forests. A number of springs are located along the intermediate and lower reaches of the stream. The hydrologic unit lies within two forest reserves, Ko'olau Forest Reserve and Hanawī Natural Area Reserve. Mokuhuki Island may be viewed from the coast. Waiohue Bay is a popular fishing location. (Pa'akea IFSAR § 7.0, p. 64.)

v. Navigation

495. No navigation values are present. (Pa'akea IFSAR §8 .0, p. 66.)

vi. Instream hydropower generation

496. HC&S operates three run-of-river hydroelectric facilities on the Wailoa Ditch, which is supplied with water from several sources including Pa'akea Stream. (Pa'akea IFSAR § 9.0, p. 67.)

vii. Maintenance of water quality

497. Pa'akea Stream does not appear on the 2006 List of Impaired Waters in Hawai'i, Clean Water Act § 303(d). Pa'akea Stream is classified as Class 1b inland waters from its headwaters to approximately 1,300 feet elevation, as the surrounding land is in the conservation subzone "protective" and the stream also lies in the Ko'olau Forest Reserve. Downstream from the 1,300 feet altitude, the stream is classified as Class 2 inland waters and the stream does not lie within any forest reserve. Marine waters at the mouth of the entire hydrologic unit of Pa'akea are Class AA waters. (Pa'akea IFSAR § 10.0, pp. 71-72.)

viii. Conveyance of irrigation and domestic water supplies to downstream points of diversion

498. No non-EMI registered diversions divert water for domestic or irrigation purposes. The DOH Safe Drinking Water Branch does not currently regulate any public water systems in the hydrologic unit of Pa'akea. (Pa'akea IFSAR § 11.0, p. 74.)

ix. Protection of traditional and customary Hawaiian rights

499. According to the 1990 Hawai'i Coastal Zone Management Program's *Hawaiian Fishpond Study for the Islands of Hawaii, Maui, Lanai, and Kauai*, there are no fishponds present in the hydrologic unit of Pa'akea. (Pa'akea IFSAR § 12.0, p. 91.)

g. Kuleana users

500. CWRM records for the hydrologic unit of Pa'akea indicate that there no registered diversions that were declared for taro cultivation. (Pa'akea IFSAR § 12.0, p. 80.)

18. Waiaaka (6062)

a. Physical features

501. The hydrologic unit of Waiaaka is located northeast of Haleakala. It covers an area of about 0.2 square miles from the lower slopes of Haleakala at 1,600 feet elevation to the sea. (Waiaaka IFSAR § 1.1, p. 1.)

502. Waiaaka Stream is 0.9 miles in length, traversing north from its headwater at the 1,300 feet altitude to the ocean. (Waiaaka IFSAR § 1.1, p. 1.)

b. Diversions

503. EMI operates a diversion on Waiaaka Stream at the Ko'olau Ditch. (Waiaaka IFSAR § 13.1 at 89.)

c. **Gaging stations**

504. One inactive USGS continuous-record stream gaging station (station 16513000) is located on Waiaaka Stream downstream of Ko'olau Ditch at the 650 feet altitude. The station has streamflow record for at least 14 years. Since the station is located downstream of the Ko'olau Ditch, streamflow records reflect flows under diverted conditions. (Waiaaka IFSAR § 3.3, p. 29.)

d. **Flow duration values**

505. According to USGS, the natural median baseflow at the middle reach of Waiaaka below the Ko'olau Ditch is 0.77 cfs (0.41 mgd); at the lower reach it is 1.10 cfs (0.59 mgd). (Table attached to Gingerich WDT 10/31/14, p. 1; USGS Regression Study, p. 60 (Table 11) and p. 64 (Table 12).)

e. **Previous IIFS recommendations, CWRM action, and implementation actions**

506. In 2010, CWRM staff recommended that the IIFS for Waiaaka Stream remain as designated on October 8, 1988, at an estimated flow of 0 cfs below all EMI diversions and just above Hana Highway, near an altitude of 1,235 feet. (Exh. C-103, p. 22.)

507. CWRM staff did not recommend flow restoration for Waiaaka Stream because restoration of additional flow would not result in significant biological return in this stream. (Exh. C-103, p. 20).

508. Waiaaka Stream was not among the streams recommended for restoration by DAR in 2010.

509. At its May 25, 2010 meeting, CWRM decided to adopt CWRM staff's recommendation to not modify the existing IIFS for Waiaaka Stream of 0 cfs. (Exh. C-91, pp. 50, 52.)

f. **Instream values**

i. Maintenance of aquatic life and wildlife habitats

510. Waiaaka Stream was not assessed in the Hawaii Stream Assessment. (Waiaaka IFSAR § 4.2, p. 40.)

511. The estimated natural (undiverted) median baseflow of Waiaaka Stream is 0.77 cfs (0.50 mgd). The amount of flow in Waiaka Stream needed to achieve H_{90} is 0.49 cfs (0.32 mgd). (Table attached to Gingerich WDT 10/31/14, p. 2; Exh. HO-1.)

ii. Outdoor recreational activities

512. The Hawaii Stream Assessment identified opportunities for fishing only related to Waiaaka Stream and it was considered to be a high-quality experience. (Waiaaka IFSAR § 5.0, p. 47.)

iii. Maintenance of ecosystems such as estuaries, wetlands, and stream vegetation

513. Riparian resources of Waiaaka Stream were not classified by the Hawaii Stream Assessment. Only a small percent of the hydrologic unit lies within the Ko'olau Forest Reserve. There are no non-tidal palustrine wetlands occurring in the hydrologic unit. (Waiaaka IFSAR § 6.0, pp. 51-53.)

iv. Aesthetic values

514. Vegetation surrounding Waiaaka Stream is predominately alien forests and grasslands with scattered Ohia forests and Uluhe shrub lands. A number of springs are located along the stream, with one of the springs near Hana Highway and another in the headwaters. Although the hydrologic unit does not lie within any forest reserve or preserve, the Na Ala Hele trail is located in the lower basin and crosses the stream where the public can access. Waiohue Bay is a popular fishing location. (Waiaaka IFSAR § 7.0, p. 59.)

v. Navigation

515. No navigation values are present. (Waiaaka IFSAR § 8.0, p. 61.).

vi. Instream hydropower generation

516. HC&S operates three run-of-river hydroelectric facilities on the Wailoa Ditch, which is supplied with water from several sources including Waiaakea Stream. (Waiaaka IFSAR § 9.0, p. 62.)

vii. Maintenance of water quality

517. Waiaaka Stream does not appear on the 2006 List of Impaired Waters in Hawai'i, Clean Water Act § 303(d). Waiaaka Stream is classified as Class 1b inland waters from its headwaters to Hana Highway (approximately 1,240 feet elevation), as the surrounding land is in the conservation subzone "protective." Downstream from Hana Highway, the stream is classified as Class 2 inland waters. Marine waters at the mouth of the hydrologic unit of Waiaaka are Class AA waters. (Waiaaka IFSAR § 10.0, pp. 66-67.)

viii. Conveyance of irrigation and domestic water supplies to downstream points of diversion

518. No non-EMI diversions divert water for domestic or irrigation purposes. (Waiaaka IFSAR § 11.0, p. 69.)

ix. Protection of traditional and customary Hawaiian rights

519. According to the 1990 Hawai'i Coastal Zone Management Program's *Hawaiian Fishpond Study for the Islands of Hawaii, Maui, Lanai, and Kauai*, there are no fishponds present in the hydrologic unit of Waiaaka. (Waiaaka IFSAR § 12.0, p. 80.)

g. <u>Kuleana users</u>

520. CWRM records for the hydrologic unit of Waiaaka indicate that there are no registered diversions that were declared for taro cultivation. (Waiaaka IFSAR § 12.0, p. 86.)

19. Kapaula (6063)

a. Physical features

521. The hydrologic unit of Kapaula is located northeast of Haleakala. It covers an area of 0.8 square miles from the lower slopes of Haleakala at 2,700 feet elevation to the sea. (Kapaula IFSAR § 1.1, p. 1.)

522. Kapaula Stream is 2.6 miles in length, traversing north from its headwater at the 2,340 feet altitude to the ocean. (Kapaula IFSAR § 1.1, p. 1.)

523. A terminal waterfall in Kapaula Stream reduces the amount of available instream habitat. Only ʻoʻopu alamoʻo and ʻōpae are able to migrate up the terminal waterfall. (Kapaula IFSAR § 4.4, p. 44.)

b. Diversions

524. EMI operates a diversion on Kapaula Stream at the Koʻolau Ditch. (Kapaula IFSAR § 13.1, p. 92.)

c. Gaging stations

525. Two inactive USGS continuous-record stream gaging stations are on Kapaula Stream. Station 16510000 at the 1,346 feet elevation is upstream from Koʻolau Ditch, and it has streamflow recorded for 40 years. Station 16511000 at the 540 feet elevation is downstream from Koʻolau Ditch, and it has streamflow recorded for 14 years. (Kapaula IFSAR § 3.3, p. 29.)

d. Flow duration values

526. According to USGS, the natural median baseflow at the upper reach of Kapaula Stream directly downstream of the Koʻolau Ditch is 2.80 cfs (1.50 mgd); at the middle reach it is 5.10 cfs (2.74 mgd); and at the lower reach it is 5.70 cfs (3.07 mgd). (Table attached to Gingerich WDT 10/31/14, p. 1; USGS Regression Study, p. 60 (Table 11) and p. 64 (Table 12).)

e. **Previous IIFS recommendations, CWRM action, and implementation actions**

527. In 2010, CWRM staff recommended that the IIFS for Kapaula Stream remain as designated on October 8, 1988, at an estimated flow of 0.20 cfs (0.13 mgd) below all EMI diversions and just above Hana Highway, near an altitude of 1,194 feet. (Exh. C-103, p. 23.)

528. CWRM staff did not recommend flow restoration for Kapaula Stream because restoration of additional flow would not result in significant biological return in this stream. (Exh. C-103, p. 20).

529. Kapaula Stream was not among the streams recommended for restoration by DAR in 2010.

530. At its May 25, 2010 meeting, CWRM decided to adopt CWRM staff's recommendation to not modify the existing IIFS for Kapaula Stream of 0.20 cfs (0.13 mgd). (Exh. C-91, pp. 50, 52.)

f. **Instream values**

i. Maintenance of aquatic life and wildlife habitats

531. For Kapaula Stream, the Hawaii Stream Assessment classifies the aquatic resources as "limited", meaning a limited number of native species were present. Kapaula Stream had a poor diversity of native stream animals. The presence of a terminal waterfall has restricted those native species that lack climbing ability from inhabiting the stream. Only the native ʻōpae kalaʻole (*Atyoida bisulcata*) was recorded and it was observed in the upper reach. Kapaula Stream rates minimal in comparison to other watersheds in Maui and statewide. DAR assigns Kapaula a total watershed rating of 6 out of 10, a total biological rating of 4 out of 10, and a combined overall rating of 3 out of 10. Native species observed in the stream include:

Crustaceans – *Atyoida bisulcata*
Insect – *Anax junius*, *Anax* sp. and *Megalagrion* sp.

(Kapuala IFSAR § 4.2, pp. 40 and § 4.4, p. 44; Exh. C-144, p. 6.)

532. The estimated natural (undiverted) median baseflow of Kapaula Stream is 2.80 cfs (1.81 mgd). The amount of flow in Kapaula Stream needed to achieve H_{90} is 1.80 cfs (1.16 mgd). (Table attached to Gingerich WDT 10/31/14, p. 1; Exh. HO-1.)

ii. Outdoor recreational activities

533. The recreational resources of Kapaula Stream were classified as substantial by the Hawaii Stream Assessment's regional recreational committee. The Hawaii Stream Assessment identified opportunities for fishing related to Kapaula Stream and it was considered to be a high-quality experience. (Kapuala IFSAR §5 .0, p. 50.)

iii. Maintenance of ecosystems such as estuaries, wetlands, and stream vegetation

534. Riparian resources of Kapaula Stream were not classified by the Hawai'i Stream Assessment. About 25% of the unit lies within the Hanawī Natural Area Reserve, and 12% within the Ko'olau Forest Reserve. Approximately 36% of Kapaula is classified as non-tidal palustrine wetlands occurring in the upper slopes of the hydrologic unit. (Kapuala IFSAR § 6.0, pp. 54-56.)

iv. Aesthetic values

535. Kapaula Stream is fed by lush native communities of Ohia forests and forested wetlands that dominate the upper and intermediate slopes of the hydrologic unit. Vegetation surrounding the lower reaches of Kapaula Stream is predominately alien forests. Several waterfalls are located along the lower reach near the mouth of the stream. Numerous spring are also located along the stream, and some are located near the Hana Highway. The hydrologic unit lies within two forest reserves, Ko'olau Forest Reserve and Hanawī Natural Area Reserve. The

body of water that the stream empties into is adjacent to Waiohue Bay, and both are used for fishing. (Kapuala IFSAR § 7.0, p. 62.)

v. Navigation

536. No navigation values are present. (Kapuala IFSAR § 8.0, p. 64.)

vi. Instream hydropower generation

537. HC&S operates three run-of-river hydroelectric facilities on the Wailoa Ditch, which is supplied with water from several sources including Kapaula Stream. (Kapuala IFSAR § 9.0, p. 65.)

vii. Maintenance of water quality

538. Kapaula Stream does not appear on the 2006 List of Impaired Waters in Hawai'i, Clean Water Act § 303(d). Kapaula Stream is classified as Class 1b inland waters from its headwaters to approximately 1,200 feet elevation, as the surrounding land is in the conservation subzone "protective." It should be noted that the conservation subzone map utilized for this interpretation is general and elevations are not exact. It should also be noted that there is no direct relationship between elevation and attainment of water quality standards. Marine waters at the mouth of the hydrologic unit of Kapaula are Class AA waters. (Kapuala IFSAR § 10.0, p. 70.)

viii. Conveyance of irrigation and domestic water supplies to downstream points of diversion

539. No non-EMI diversions divert water for domestic or irrigation purposes. The DOH Safe Drinking Water Branch does not currently regulate any public water systems in the hydrologic unit of Kapaula. (Kapuala IFSAR § 11.0, p. 72.)

ix. Protection of traditional and customary Hawaiian rights

540. According to the 1990 Hawai'i Coastal Zone Management Program's *Hawaiian Fishpond Study for the Islands of Hawaii, Maui, Lanai, and Kauai*, there are no fishponds present in the hydrologic unit of Kapaula. (Kapuala IFSAR § 12.0, p. 89.)

g. Kuleana users

541. CWRM records for the hydrologic unit of Kapaula indicate that there are no registered diversions that were declared for taro cultivation. (Kapuala IFSAR § 12.0, p. 80.)

20. Hanawī (6064)

a. Physical features

542. The hydrologic unit of Hanawī is located northeast of Haleakala. It covers an area of 5.6 square miles from the upper slopes of Haleakala at 8,000 feet elevation to the sea. (Hanawī IFSAR § 1.1, p. 1.)

543. Hanawī Stream is about 7 miles in length, traversing north from its headwater at the 7,300 feet altitude to the ocean. (Hanawī IFSAR § 1.1, p. 1.)

b. Diversions

544. EMI operates a diversion on Hanawī Stream at the Ko'olau Ditch. (Hanawī IFSAR § 13.1, p. 97.)

c. Gaging stations

545. Two USGS continuous record stream gaging stations are on Hanawī Stream, one of which is currently in operation. Active station 16508000 is immediately upstream of Ko'olau Ditch at the 1,318 feet altitude. Inactive station 16509000 is downstream of Ko'olau Ditch at the 500 feet altitude. Streamflow record for the active station dates back to 1914. Since the station is located upstream of the ditch, streamflow records reflect flows from natural (undiverted) conditions. (Hanawī IFSAR § 3.3, p. 30.)

d. **Flow duration values**

546. According to USGS, the natural median baseflow at the upper reach of Hanawī Stream directly downstream of the Ko'olau Ditch is 4.60 cfs (2.48 mgd); at the middle reach it is 24.00 cfs (12.92 mgd); and at the lower reach it is 26.00 cfs (13.99 mgd). (Table attached to Gingerich WDT 10/31/14, p. 1; USGS Regression Study, p. 60 (Table 11) and p. 64 (Table 12).)

e. **Previous IIFS recommendations, CWRM action, and implementation actions**

547. In 2010, CWRM staff recommended that one measurable IIFS be established for Hanawī Stream at an estimated flow of 0.10 cfs (0.06 mgd) below all EMI diversions and just above Hana Highway, near an altitude of 1,300 feet. (Exh. C-103, p. 23.)

548. CWRM staff proposed flow restoration for Hanawī Stream because minimal flow is needed to achieve the desired biological diversity and, according to CWRM staff, impacts to HC&S would be negligible. Modification of the diversion would serve mainly to create a wetted pathway for stream animal connectivity from the diversion to the ocean. The proposed IIFS for Hanawī Stream is an exception to the staff's approach of calculating the IIFS because the stream has adequate flow to sustain a viable biota population. As recommended by DAR, the biological health of the stream could be further improved simply by providing connectivity in the dry reach immediately below the diversion. For this reason, staff established the monitoring site directly below the ditch at an IIFS of 0.1 cfs (0.06 mgd) to ensure a wetted pathway. (Exh. C-103, p. 19.)

549. In 2010, DAR recommended no additional flow restoration for Hanawī Stream except that necessary to provide a wetted pathway past the diversion structure (approximately 0.1 cfs (0.06 mgd)). DAR also recommended modifications to the K-4 intake into Ko'olau Ditch. DAR estimated that the recommended restoration actions on Hanawī Stream would result in the creation of an additional 1.3 km of additional habitat for native species. DAR ranked Hanawī

Stream eighth in priority among the streams it recommended for restoration. (Appendix C to Higashi, WDT, p. 12.)

550. At its May 25, 2010 meeting, CWRM adopted CWRM staff's recommendation to modify the existing IIFS for Hanawī Stream to restore 0.10 cfs (0.06 mgd) (Exh. C-91, pp. 47-48, 52.)

f. <u>Instream values</u>

i. Maintenance of aquatic life and wildlife habitats

551. For Hanawī Stream, the Hawaii Stream Assessment classifies the aquatic resources as "outstanding", meaning a diversity of native species were present. A number of native stream animals were observed in Kopili'ula Stream, including 'o'opu nākea (*Awaous guamensis*), 'o'opu nōpili (*Sicyopterus stimpsoni*), 'o'opu akupa (*Eleotris sandwicensis*), 'o'opu alamo'o (*Lentipes concolor*), 'ōpae kala'ole (*Atyoida bisulcata*), hīhīwai (*Neritina granosa*), and aholehole (*Kuhlia xenura*). During the most recent surveys, most of these native species were observed in the lower and middle reaches below the ditch level. 'O'opu alamo'o was abundant in the middle reach. All these stream animals except the 'o'opu akupa were observed in the lower, middle, and upper reaches in past surveys. Hanawī has a small estuary; however, no estuary survey was conducted. Hanawī Stream rates high in comparison to other watersheds in Maui and statewide. DAR assigns Hanawī 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:

> Fish – *Awaous guamensis*, *Eleotris sandwicensis*, Gobiid sp. *Kuhlia sandwicensis*, *Kuhlia* sp., *Kulhia xenura*, *Lentipes concolor*, *Sicyopterus stimpsoni*, and *Stenogobius hawaiiensis*
> Crustaceans – *Atyoida bisulcata*
> Insects – *Anax junius*, *Anax* sp., *Megalagrion blackburni*, *Megalagrion calliphya*, *Megalagrion hawaiiense*, *Megalgrion nigrohamatum*, *Megalagrion pacificum*, *Megalagrion* sp., *Procanacae* sp., and *Telmatogen* sp.

Snails – *Neritina granosa*

(Hanawī IFSAR § 4.2, pp. 42 and § 4.4, p. 46; DAR Report on Hanawī Stream, Maui, Hawai'i, October 2009, p. 5.)

552. The estimated natural (undiverted) median baseflow of Hanawī Stream is 4.60 cfs (2.97 mgd). The amount of flow in Hanawī Stream needed to achieve H_{90} is 2.90 cfs (1.87 mgd). (Table attached to Gingerich WDT 10/31/14, p. 1; Exh. HO-1.)

ii. Outdoor recreational activities

553. The recreational resources of Hanawī Stream were classified as outstanding by the Hawaii Stream Assessment's regional recreational committee. The Hawaii Stream Assessment identified opportunities for camping, hiking, fishing, hunting, swimming, and scenic views related to Hanawī Stream. Only camping and hunting were not considered to be high-quality experiences. (Hanawī IFSAR § 5.0, p. 54.)

iii. Maintenance of ecosystems such as estuaries, wetlands, and stream vegetation

554. Riparian resources of Hanawī Stream were classified as outstanding by the Hawaii Stream Assessment. About 74% of the unit lies within the Hanawī Natural Area Reserve, and 6% within the Ko'olau Forest Reserve and the Haleakala National Park. Nearly 72% of Hanawī is classified as non-tidal palustrine wetlands occurring in the intermediate and upper slopes of the hydrologic unit. (Hanawī IFSAR § 6.0, pp. 58-60.)

iv. Aesthetic values

555. Hanawī Stream is fed by lush native communities of Ohia forests and forested wetlands that dominate the upper and intermediate slopes of the hydrologic unit. Vegetation surrounding the lower reaches of the stream is predominately alien forests. A number of waterfalls are located along the lower reaches of the stream, most of which are followed by a

plunge pool. One of the waterfalls can be viewed from Hana Highway, and another waterfall is located immediately downstream from the highway. The hydrologic unit lies within two forest reserves, Koʻolau Forest Reserve and Hanawī Natural Area Reserve. Hanawī Stream empties into Honolulu Nui Bay, which is a popular fishing location. (Hanawī IFSAR § 7.0, p. 61.)

v. Navigation

556. No navigation values are present. (Hanawi IFSAR § 8.0, p. 68.)

vi. Instream hydropower generation

557. HC&S operates three run-of-river hydroelectric facilities on the Wailoa Ditch, which is supplied with water from several sources including Hanawī Stream. (Hanawī IFSAR § 9.0, p. 69.)

vii. Maintenance of water quality

558. Hanawī Stream appears on the 2006 List of Impaired Waters in Hawaiʻi, Clean Water Act § 303(d). While some data exist for Hanawī Stream, there were not sufficient data for decision-making; therefore, no decision was made pertaining to the attainment of WQS or the applicable designated uses. Hanawī Stream is classified as Class 1b inland waters from its headwaters to approximately 1,300 feet elevation, as the surrounding land is in the conservation subzone "protective" and the steam also lies in the Hanawī Natural Area Reserve and the Koʻolau Forest Reserve. The rest of the stream is classified as Class 2 inland waters. Marine waters at the mouth of the entire hydrologic unit of Hanawī are Class AA waters. (Hanawī IFSAR § 10.0, pp. 74-75.)

viii. Conveyance of irrigation and domestic water supplies to downstream points

559. divert water for domestic or irrigation purposes. (Hanawī IFSAR § 11.0, p. 77.)

ix. Protection of traditional and customary Hawaiian rights

560. According to the 1990 Hawai'i Coastal Zone Management Program's *Hawaiian Fishpond Study for the Islands of Hawaii, Maui, Lanai, and Kauai*, there are no fishponds present in the hydrologic unit of Hanawī. (Hanawī IFSAR § 12.0, p. 94.)

g. **Kuleana users**

561. CWRM records for the hydrologic unit of Hanawī indicate that there are no diversions declared for taro cultivation or other domestic purposes. (Hanawī IFSAR § 12.0, p. 88.)

21. **Makapipi (6065)**

a. **Physical features**

562. The hydrologic unit of Makapipi is located northeast of Haleakala. It covers an area of 3.3 square miles from the intermediate slopes of Haleakala at 5,150 feet elevation to the sea. (Makapipi IFSAR § 1.1, p. 1.)

563. Makapipi Stream is about 4.4 miles in length, traversing north from its headwater at the 3,300 feet altitude to the ocean. (Makapipi IFSAR § 1.1, p. 1.)

564. Makapipi Stream flows directly to the ocean through a cobble beach from a small waterfall. (DAR Report on Makapipi Stream, Aug. 2009, p. 6; Makapipi IFSAR § 7.0, p. 62.)

565. In 2001, during the dengue fever outbreak, EMI closed its Makapipi Stream diversion at the request of the State Department of Health (DOH), allowing all of the water to flow in the natural streambed in order to limit breeding opportunities for mosquitoes. The diversion was closed from September 20-21, 2001. EMI discovered from the release the existence of losing reaches below the diversion right below of the Hana Highway Bridge that caused most of the stream water to disappear into the ground, resulting in more pools of standing water instead of a continuous flowing stream. Because this defeated the purpose for the releases, the experiment was terminated and the diversion reopened after two days. (Exh. C-53, p. 1.)

b. **Diversions**

566. EMI operates a diversion on Makapipi Stream at the Ko'olau Ditch. (Makapipi IFSAR § 13.1, p. 94.)

c. **Gaging stations**

567. Three USGS gaging stations are on Makapipi Stream, one of which is a continuous-record stream gaging station. Station 16507000 is located on Makapipi Stream upstream from Hana Highway. Station 16506000 measured the amount of water flowing from the development tunnels into Ko'olau Ditch, and it had 17 years of complete record (1949-1965). Station 16506500 measured the spring discharge at Makapipi Spring. (Makapipi IFSAR § 3.3, p. 30.)

d. **Flow duration values**

568. According to USGS, the natural median baseflow at the upper reach of Makapipi is 1.30 cfs (0.70 mgd). (Table attached to Gingerich WDT 10/31/14, p. 1; USGS Regression Study, p. 60 (Table 11).)

e. **Previous IIFS recommendations, CWRM action, and implementation actions**

569. In 2010, CWRM staff recommended that one measurable IIFS be established for Makapipi Stream at an estimated flow of 0.93 cfs (0.60 mgd) below all EMI diversions and just above Hana Highway, near an altitude of 935 feet. Due to the uncertainty of existing hydrogeologic conditions of Makapipi Stream, CWRM staff recommended that this IIFS be subject to a conditional release of water by EMI and monitoring by CWRM staff. Should an estimated flow of 0.93 cfs be unattainable, the IIFS may be revised by future CWRM action. (Exh. C-103, p. 24.)

570. CWRM staff recommended flow restoration for Makapipi Stream because, according to CWRM staff, the Nahiku community relies heavily on the stream from cultural

practices, recreation, and other instream uses. The IIFS for Makapipi Stream is an exception to CWRM staff's approach of calculating IIFS because flow restoration is proposed mainly for the purpose of taro cultivation. (Exh. C-103, p. 20.)

571. Makapipi Stream was not among the streams recommended for restoration by DAR in 2010.

572. At its May 25, 2010 meeting, CWRM adopted CWRM staff's recommendation to establish an IIFS for Makapipi Stream of 0.93 cfs (0.06 mgd) at an altitude of 935 feet, just above Hana Highway, subject to a conditional release of water by EMI and monitoring by CWRM staff. (Exh. C-91, pp. 47, 52.)

573. In accordance with CWRM's May 25, 2010 decision amending the IIFS for Makapipi Stream, EMI released water from the Ko'olau Ditch diversion on the stream to determine if the restored flow would result in continuous flow to the coast. USGS in cooperation with CWRM made the discharge measurements at Makapipi Stream. (Exh. C-54, p. 1-2.)

A. Initial discharge measurements were made on September 13, 2010 when the sluice gate was closed and most water from Makapipi Stream was being diverted into the Ko'olau Ditch system. Streamflow increased 0.78 cfs (0.42 mgd) in the 1,085-feet reach between station 204756156062101 and station 204805156061501, located about 140 feet upstream of the Ko'olau Ditch diversion. (Exh. C-54, pp. 1, 3 (Table 1).)

B. The sluice gate was partially opened on September 14, 2010 to allow the majority of the water in Makapipi Stream to flow downstream of the diversion. Subsequently, discharge measurement values at station 204808156061401, located about 75 feet downstream of the diversion, ranged from 1.35 cfs (0.73 mgd) on September 14, 2010 to 1.18 cfs on September 17, 2010. (Exh. C-54, p. 1 (Table 1).)

C. USGS, CWRM staff, and local residents hiked about 1,000 feet upstream of the Hana Highway bridge during the afternoons of September 14 and 16, 2010. This 1,000-foot reach was dry with the exception of a few isolated pools of water, and there was no indication of recent streamflow. The precise location where Makapipi Stream went dry farther upstream was not determined because it could not be safely accessed on foot. (Exh. C-54, p. 1.)

D. Daily site visits from September 13-17, 2010 indicated zero flow at the Hana Highway bridge, located about two-thirds of a mile downstream of the diversion. (Exh. C-54, p. 1 (Table 1).)

E. Post-release, much of the lower section below Hana Highway consisted of largely dry areas with isolated reaches of pools. (Uyeno, Tr., 3/3/15, p. 48, ll. 6-14.)

f. <u>Instream values</u>

i. Maintenance of aquatic life and wildlife habitats

574. For Makapipi Stream, the Hawaii Stream Assessment classifies the aquatic resources as "outstanding", meaning a diversity of native species were present. A number of native stream animals were observed in Makapipi Stream, including ʻoʻopu naniha (*Stenogobius hawaiiensis*), ʻoʻopu nākea (*Awaous guamensis*), ʻoʻopu akupa (*Eleotris sandwicensis*), ʻoʻopu alamoʻo (*Lentipes concolor*), ʻōpae kalaʻole (*Atyoida bisulcata*), and aholehole (*Kuhlia xenura*). During the most recent surveys, ʻoʻopu alamoʻo was observed in the middle and upper reaches. ʻŌpae kalaʻole was only observed in the upper reach; although it was recorded to inhabit the lower and middle reaches of Makapipi Stream. Makapipi has a small estuary; however, no estuary survey was conducted. Makapipi Stream rates high in comparison to other watersheds in Maui and statewide. DAR assigns Makapipi a total watershed rating of 8 out of 10, a total biological rating of 6 out of 10, and a combined overall rating of 8 out of 10. Native species observed in the stream include:

Fish – *Awaous guamensis*, *Eleotris sandwicensis*, Gobiid sp., *Lentipes concolor*, *Kuhlia sandwicensis*, *Kuhlia* sp., and *Sicyopterus stimpsoni*
Crustaceans – *Atyoida bisulcata*
Worms – Hirudinean sp.

(Makapipi IFSAR § 4.2, pp. 39 and § 4.4, p. 42; DAR Report on Makapipi Stream, Maui, Hawai'i, October 2009, p. 6.)

575. The estimated natural (undiverted) median baseflow of Makapipi Stream is 1.30 cfs (0.84 mgd). The amount of flow in Makapipi Stream needed to achieve H_{90} is 0.83 cfs (0.54 mgd). (Table attached to Gingerich WDT 10/31/14, p. 1; Exh. HO-1.)

ii. Outdoor recreational activities

576. The recreational resources of Makapipi Stream were classified as substantial by the Hawaii Stream Assessment's regional recreational committee. The Hawaii Stream Assessment identified opportunities for hiking, fishing, hunting, swimming, and scenic views related to Makapipi Stream. Of the four, fishing and scenic view were considered to be a high-quality experience. (Makapipi IFSAR § 5.0, p. 50.)

iii. Maintenance of ecosystems such as estuaries, wetlands, and stream vegetation

577. Riparian resources of Makapipi Stream were not classified by the Hawaii Stream Assessment. About 38% of the unit lies within the Hanawī Natural Area Reserve, and 14% within the Ko'olau Forest Reserve. Approximately 42% of Makapipi is classified as non-tidal palustrine wetlands occurring in the intermediate and upper slopes of the hydrologic unit. (Makapipi IFSAR § 6.0, pp. 54-56.)

iv. Aesthetic values

578. Makapipi Stream is fed by lush native communities of Ohia forests and forested wetlands that lie within the Hanawī Natural Area Reserve and Ko'olau Forest Reserve. Vegetation surrounding the lower reach of the stream is predominately alien forests. Despite a

relatively large number springs located along Makapipi Stream, the stream is intermittent for most of the year. However with sufficient rainfall, the stream can be seen flowing over a waterfall (i.e., Makapipi Falls) just below Hana Highway, and the public can only view the waterfall from the top. At other times, the waterfall is usually only a trickle if not dry. Makapipi Stream empties into Honolulu Nui Bay, which offers opportunities for fishing, crabbing, and opihi and lobster catching. Nahiku is located off of Hana Highway. At the end of Lower Nahiku Road is Nahiku Cove. (Makapipi IFSAR § 7.0, p. 62.)

v. Navigation

579. No navigation values are present. (Makapipi IFSAR § 8.0, p. 64.)

vi. Instream hydropower generation

580. HC&S operates three run-of-river hydroelectric facilities on the Wailoa Ditch, which is supplied with water from several sources including Makapipi Stream. (Makapipi IFSAR § 9.0, p. 65.)

vii. Maintenance of water quality

581. Makapipi Stream does not appear on the 2006 List of Impaired Waters in Hawai'i, Clean Water Act § 303(d). Makapipi Stream is classified as Class 1b inland waters from its headwaters to approximately 1,100 feet elevation, as the surrounding land is in the conservation subzone "protective" and the stream also lies in the Hanawī Natural Area Reserve in the headwaters and then the Ko'olau Forest Reserve in the intermediate reach. Between the 1,100 feet altitude and the coast, the stream is mostly classified as Class 2 inland waters excepting a short reach near the 1,000 feet altitude in which the stream lies within the Ko'olau Forest Reserve and is classified as Class 1a inland waters. Marine waters at the mouth of the hydrologic unit of Makapipi are Class AA waters. (Makapipi IFSAR § 10.0, p. 70.)

viii. ***Conveyance of irrigation and domestic water supplies to downstream points of diversion***

582. Two diversions divert water for domestic or irrigation purposes. The DOH Safe Drinking Water Branch does not currently regulate any public water systems in the hydrologic unit of Makapipi. (Makapipi IFSAR § 11.0, p. 72.)

ix. ***Protection of traditional and customary Hawaiian rights***

583. According to the 1990 Hawai'i Coastal Zone Management Program's *Hawaiian Fishpond Study for the Islands of Hawaii, Maui, Lanai, and Kauai*, there are no fishponds present in the hydrologic unit of Makapipi. (Makapipi IFSAR § 12.0, p. 90.)

g. <u>Kuleana users</u>

584. CWRM records for the hydrologic unit of Makapipi indicate that there are a total of 3 registered diversions. Two of the diversions were declared for taro cultivation or other domestic purposes. (Makapipi IFSAR § 12.0, p. 84.)

585. Jeffrey Paisner is the owner of property designated as TMK (2) 1-2-001:018, which abuts Makapipi Stream. Mr. Paisner lived on the property from 1972 through 1979. In 1979, he moved to New York and entrusted the property to a caretaker. From 1979 until the present, Mr. Paisner has visited the property from time to time. (Paisner, WDT 12/30/14, ¶ 5.)

586. Mr. Paisner claims that taro was historically cultivated on his property. Mr. Paisner bases his claim on conversations with other Nahiku residents about the history of Nahiku. He has no firsthand knowledge that taro was cultivated on his property. He has never grown taro on his property. (Paisner, WDT 12/30/14, ¶ 6; Paisner, Tr., 3/11/15, p. 23, l. 17 to p. 24, l. 9.)

587. Mr. Paisner also stated that he has found walls and terraces on his property. He does not know when the walls and terraces on his property were built. (Paisner, tr., 3/11/15, p.

24, l. 10 to p. 25, l. 2.)

588. Mr. Paisner did not submit evidence demonstrating that any portion of his property was in taro cultivation at the time of the Great Māhele.

589. Mr. Paisner did not submit evidence describing the size of the lo'i that he claims were located on his property.

F. Findings of Fact Regarding Noninstream Uses

1. HC&S

a. The HC&S Plantation

590. HC&S operates a sugarcane plantation of approximately 35,000 acres. (Volner, WDT 12/30/14, ¶ 2.)

591. Approximately 30,000 acres of the HC&S plantation (the "***East Maui Fields***") can be serviced by surface water from EMI or brackish groundwater pumped from within the boundaries of the plantation, but not water from the West Maui ditch system. (Volner, WDT 12/30/14, ¶ 2; Hew, WDT 12/30/14, ¶ 25; Exhibit C-35.)

592. From 2008-2013, HC&S actively cultivated sugarcane on an average of 28,941 acres of the East Maui Fields. (Exh. C-137, Column I; Volner, Tr., 3/23/15, p. 27, ll. 22-25.)

593. Sugar in Hawai'i is produced on a two-year crop cycle. (Volner, WDT 12/30/14, ¶ 21.)

b. The EMI water collection system and HC&S irrigation system

i. The EMI Ditch System

594. The Kingdom of Hawai'i and A&B entered into an Agreement dated September 13, 1876 granting A&B the right to take water from streams arising from lands owned by the Kingdom to construct and maintain a ditch system to transport such water. The recitals of the Agreement stated, among other things, that A&B was "desirous of using for irrigation and

otherwise the water of certain streams" on lands of the Hawaiian Government, that the "water of the said streams has from time immemorial flowed off into the sea and thereby become useless for irrigation or other purposes and it would promote the general welfare of the Kingdom and its agriculture if the same were utilized as aforesaid," and that "the Hawaiian Government is not now ready or willing to incur the expense and undertake the labor of constructing such water course." (Exh. C-2, pp. 1-3.)

595. The EMI ditch system (the "***EMI Ditch System***") was constructed in phases beginning in the 1870's and extending to the completion of the current system in 1923. The Ko'olau Ditch was completed in 1904; the Haiku Ditch completed in 1914, the Kauhikoa Ditch completed in 1915, and the Wailoa Ditch completed in 1923. (Hew, WDT 12/30/14, ¶ 5.)

596. Since 1938, the relationship between the government of Hawai'i and EMI with regard to the coordinated operation of the Ditch System on government and EMI owned lands has been based on an agreement dated March 18, 1938 between the Territory of Hawai'i and EMI (the "***1938 Agreement***"). The 1938 Agreement provided a framework for a transition from a patchwork of previously issued water leases with differing lease and rental terms, to the subsequent issuance by the Territory, following public auction, of long term water licenses for each of the four watersheds that comprise the current license areas of Huelo, Honomanū, Ke'anae, and Nahiku. (Hew, WDT 12/30/14, ¶¶ 5-6; Exh. C-3.)

597. The delivery capacity of the EMI Ditch System is 450 mgd. (Hew, WDT 12/30/14, ¶ 23.)

598. Of the 27 streams that are the nominal subject of the IIFS Petitions, EMI operates diversions on 23 of them. The following streams are not diverted at all by EMI: Waiokamilo Stream has not been diverted since 2007; Waianu Stream is below the EMI Ditch System and has

never been diverted; Kualani Stream is also below the EMI Ditch System and has never been diverted; Waikani is not a stream, but rather, a waterfall along Wailuanui Stream, which is the subject of its own petition. (Hew, WDT 12/30/14, ¶ 36.)

599. Wailoa Ditch is the ditch at the highest elevation in the EMI Ditch System. Wailoa Ditch flows are an important benchmark of the system. During extreme drought conditions, the flow rate in the Wailoa Ditch, which has a capacity of 195 mgd, can drop as low as the 10 mgd measured at Honopou Stream in October of 1984. Under these conditions, essentially no water can be supplied by EMI to HC&S since the County would draw all or most of the available flow from the Wailoa Ditch at its Kamole Water Treatment Plant. When the Wailoa Ditch flow is extremely low, the lower ditches have little or no water. (Hew, WDT 12/30/14, ¶¶ 28, 29.)

600. The EMI Ditch System collects and transports surface water from Nahiku to Maliko Gulch using approximately 50 miles of tunnels, the majority of which are lined, and 25 miles of ditches. (Exh. C-71, Appendix B thereto, p. B-1.)

601. EMI records the amount of water that is delivered to HC&S based on ditch gages located where each of the four main ditches crosses Maliko Gulch. Most of the water that is measured at this point was collected in the portions of the EMI Ditch System that is covered by the 1938 Agreement, but some additional water is collected from diversions of streams to the west of Honopou Stream, which represents the westernmost boundary of the license areas of Huelo, Honomanū, Ke‘anae, and Nahiku. (Hew, WDT 12/30/14, ¶ 24; Exh. C-34.)

602. EMI has 6 reservoirs with a combined capacity of 267 mgd which are operated separately by EMI to periodically store water east of Maliko Gulch, i.e., before delivery to HC&S. The EMI reservoirs are not used during low ditch flows. (Hew, WDT 1/27/15, ¶ 40.)

603. EMI submits monthly reports to CWRM of the surface water it collects and the surface water it receives from separate ditch systems operated by HC&S and Wailuku Water Company in West Maui. (Hew, WDT 12/30/14, ¶ 22; Exh. C-32.)

ii. The HC&S irrigation system

604. The EMI side of the system is the "supply" side and is east of Maliko Gulch. The HC&S side is the "use" side of the system and is west of Maliko Gulch. The EMI Ditch System and the HC&S ditch and reservoir systems are depicted in the schematic diagram in Exhibit C-33. The schematic also depicts the locations and capacities of HC&S' reservoirs and the locations of its pumps. (Hew, WDT 12/30/14, ¶ 23; Hew, Tr., 3/18/15, p. 143, l. 24 to p. 143, l. 2; Exh. C-33.)

605. To minimize pumping, and in turn, consumption of electric power, the HC&S irrigation system is designed to operate to the maximum extent possible on the gravity flow of water from higher to lower elevations. To accomplish this, the maximum possible amount of water is taken into the HC&S system at the Wailoa Ditch, the ditch at the highest elevation. This maximizes HC&S' flexibility to distribute water by gravity flow to the fields with the highest irrigation priority at any given time, as well as maximizes the use of HC&S' hydro power generation capacity. (Hew, WDT 12/30/14, ¶ 28.)

iii. HC&S' brackish water wells

606. In addition to the surface water imported from the EMI Ditch System and the West Maui Ditch System, the HC&S irrigation infrastructure includes 15 brackish water wells and associated pumps that can add ground water to the irrigation ditches operated within certain areas of the plantation. The location of the wells and pumps are shown schematically on Exhibit C-33. Exhibit C-35 is an HC&S field map color coded to show the water sources available to each field. The blue and green areas represent the approximately 30,000 acres of the plantation

that comprise the East Maui Fields. The blue area is irrigated only with EMI ditch water. The green area is serviced by a combination of EMI water and well water, depending upon ditch deliveries. The brown area is serviced by a combination of Nā Wai ʻEhā water imported from the West Maui Ditch System and pumped from Well 7. The red area is serviced solely by Nā Wai ʻEhā water from the West Maui Ditch System. (Hew, WDT 12/30/14, ¶ 25; Exh. C-33; Exh. C-35.)

607. Of the 15 wells in use, 8 are located in the Paia Aquifer System, 5 in the Kahului Aquifer System, and 2 in the Kamaole Aquifer System. (Exh. C-71, Appendix E thereto, p. E-1.)

608. Of the 15 brackish water wells used by HC&S for irrigation, 14 can be used to irrigate 17,200 of the approximately 30,000 acres that are serviced by water from the EMI Ditch System. The current service areas for Wells 1, 2, 3, 4, 6, 7, 8, 9, 11, 12, 13, 16, 17, 18, and 19 are shown on Exhibits C-36 to C-50. (Hew, WDT 12/30/14, ¶¶ 26A-26O; Exhs. C-36 to C-50.)

609. Approximately 12,800 acres of the East Maui Fields cannot be irrigated with HC&S brackish water wells. (Exh. C-71, Appendix D thereto, Exhs. D-1 and D-2 thereto.)

610. Exhibit C-50 is an HC&S field map color coded to show the current service area of Well 19, in yellow, and an area that formerly was but is no longer served, in orange. The orange area was served in the past through the use of booster pumps (18C1 and 18C2) and a pipeline to pump water uphill from Well 18. The infrastructure that was previously used to service this area has not been used since 2003 due to deterioration, obsolescence, and the relative inefficiency of expending electrical power to transport water from Well 18 to fields at this elevation versus other locations. (Hew, WDT 12/30/14, ¶ 26O; Exh. C-50.)

611. The maximum instantaneous pumping capacity of wells that can service the East Maui fields is 215 mgd. However, the true instantaneous pumping capacity of the wells—i.e.,

the most HC&S can pump over 3 to 5 days—is 115-120 mgd. Sump levels in the wells start to drop when pumping reaches 115 to 120 mgd, especially in the summer months where there is little recharge. Further lowering of the sump levels could cause severe mechanical damage to the pumps. (Volner, Tr., 3/23/15, p. 16, l. 23 to p. 19, l. 1.)

iv. HC&S reservoirs

612. HC&S has 48 reservoirs, 36 of which are operated in conjunction with water received by HC&S from EMI. (Hew, WDT 1/27/15, ¶ 40; Exh. C-71, Appendix C thereto, Exhs. C-1 to C-3 thereto.)

613. The combined storage capacity of the reservoirs at full capacity is 862 MG. This is only a five to ten day supply of water for fields that are serviced by these reservoirs (about 12,800 acres). (Exh. C-68, pp. 5-6.)

614. HC&S does not normally operate the reservoirs at maximum capacity, for safety reasons as well as lack of available water. Total normal operating capacity of the reservoirs ranges approximately from 145 mg to 610 mg. (Exh. C-71, Appendix C thereto, p. C-1.)

615. The HC&S reservoir system is a carry-over from the days of furrow irrigation when reservoirs would be filled at night and, in the morning, gates would be manually opened to allow water from the reservoirs to flow into the furrows until the end of the day, when the gates would be closed. Thus, the reservoirs are sized to essentially provide one night's storage. Most of the reservoirs are relatively small earthwork structures ranging in size from 4 to 80 mg. The reservoirs are located close to the fields at a slightly higher elevation,and serve limited areas. The service areas of the reservoirs are shown on the maps in Exhibit C-71 (Exhibit C-1 thereto). (Exh. C-68, p. 5; Exh. C-71, Appendix C thereto, p. C-1 and Exh. C-1 thereto.)

616. The reservoirs are primarily holding ponds where water is collected and distributed for irrigation or other uses on a daily basis. Only when the ditch flows are high does HC&S have the ability to store additional water in these reservoirs. (Exh. C-68, p. 5.)

617. Five of the 36 reservoirs that receive water from EMI are lined. (Exh. C-71, Appendix C thereto, p. C-2; Hew, Tr. 3/17/15, p. 182, ll. 20-23.)

618. HC&S submits monthly ground water use reports to CWRM. (Hew, WDT 12/30/14, ¶ 31; Exh. C-51.)

619. From 2008-2013, HC&S pumped an annual average of 25,512 mg for use on the East Maui Fields, including mill use. (Exh. C-137, Column C.)

c. <u>Power generation</u>

620. HC&S generates electricity for its operations by burning bagasse (the fiber residual from the sugarcane plant), as well as supplemental fossil fuels, including coal, recycled oil, and diesel. (Volner, Tr., 3/23/15, p. 124, ll. 1-7.)

621. HC&S also generates electricity through hydropower. Irrigation water from EMI is dropped from a higher to a lower elevation to turn hydropower turbines before being applied to the fields. Surface water from EMI is not diverted or imported specifically for hydropower generation. (Volner, WDT 2/10/15, ¶ 11.)

d. <u>Water deliveries to HC&S</u>

622. EMI deliveries of surface water to HC&S have trended downward over time. Over its history, the long-term average delivery by EMI to HC&S has been approximately 165 mgd. In the ten-year period from 1925 to 1934, the average deliveries to HC&S at the Maliko Gulch boundary were 173 mgd. For the ten-year period from 1964 to 1975, the average deliveries were 160 mgd. In the ten-year period from 2004 through 2013, the average deliveries

dropped to 126 mgd. (Hew, WDT 12/30/14, ¶ 30; Hew, WDT, 2/10/15, ¶ 3; Hew, Tr., 3/18/15, p. 130, ll. 15-24; Exh. C-34; Exh. C-124; Exh. C-125.)

623. Measuring ditch flows in terms of daily averages could be misleading. Averages may commonly be thought of as the amount of water that is available in the ditch at all times (i.e., every day), but ditch flows vary every day. (Exh. C-130, p. 6.)

e. Water use management

624. HC&S converted from a furrow irrigation system to a drip irrigation system, a 12-year, $35 million project that was completed in 1986. (Exh. C-71, Appendix C thereto, p. C-1.)

625. Because HC&S does not have the capacity to irrigate all of its fields simultaneously, available irrigation water is applied in "rounds" to different fields in accordance with the priorities that are assigned to them by the farm managers. The highest priority is given to fields that are being planted, the second priority to fields that are ripening, and the third priority to all other fields (routine irrigation). A round of irrigation can consist of anywhere from 24 hours up to 72 hours of continuous irrigation. Sometimes it can be longer, as in germinating cane, or shorter, as in fertilizer. At any given time, only a fraction of the fields are actually receiving water. (Exh. C-120, p. 71, ¶ 448.)

626. To ensure the most effective and efficient use of available water, HC&S determines irrigation needs of each field on a day-to-day basis employing a computerized water balance model. The water balance model essentially calculates a water budget that accounts for "deposits" of water in the form of rainfall and irrigation and "withdrawals" in the form of evapo-transpiration. HC&S uses the water balance model as a managerial tool to determine what fields need to be irrigated. The model prioritizes field needs, indicating which field should receive water next based on the estimated soil moisture status of each field. (Exh. C-67, pp. 5-6.)

627. HC&S previously relied on pan evaporation ratios in its water balance model to estimate the amount of water required in various crop stages, but now uses data collected from fifteen major automated weather stations situated across the plantation to calculate daily evaporation using a modified Penman equation. HC&S' use of its modified Penman equation was validated by a study published in the Journal of Water Resource and Protection as "the most accurate [potential evapotranspiration (PET)] method compared to the other commonly used PET equations, with less than 10% error." (Exh. C-67, pp. 5-6; Exh. C-73, pp. 7-161; Exh. C-136, p. 1.)

f. <u>Water needs</u>

628. For the 24-year period from 1986 to 2009, HC&S has been operating on 85% of its water needs for the East Maui Fields. Based on average need of 270 mgd, the plantation's water demands are not met 10 months out of the year. Only during the winter months of November and December are the water needs of the plantation satisfied with available water. (Exh. C-71, Appendix G thereto, p. G-3; Exh. C-103, pp. 14-15.)

629. More recent data continue to show that HC&S is not generally able to fully satisfy its irrigation requirements for the East Maui Fields. For the six-year period from 2008 to 2013, HC&S operated at an average of 89% of its required irrigation needs based on the data and calculations below (all water data expressed as annual averages):

A. HC&S receives a total of 41,505 mg from surface water deliveries and 25,512 mg in pumped groundwater for a combined total of 66,717 mg. (Exh. C-137, Columns B and C.)

B. The County of Maui receives deliveries of 1,034 mg from HC&S. (Exh. C-137, Column D.)

C. HC&S uses 2,283 mg for its power plant and factory operations, including milling, cooling water for bearings and pumps, heat exchange for turbines and generators, herbicide mixing, cane washing, sugar drying, sanitation, fire protection, seed tank dipping, and fertilizer solutionizing. HC&S currently needs 2 mgd for power plant operations year round and 6 mgd for factory usage when it engages in milling, which typically span 9-10 months each year. The majority of the water used for industrial purposes comes from wells located in the factory and power plant. Approximately 2 mgd comes from the EMI Ditch System and is used for the power plant boiler to generate steam. (Volner, WDT 12/30/14, ¶ 58; Volner, WDT 2/10/15, ¶ 12; Volner, Tr., 3/23/15, p. 24, ll. 3-19 and p. 25, ll. 13-25; Exh. C-71, Appendix G thereto, p. G-1; Exh. C-137, Column E.)

D. HC&S uses 150 mg annually for its tenants. (Exh. C-137, Column F.)

E. An estimated 15,206 mg is lost to seepage, evaporation, and miscellaneous system losses. (Exh. C-137, Column G.)

F. Deducting the above uses from the 66,717 mg combined total of surface water deliveries and pumped groundwater leaves 48,345 mg available for irrigation. (Exh. C-137, Column H.)

G. HC&S irrigated an average of 28,941 acres annually. (Exh. C-137, Column I.)

H. To meet its irrigation requirements—as calculated by HC&S' modified Penman equation for evapotranspiration—HC&S needed 5,146 gpad. (Exh. C-137, Column J; FOF 627.)

I. However, irrigating 28,941 acres annually with a total of 48,345 mg available annually only equates to 4,579 gpad, or 89% of the irrigation requirement. (Exh. C-137, Columns K, L.)

630. HC&S' computed water needs of 5,146 gpad for the East Maui Fields are less than that which CWRM found to be reasonable in the Nā Wai 'Ehā contested case hearing. There, CWRM found that the water use requirements for the Waihe'e-Hopoi Fields are 5,958 gad, and the water use requirements for the 'Īao-Waikapū Fields are 5,408 gad. (Exh. C-120, p. 128 (COL 91.)

631. HC&S' water needs for cultivating sugarcane are not dictated solely by the amount of water needed for the sugarcane plant to survive. The sugarcane plant can survive, but not thrive, with less than optimal water. Sugar yields increase as water application to the cane plant increases. The determination of HC&S' water needs for sugarcane cultivation is thus based on the amount of water required to produce yields at levels that enable HC&S to remain economically viable. (Volner, WDT 12/30/14, ¶ 55; Exh. C-71, Appendix G thereto, p. G-3.)

632. The water needs of HC&S' sugarcane crop differ significantly between the wet and dry months of the year. (Volner, WDT 12/30/14, ¶ 61; Exh. C-74.)

633. Every month of the year, HC&S pumps its brackish groundwater wells to supplement available surface water supplies. (Volner, WDT 12/30/14, ¶ 61; Exh. C-74.)

634. HC&S regularly operates at a total water deficit for the East Maui Fields. Based on monthly averages, the only months HC&S has had adequate water over the long term have been November and December. (Volner, WDT 12/30/14, ¶ 61; Exh. C-74.)

635. Incremental water loss in any month other than November or December will, on average, put HC&S further below its water requirements. The impact of such reductions will be

far less, on average, in the winter months than in the summer months due to the lower deficit and the lower rate of evapotranspiration, which reduces growth potential during that period. (Volner, WDT 12/30/14, ¶ 61; Exh. C-74.)

g. **Seepage and system losses**

636. Estimating seepage and evaporation losses from HC&S' ditches and reservoirs by way of direct measurement would require closing sections of the ditches and reservoirs, allowing the water to remain in those structures for a period of time, and taking before and after readings. This is impractical to do on a large scale because it would interrupt plantation operations. (Hew, WDT 2/10/15, ¶ 10; Hew, Tr., 3/17/15, p. 184, ll. 16-17 and p. 186, ll. 2-5.)

637. As an alternative to direct measurement of seepage and evaporation losses, HC&S estimated its system loss rate by calculating the amount of water available to HC&S, including both surface water and groundwater pumped from its brackish wells, that cannot be accounted for as having been utilized for irrigation or other operations. This amount represents HC&S' estimated system losses, and includes water lost due to seepage, evaporation, back-flushing of filters, drip tube ruptures or breaks, animal damage, and pipeline breaks. For the period of 2008 to 2013, HC&S' estimated system losses totaled an average of 15,206 mg per year. This represents 22.7% of the total amount of surface water delivered to HC&S and groundwater pumped during the same six-year period. (Volner, Tr., 3/23/15, p. 30, l. 10 to p. 31, l. 11, p. 26, ll. 10-17, and p. 140, ll. 2-19; Exh. C-137, Columns G and M.)

638. To obtain a benchmark against which the estimated 22.7% loss rate could be compared, HC&S consulted the National Engineering Handbook published by the Soil Conservation Service of the U.S. Department of Agriculture ("***USDA***"), which provides seepage rate factors that can be applied to various sections of the HC&S system. HC&S calculated the

average surface area under water for each type of material that holds or conveys the water (i.e., lined or unlined ditches or reservoirs). For each type of material, HC&S selected a relatively low seepage factor along with a relatively high seepage factor from the National Engineering Handbook and applied each factor to the estimated surface area under water to calculate what would represent low seepage loss and high seepage loss in the HC&S system per USDA standards. Based on the foregoing calculations, a low seepage loss per day in the HC&S system was estimated to be 30.75 mgd, or 16.76% of average daily water deliveries of surface water and groundwater of 183.48 mgd; a high seepage loss per day was estimated to be 65.06 mgd, or 35.46% of average daily water deliveries. (Hew, WDT 2/10/15, ¶¶ 11-12; Exh. C-138, Figure 2-50; Exh. C-139.)

639. To account for loss due to evaporation, HC&S estimated the average daily amount of evaporation from the surface of the water contained in the same ditches and reservoirs as those considered in producing the range of seepage loss based on USDA standards. HC&S multiplied the average daily evaporation rate of 0.40 acre-inches by the average daily surface area of the water in the system (243.48 acres), which yielded an average daily evaporation loss rate of 2.64 mgd. This was added to the high and low seepage loss factor calculations. This yielded an estimated range of losses from seepage and evaporation of from 33.40 mgd, or 18.20% of average daily water deliveries to 67.70 mgd, or 36.90% of average daily water deliveries. (Hew, WDT 2/10/15, ¶ 13; Exh. C-139.)

640. The average of the low seepage/evaporation loss factor of 18.20% and the high seepage/evaporation loss factor of 36.90% is 27.55% of average daily water deliveries. HC&S' estimated 22.7% system loss rate falls below this average. (Exh. C-139.)

641. The amount of water "lost" to the ground water aquifers due to infiltration from unlined reservoirs is a function of the size of the reservoir and underlying geology, as well as the water level in the reservoir and the duration that the water remains in the reservoir. Most losses due to infiltration occur in times of high rainfall, when the water levels in the reservoirs are higher, and water sits in the reservoirs for a greater length of time. Conversely, during the summer season, it is infrequent that water availability exceeds the needs of the crop, and thus, there is rarely water to store. When reservoir levels are low and water does not remain long in the reservoirs, infiltration would be less than average. (Exh. C-71, Appendix C thereto, p. C-2 and Exh. C-2 thereto.)

642. Infiltration from the reservoirs into the ground recharges the underlying aquifers from which HC&S withdraws water to supplement surface water supplies. (Exh. C-71, Appendix C thereto, p. C-3.) This principle is reflected in the following evidence in the record:

A. The land licenses issued to EMI by the State in the 1950s and 1960s contained provisions allowing EMI "for purposes of replenishing the ground water resources of the Central Maui area (and not for the irrigation of sugar cane or other plant crops) . . . to take further water [from the Licensed Areas] and discharge the same into gulches, reservoirs and other places approved by the Territorial Hydrographer, [and] may do so without payment of rental therefor." Accordingly, until the expiration of the one-year holdover of the Honomanū license, HC&S regularly reported to the USGS or the DLNR how much water it discharged as "waste" to recharge the Central Maui basal ground water aquifer. (Hew, Tr., 3/18/15, p. 133, l. 24 to p. 134, l. 17; Exh. C-4, p. 13, ¶ 22; Exh. C-6, p. 13, ¶ 22; Exh. C-8, p. 8, ¶ 5; Exh. C-10, pp. 7-8, ¶ 5; Exh. C-17; Exh. C-12; Exh. C-13; Exh. C-14; Exh. C-15; Exh. C-16.)

B. The State Water Resource Protection Plan adopted by CWRM in June 2008 states, in pertinent part:

> Throughout the era of sugar and pineapple plantations, artificial recharge was incidental to irrigation practices, but in some areas contributed largely to ground water recharge. Leakage from reservoirs and ditches, together with percolation from irrigated fields, constituted a considerable amount of recharge. Some agricultural users returned excess irrigation water to the ground water sources. For example, the McBryde Sugar Company formerly recharged the ground water body beneath Kauai's Hanapepe River Valley through a system of tunnels and shafts. At one time, it was hypothesized that return irrigation water was responsible for greater than 60% of the total recharge. However, a 1987 study by Mink and Yuen indicated that the figure was closer to 40%. Since the agriculture industry has shifted from plantations to diversified agriculture and some former crop lands have been developed for non-agricultural uses, the amount of water being applied for irrigation has decreased significantly, and it remains to be determined how the change in land use has affected ground water recharge.

(State Water Resource Protection Plan, June 2008, p. 7-36 (quoted in Exh. C-71, Appendix C thereto, p. C-3).)

C. A 2014 USGS study on the spatial distribution of groundwater recharge on the island of Maui concluded: "In general, areas that have water inflows from irrigation, septic-system leaching, and direct recharge have more total recharge than areas without these supplementary water inflows." (Exh. C-140, p. 49.)

643. In or around 2010, HC&S obtained a quote for installation of polypropylene lining of $4/square foot. Based on this quote, it would cost approximately $43.5 million to line HC&S' 31 unlined reservoirs. (Exh. C-71, Appendix C thereto, p. C-3.)

h. <u>Alternative water sources</u>

i. Increased groundwater pumping

644. Of the 30,000 acres comprising the East Maui Fields of the HC&S plantation, 17,200 acres can be irrigated with well water. However, the irrigation needs of all these fields cannot be satisfied solely with pumped groundwater. (FOF 608; Volner, WDT 2/10/15, ¶ 20.)

645. HC&S lacks the infrastructure to service the remaining 11,800 acres of the East Maui portion of the HC&S plantation with pumped groundwater on a consistent basis. Groundwater can be delivered to 7,000 acres via a shared pipeline that serves as a penstock line for a hydroelectric unit for the majority of the year. This pump system was designed and built to be an emergency water source for high elevation fields in the event of extreme drought rather than a primary source of water. The system consists of a booster pump system that diverts primary groundwater currently being used at the Lowrie Ditch level to a higher elevation. This reduces overall groundwater availability on a per acre basis for the plantation. Moreover, the electrical requirements to use this pump system are extremely high and would displace pumping at lower elevations. (Volner, WDT 2/10/15, ¶ 19.)

646. A reduction in surface water importation coupled with an increase in groundwater pumping will likely degrade the aquifer and increase salinity levels. HC&S observed a very evident pattern of rising total salt levels for each of its wells since 2007, which correlates with the severe drought that occurred in Maui that resulted in significantly less surface water being available to irrigate the overlying fields. Also evident are increases in salinity that occur in the summer months, when the pumping of HC&S' brackish water wells is the highest. (Exh. C-71, Appendix E thereto, p. E-2 and Exh. E-3 thereto.)

ii. Recycled wastewater

647. The Kahului Wastewater Reclamation Facility ("***Kahului WWRF***") currently produces R-2 recycled water. (Exh. E-88A, p. 2.)

648. While the Hawai'i Department of Health has approved the use of R-2 water for sugarcane irrigation, HC&S prefers R-1 water due to its user flexibility and concerns about workers coming in direct contact with the recycled water. R-1 water is recycled water that is at

all times oxidized, filtered, and then exposed to a high level of disinfection. (Exh. E-88A, pp. 2, 6.)

649. In 2010, the Maui County Council published the "Central Maui Recycled Water Verification Study" (the "***Verification Study***") to analyze future alternatives for the transmission and optimization of R-1 recycled water from the Kahului WWRF in order to provide a source of irrigation water for existing and planned future projects, and to provide alternatives to the use of injection wells. (Exh. E-88A, p. 2.)

650. Seed cane is the best use of recycled water because nitrogen present in recycled water can reduce sugar yields in mature cane if recycled water is used at 100% concentration. Blending recycled water with ditch water can reduce nitrogen levels, but there are constraints on HC&S' ability to blend recycled water using its distribution system. Some of the distribution systems owned by HC&S are considered Hawai'i State waterways, and the DOH does not permit recycled water of any quality to enter State waterways. Thus, the use of recycled water by HC&S is limited to areas where it has distribution systems that would be dedicated only to recycled water. (Exh. E-88A, pp. 12-13.)

651. The most desirable location for HC&S to use recycled water would be in the vicinity of Maui Lani towards Maalaea where seed cane is cultivated. (Exh. E-88A, p. 6.) According to the Verification Study, the equipment that would be needed to be installed to upgrade the Kahului WWRF to R-1 water capability includes a coagulation system, a filtration system, a turbidity monitoring system, an automatic diversion system for use when R-1 turbidity systems are not met, and an ultra violet disinfection system. The estimated cost of the upgrades is $4.97 million. (Exh. E-88A, p. 6.)

652. The Verification Study analyzed three options for distribution of R-1 water after the upgrade of the Kahului WWRF to R-1 water capability is complete:

- Option 1: Develop distribution system from Kahului WWRF to Maui Lani where R-1 water could be used for landscape irrigation at commercial properties in the Kaahumanu Avenue vicinity. The estimated cost of Option 1 is $24.02 million.
- Option 2: Develop distribution system from Kahului WWRF to Kanaha Beach Park and Kahului Airport where R-1 water could be used for landscape irrigation. The estimated cost of Option 2 is $3.97 million.
- Option 3: Develop distribution system from Kahului WWRF to HC&S where R-1 water could be used for agricultural irrigation. This option could connect to an existing non-potable water distribution system previously constructed and utilized by Maui Land & Pineapple Company ("***MLP***") to deliver cannery wastewater to HC&S where it was used for seed cane irrigation. The Verification Study also analyzed an abbreviated version of Option 3 (Option 3A), which would create a dedicated system that would only serve HC&S by constructing only enough R-1 pipe along Kaahumanu Avenue to reach the existing MLP pipe lines. The estimated cost of Option 3 is $1.85 million, and the estimated cost of Option 3A is $11.38 million.

(Exh. E-88A, p. 7-8, 10.) None of these options would entail distributing recycled wastewater for use by HC&S on its East Maui Fields.

653. The Verification Study does not provide a timeline for when any of the three options for developing a recycled water distribution system from the Kahului WWRF to the Central Maui region would be completed, but because the upgrade of the Kahului WWRF to R-1

water capability is a prerequisite to developing any of the options, none of the options will be completed, if at all, until sometime after 2020.

654. HC&S retained Austin Tsutsumi & Associates, Inc. ("***ATA***") to address the feasibility of utilizing treated effluent from the Kahului WWRF as an alternative source to Na Wai Eha stream water in the Na Wai Eha IIFS contested case proceeding. Exhibit C-119 is a copy of the resulting report dated January 22, 2014. The fields that could be served by such a project are on the western side of the plantation, i.e., on the opposite side of the HC&S plantation from the HC&S infrastructure that distributes water received from EMI. (Volner, WDT 1/27/15, ¶ 2; Exh. C-119.)

655. According to the ATA Report, there is approximately 2.95 mgd of R-2 treated effluent that could potentially be reliably made available to HC&S 365 days a year from the WWRF upon a definitive agreement being reached between HC&S and the County of Maui and the construction of improvements at an estimated capital cost of approximately $16.9 million associated with making the water accessible to HC&S for its Nā Wai 'Ehā fields. Upon completion of the improvements, projected to be sometime in 2020 at the earliest, there would then be an additional annual operating and maintenance ("***O&M***") cost to HC&S of approximately $521,000, which includes $161,512.50 in fees that the County of Maui would charge for treated effluent at the rate of $0.15/1,000 gallons as stated in the County of Maui's letter to ATA dated January 15, 2014 (attached as Appendix A to the ATA Report). (Volner, WDT 1/27/15, ¶ 3; Exh. C-119, p. 35.)

656. The ATA Report, like the Verification Study, was focused on the potential use of reclaimed water on fields that are in relatively close proximity to the KWWRF utilizing existing pipelines formerly operated to transport cannery wastewater from the now closed Maui Land &

Pineapple Company, Inc. facility in Kahului. It would be much more difficult and costly to design and construct a system to transport reclaimed water to irrigate the East Maui fields that would be most impacted by reductions in EMI water since they are located much farther away from the KWWRF and at much higher elevations. (Volner, WDT 1/27/15, ¶ 4; Exh. C-119.)

iii. Additional reservoirs

657. In the 1960s, HC&S internally considered the alternative of building a very large reservoir for water storage, but decided not to pursue this alternative after a study indicated that a billion-gallon reservoir would provide only a 10-day supply of water for the plantation. (Volner, Tr., 3/23/15, p. 32, l. 6 to p. 32, l. 15; Exh. C-68, p. 6; Exh. C-71, Appendix F thereto, p. F-3.)

658. A reservoir would need to have an extremely large storage capacity to meet demands for a prolonged period of time during the summer months when water would be the most valuable to HC&S. In the summer months, HC&S' daily water needs are in the range of 200-300 mgd. Even a billion-gallon reservoir would provide 200 mgd for only five days. (Hew, Tr., 3/18/15, p. 236, ll. 2-7; Volner, Tr., 3/23/15, p. 33, ll. 15-21.)

659. To be of the most value to HC&S, a large reservoir would need to be located at the highest elevation at the head of Wailoa Ditch (i.e., above Paia or Haliimaile), which supplies the greatest amount of water to HC&S, so as to maximize the ability of the reservoir to supply water to various parts of the plantation during dry periods. HC&S has not considered building a larger number of smaller reservoirs at higher elevations because that would not be the best use of reservoirs. (Volner, Tr., 3/23/15, p. 32, l. 18 to p. 33, l. 3, p. 34, ll. 20-24 and p. 142, l. 19 to p. 143, l. 17.)

660. A billion-gallon reservoir is approximately 3,800 acre feet. If the reservoir is 10 feet deep, the reservoir would occupy approximately 30 acres. It would be very difficult to site a

reservoir that large at the highest elevation on the plantation. (Hew, Tr., 3/18/15, p. 98, ll. 9-21; Volner, Tr., 3/23/15, p. 33, ll. 7-14.)

661. A large reservoir would be of limited value to HC&S. Water can usually be stored in reservoirs only when stream flow levels are high. In the summertime when flows are low, water is applied to the fields directly from the ditch as quickly as possible rather than being stored in reservoirs. Direct application of water from the ditches reduces system losses. (Hew, Tr., 3/18/15, p. 96, ll. 1-22; Volner, Tr., 3/23/15, p. 33, l. 22 to p. 34, l. 3.)

662. Construction and operation of a billion-gallon reservoir would create safety concerns and potentially result in significant impacts to the surrounding environment and ecosystem. (Exh. C-71, Appendix F thereto, p. F-3; Volner, Tr., 3/23/15, p. 34, ll.4-14.)

663. The cost of building a billion-gallon reservoir would depend on a number of factors including terrain, acquisition of land, and permitting. In 2009, HC&S estimated that building a billion-gallon reservoir on Maui would cost well in excess of $150 million. (Exh. C-68, p. 6.)

iv. Green harvesting

664. MT has suggested that green harvesting methods (i.e., mechanical harvesting) could reduce HC&S' irrigation requirements. Green harvesting involves foregoing the pre-harvest burn of cane trash, leaving a trash blanket on the ground. (Bowie, 12/29/14 WDT, ¶ 28; Volner, 1/27/15 WDT, ¶ 7.)

665. The water savings that could theoretically be realized from green harvesting are due to the green trash blanket on the ground reducing evaporation from the soil surface. However, HC&S installs drip irrigation tubing below the ground. As a result, soil surface evaporation at the HC&S plantation is very low, and the fields generally are not irrigated to the

point that the surface becomes wet. (Volner, WDT 1/27/15, ¶ 7; Volner, Tr., 3/23/15, p. 38, l. 25 to p. 39, l. 10.)

666. In regions where green harvesting reportedly is practiced, sugar is not a two-year crop as is uniquely the case in Hawai'i. Sugarcane that is mechanically harvested in a one-year crop cycle is ratooned (i.e., cut and allowed to regrow) multiple times over a four to five year period. Every time the crop is ratooned, it must be irrigated the next day to prevent damage to the corn stock core. Mechanically harvested sugarcane also has a shorter ripening and drying off phase. It is thus very likely that green harvesting would increase annual water usage as compared to the current two-year crop cycle. (Volner, WDT 1/27/15, ¶ 7; Volner, Tr., 3/23/15, p. 37, ll. 7-24 and p. 39, l. 23 to p. 40, l. 19; Bowie, Tr., 3/23/15, p. 193, l. 11 to p. 194, l. 5 and p. 195, l. 24 to p. 196, l. 12.)

667. HC&S previously considered adopting a mechanical harvesting approach and determined that would not achieve economies of scale. Mechanical harvesting requires that the fields be free of rocks. Based on that limitation, approximately 12,000 acres could effectively be mechanically harvested if HC&S were to purchase the equipment. There are probably an additional 4,000 to 5,000 acres that would require extensive rock clearing in order to be mechanically harvested. The remaining 13,000 to 14,000 acres cannot be mechanically harvested. (Volner, Tr., 3/23/15, p. 39, ll. 11-22.)

668. The desert-like climate where most of the plantation is situated does not promote good trash breakdown over a four to five-year period. Consequently, after a crop is ratooned, the trash must be disposed of either by burning or plowing. (Volner, Tr., 3/23/15, p. 40, l. 20 to p. 41, l. 7.)

2. MDWS

[Reserved]

G. Impact of restricting non-instream uses

1. Impact on HC&S

a. HC&S' business model

669. The economic success of HC&S is influenced by many factors, including economies of scale, sugar production, sugar pricing, and revenue streams other than from sale of commodity sugar. (Volner, WDT 12/30/14, ¶¶ 4, 5, 6, 7, 14; Volner, Tr., 3/23/15, p. 58, ll. 16-21 and p. 59, l. 24 to p. 60, l. 3.)

670. A chief reason HC&S has been able to sustain its sugar operations whereas all of the other sugar plantations in the State of Hawai'i have been forced to cease operations for lack of profitability is the economy of scale that results from HC&S being able to farm 35,000 contiguous acres, more or less. Sugar cultivation in Hawai'i is a very high fixed cost operation in that the plant and the personnel required to run the operation remain essentially the same size regardless of the level of output. HC&S has been able to spread the fixed costs of operating its mill and related facilities over the revenues generated from farming a relatively large number of acres. As a point of comparison, Wailuku Sugar Company had to spread its fixed costs over revenues generated from the approximately 5,250 acres it had in sugar cultivation before closing its plantation in 1988. (Volner, WDT, 12/30/14, ¶ 4; Exh. C-65, p. 8, 11.)

671. HC&S benefits from additional cost efficiencies arising out of the fact that the majority of the lands it cultivates are in Central Maui on lands that do not receive much rainfall and thus, when unirrigated, can be dried and relatively easily accessed by harvesting equipment traveling HC&S' internal road system. (Volner, WDT, 12/30/14, ¶ 4.)

672. Another important factor affecting sugar revenues is sugar production. Production is in turn influenced by two other main variables: yield per acre and acreage harvested. Of the two, yield per acre is more critical than acreage harvested. The key agronomic driver in determining sugar production is per acre yields, measured in Tons of Sugar per Acre ("***TSA***"). (Volner, WDT, 12/30/14, ¶ 7; Exh. C-65, Appendix I thereto, p. 20.)

673. HC&S has determined that, on a long term basis, sustainable yields should be between 12 and 14 TSA per crop cycle, which translates into over 200,000 tons of sugar per year given the acreage that HC&S has in cultivation. HC&S needs to achieve yields in this range to generate sufficient revenues to carry its fixed and variable costs and return a reasonable profit to its shareholders. (Volner, WDT 12/30/14, ¶ 17; Volner, Tr., 3/23/15, p. 58, ll. 11-21.)

674. The single most important variable affecting yields per acre is the amount of irrigation water available to HC&S. The loss of a significant amount of irrigation water will result in lower sugar yields. (Volner, WDT 12/30/14, ¶ 7; Volner, Tr., 3/23/15, p. 66, ll.13-15; Exh. C-65, Appendix I thereto, p. 20.)

675. The market price of commodity sugar is a direct factor influencing sugar revenues. However, HC&S has no control over the sugar markets. At most, HC&S can attempt to time the market well and take advantage of spikes in sugar pricing. (Volner, Tr., 3/23/15, p. 66, ll. 9-12; Exh. C-65, Appendix I thereto, p. 20.)

676. It has taken HC&S more than just maintaining the size of its plantation and production levels to remain economically viable as costs have risen and global competition has placed downward pressure on sugar prices. One of HC&S' strategies has been to diversify its revenue streams.

A. HC&S has generated significant revenues from selling electrical power to utilities under long term contracts with fixed delivery requirements. Revenue from energy sales, including energy generated by hydroelectric plants on Kaua'i and Maui, have accounted for a significant percentage of the revenues generated by A&B's agribusiness segment in recent years.

B. Because of the slim profit margins that can be realized from producing commodity sugar, HC&S has diversified into producing specialty food-grade raw sugars, which yield higher margins than commodity sugar.

C. HC&S is exploring further expansion of its energy related operations. (Volner, WDT 12/30/14, ¶ 5.)

b. <u>Recent economic performance and outlook</u>

677. The agribusiness segment of A&B is comprised of HC&S, Kahului Trucking & Storage, Inc., Kauai Commercial Company, McBryde Resources, and Kauai Coffee Company until it was sold in 2011. In its public filings, A&B reports financial results of its agribusiness segment in the aggregate, and does not report financial data for HC&S separately. (Volner, WDT 12/30/14, ¶ 9.)

678. In 2006, the agribusiness segment of A&B earned an operating profit of $6.9 million. HC&S produced 173,600 tons of sugar, with average yields of 10.2 TSA. (Volner, WDT 12/30/14, ¶ 10.)

679. In 2007, the agribusiness segment earned an operating profit of $0.2 million. HC&S produced 164,500 tons of sugar, with yields of 9.7 TSA. (Volner, WDT 12/30/14, ¶ 11.)

680. In 2008, the agribusiness segment lost $12.9 million. HC&S produced 145,200 tons of sugar, with average yields of 8.6 TSA. Compared to 2007, both production and average yields decreased by approximately 12%. (Volner, WDT 12/30/14, ¶ 12; Exh. C-57, p. 4, 13.)

681. In 2009, the agribusiness segment lost $27.8 million. Compared to 2008, production decreased by 12.8% (126,800 tons of sugar) and average yields decreased by 2.3% (8.4 TSA). (Volner, WDT 12/30/14, ¶ 13; Exh. C-58, pp. 6-7, 17.)

682. In 2010, the agribusiness segment earned an operating profit of $6.1 million, including $4.9 million in disaster relief funds. Compared to 2009, production increased by 35.5% (171,800 tons of sugar) and average yields increased by 20.3% (11.1 TSA). (Volner, WDT 12/30/14, ¶ 14; Exh. C-59, p. 6, 17.)

683. In 2011, the agribusiness segment earned an operating profit of $22.2 million. Compared to 2010, production increased by 6.4% (182,800 tons of sugar) and average yields increased by 9% (12.1 TSA). (Volner, WDT 12/30/14, ¶ 15; Exh. C-60, p. 6, 17.)

684. In 2012, the agribusiness segment earned an operating profit of $20.8 million. Compared to 2011, production decreased by 2.5% (178,300 tons of sugar) and average yields decreased by 7% (11.3 TSA). (Volner, WDT 12/30/14, ¶ 16; Exh. C-61, p. 6, 15.)

685. In 2013, the agribusiness segment earned an operating profit of $10.7 million. Compared to 2012, production increased by 7.4% (191,500 tons of sugar) and average yields increased by 9.7% (12.4 TSA). (Volner, WDT 12/30/14, ¶ 17; Exh. C-62, p. 4, 10.)

686. In 2014, the agribusiness segment lost $11.8 million. Compared to 2013, production decreased by 15.4% (162,100 tons of sugar) and average yields decreased by 8.0% (11.4 TSA). (Volner, Tr., 3/23/15, p. 9, ll. 6-8; Exh. C-150, p. 2.)

687. From 2006 to 2014, the agribusiness segment earned average annual operating profits of $2.6 million. However, the average is largely skewed by the profits earned in 2009 to 2012, when sugar prices were unusually high. If the profits earned in those years were

discounted, the agribusiness segment's average annual operating profits from 2006 to 2014 would likely have been negative (i.e., a loss).

688. HC&S has implemented various measures to improve its agronomic practices in an effort to reverse the declining sugar yields experienced from 2006 through 2009 and to cope with the reduced water deliveries resulting from the amended IIFS determinations previously issued by CWRM in this proceeding and in the separate Nā Wai 'Ehā proceeding. The measures include a one-time harvesting delay in 2009 to increase the average crop age, increased deep tilling of fields before planting, improved fertilization and improved ripening practices. HC&S has also shifted some of its available power generation capacity from power sales to increased well pumping for irrigation. (Volner, WDT 12/30/14, ¶ 20.)

689. With these improved agronomic practices and increased water availability as compared with the severe drought years of 2007 and 2008, HC&S was able to realize increases in total production of 18.3% from the 2008 to 2010 crop cycle and 44.2% from the 2009 to 2011 crop cycle, and 3.8% from the 2010 to 2012 crop cycle. Production of 182,100 tons in 2011 was a 19.8% increase over average production between 2006 and 2009. Yields also improved in 2010 and 2011. As compared to the average of the four years preceding 2010, HC&S experienced 20.3% higher yields in 2010, i.e., 11.1 TSA. Production continued to increase in 2011 (12.1 TSA), declined in 2012 (11.3 TSA), and increased again in 2013 (12.4 TSA). (Volner, WDT 12/30/14, ¶ 21.)

690. Production improvements accounted for about half of the increase in revenues during this period, with dramatically improved sugar prices accounting for the other half. HC&S benefited from a highly providential spike in raw sugar prices extending from the last quarter of 2009 through the first quarter of 2012. (Volner, WDT 12/30/14, ¶ 22.)

691. In 2009, the annual average price of sugar rose to 35.97 cents per pound, and in 2011, it further increased to 38.12 cents per pound. These were the highest prices the sugar industry had seen in over 50 years. (Volner, WDT 12/30/14, ¶ 24; Exh. C-64.)

692. HC&S responded to the increase in sugar prices by shifting some of its production away from specialty sugars to raw sugar. HC&S also increased deliveries of pumped well water to its fields at the expense of higher power costs and reductions in power sales. (Volner, WDT 12/30/14, ¶ 25.)

693. Due primarily to the increase in sugar revenues from higher total production and unit pricing, coupled with the lowering of unit costs attributable to higher production, the agribusiness segment of A&B experienced a return to profitability from 2010 to 2012. The profits earned in this period enabled HC&S to invest in long deferred infrastructure upgrades, including a major improvement to Well No. 7 to enhance its ability to cope with reductions in Nā Wai 'Ehā surface water resulting from the amended IIFS. (Volner, WDT 12/30/14, ¶ 26.)

694. Sugar prices have been trending downward since 2012. The average annual price of sugar in 2012 was 28.90 cents per pound—a 24.2% reduction from 2011. However, sustained high production enabled the operation to maintain its profitability, albeit at lower levels than 2011. The price of sugar continued to fall in 2013, when the average price of sugar for the year was 20.46 cents per pound. Through the third quarter of 2014, the price has risen to 23.82 cents per pound—which is still 40.7% below 2011's peak price of 40.16 cents per pound. (Volner, WDT 12/30/14, ¶ 27.)

i. Incremental impacts of reductions in East Maui surface water diversion

695. HC&S created a model to provide CWRM with a basis for assessing the economic impact on HC&S of reducing the amount of East Maui surface water available for

diversion and irrigation of HC&S' plantation. The model separately assesses reduction of deliveries to the upper two ditches (the Wailoa Ditch and Kauhikoa Ditch) and reduction of deliveries to the lower two ditches (the Lowrie Ditch and Haiku Ditch). (Exh. C-76; Exh. C-77.)

696. Reduced deliveries to the Wailoa Ditch and Kauhikoa Ditch result in reduced water availability to irrigate the 12,800 acres of sugarcane that cannot be irrigated with ground water. The financial impact is therefore calculated in terms of HC&S' anticipated loss in sugar yields due to the average decrease in available water. The estimated value to HC&S of the average yield per million gallons of available water is $1,390. Therefore, the estimated average annual financial impact to HC&S per million gallons of reduced deliveries to either the Wailoa Ditch or the Kauhikoa Ditch is $507,858.00 (Volner, WDT 12/30/14, ¶ 69; Volner, Tr., 3/23/15, p. 20, l. 10 to p. 22, l. 14; Exh. C-76; Exh. C-78.)

697. Reduced deliveries to the Lowrie Ditch and Haiku Ditch are assumed to be compensated for by increased pumping of brackish ground water. The financial impact is therefore calculated in terms of the average cost of this pumping to be $439 per million gallons. Therefore, the estimated average annual financial impact to HC&S per million gallons of reduced deliveries to either the Lowrie Ditch or the Haiku Ditch is $160,250.00 and $74,825.00, respectively. (Volner, WDT 12/30/14, ¶ 69; Volner, Tr., 3/23/15, p. 22, ll. 15-20; Exh. C-76; Exh. C-78.)

c. <u>Public interest in continuing HC&S operations</u>

i. Economic benefits to Maui County and State of Hawai'i

698. In 2008, HC&S retained Leroy O. Laney, Ph.D., a Professor of Economics and Finance at Hawai'i Pacific University and the former Chief Economist and Senior Vice President of First Hawaiian Bank, to analyze the importance of HC&S to the economy of Maui County and the State of Hawai'i and to describe the major conditions for HC&S' survival. Dr. Laney

prepared a report of his analysis entitled "The Importance of the Hawaiian Commercial & Sugar Company to the Hawaii Economy and Conditions For Its Survival" (the "***2008 Laney Report***") a copy of which HC&S submitted in this proceeding as Exhibit C-65.

699. HC&S is one of Maui's largest employers after the public sector. At the time of the 2008 Laney Report, HC&S had 800 full time employees and was expending over $100 million annually on Maui. HC&S currently employs 750 people on Maui and expends $115 million annually, a majority of which is spent on Maui. (Volner, WDT 12/30/14, ¶ 34; Exh. C-65, p. 5.)

700. The 2008 Laney Report estimates that HC&S injects over $100 million annually in direct contributions to the Maui economy. Applying even a conservative multiplier of 1.5 to this sum would add about 50% more to that total, or $150 million a year. (Exh. C-65, p. 5 and Appendix II thereto).

701. A jobs multiplier would likely be higher than an overall regional multiplier. Applying a conservative jobs multiplier of 1.87 means than if HC&S employs 800 people, there are almost 2,300 jobs on Maui that are dependent on HC&S in some fashion. This amounts to over 3% of Maui County employment in 2007 (76,190 people). The $150 million derived by applying the overall regional multiplier would also amount to over 3% of Maui County total personal income ($4,844 million in 2006). If 3% were taken out of the Maui economy, the impact would be more damaging than if probably any other single private entity on Maui ceased to exist. (Exh. C-65, p. 5 and Appendix III thereto.)

ii. Benefits to MDWS and its customers

702. HC&S delivers water to MDWS, the only municipal water supplier for the County of Maui. MDWS relies on waters diverted by the EMI Ditch System to fulfill its public

trust mandate of providing domestic water supply. If EMI were to cease operations, MDWS would not be able to meet the demands of the Upcountry System. (Taylor, WDT 12/30/14, ¶¶ 5, 15.)

703. There has been a long history of written agreements between EMI and MDWS pertaining to the delivery by EMI to MDWS of water from the EMI Ditch System. EMI and MDWS entered into an agreement dated December 22, 1961 that canceled all previous agreements and was for a term extending from January 1, 1962 through June 30, 1986 (the "***1961 Agreement***"). EMI and MDWS entered into a Memorandum of Understanding dated December 31, 1973 (the "***1973 MOU***") with an initial term extending from January 1, 1974 through December 31, 1993. A letter dated July 27, 1982 set forth additional understandings relating to the 1961 Agreement and the 1973 MOU. Between May 18, 1992 and March 28, 2000, EMI and MDWS entered into eight amendments of the 1973 MOU. The final amendment extended the term of the 1973 MOU through April 30, 2000 (the "***2000 MOU***"). (Hew, WDT 12/30/14, ¶ 19; Exhs. B-5- to B-15; Exhs. C-19 to C-30.)

704. Since April 30, 2000, the delivery of water from the EMI Ditch System to MDWS has been pursuant to the terms and conditions of an unwritten informal agreement that essentially has continued the practices and performance that developed under the prior written agreements. (Hew, WDT 12/30/14, ¶ 20; Volner, Tr., 3/23/15, p. 149, ll. 5-24.)

705. Approximately 80% of water within the Upcountry Maui System comes from surface water. The remaining 20% comes from ground water sources. The majority of the water used by MDWS is delivered by EMI from the streams of East Maui to the three Water Treatment Facilities of Kamole-Weir, Piiholo and Olinda. Additional water is left untreated and delivered to the Kula Agricultural Park for agricultural use. (Taylor, WDT 12/30/14, ¶ 7.)

706. MDWS' access points to the EMI system for water that it takes, treats and delivers as potable water to its customers on its Makawao, Kula and Nahiku systems are at the Waikamoi upper pipeline (near the Olinda water treatment plant), the Waikamoi lower pipeline (near the Piiholo water treatment plant), the western end of the Wailoa Ditch (near the Kamole water treatment plant) and in a development tunnel in the Ko'olau Ditch (Nahiku). In addition, non-potable water is taken by MDWS from HCS' Hamakua Ditch at Reservoir 40 for delivery to the Kula Agricultural Park. (Hew, WDT 12/30/14, ¶ 20.)

707. MDWS contracts with EMI to service the diversions for MDWS to keep them clear. MDWS pays EMI for maintenance of the intakes on both Olinda and Piiholo systems and the Wailoa Ditch based on the amount of water it takes from EMI. (Taylor, Tr., 3/11/15, p. 53, ll. 17-25; Hew, Tr., 3/18/15, p. 193, ll. 11-15.)

708. MDWS has no operational expertise to operate the EMI Ditch System. It has no knowledge of the ditch system or proper maintenance procedures. (Taylor, Tr., 3/11/15, p. 164, ll. 4-22.)

709. MDWS does not have the infrastructure to support the demands of the Upcountry System without the EMI system, and does not have the capital to create a new ditch system or take over the existing EMI ditch system. (Taylor, WDT 12/30/14, ¶ 8.)

710. EMI deliveries from the Wailoa Ditch constitute the largest percentage of the water supply for Upcountry Maui. MDWS has no contingency plan if water deliveries from the Wailoa Ditch were to cease. MDWS considers it a complete crisis if it completely stopped receiving water from the Wailoa Ditch for a long period of time. (Taylor, Tr., 3/11/15, p. 165, ll. 8-13.)

711. The Kula Agricultural Park would close immediately if the Wailoa Ditch were no longer functional because it has no alternative water source. (Taylor, Tr., 3/11/15, p. 166, ll. 1-8.)

712. The County's average annual usage of water taken from the EMI Ditch System is 1,034 mg. (Volner, Tr., 3/23/15, p. 13, ll. 17-18; Exh. C-137, Column D.)

iii. Renewable energy benefits

713. In addition to being a major employer and injecting money directly into the Maui economy, HC&S contributes to Maui in other ways. HC&S sells power produced by burning bagasse (sugarcane waste) to Maui Electric Company. The termination of HC&S sugar operations would result in the loss of a viable provider of renewable energy. (Exh. C-65, p. 6.)

iv. Agricultural benefits

714. HC&S supports Maui's agricultural sector in various ways, such as by taking advantage of quantity discounts to buy farm inputs that would otherwise be more expensive to small farmers on Maui, and by allowing Maui cattlemen to use canetops from seed operations as feedstock for free. (Exh. C-65, p. 5.)

715. The termination of HC&S sugar operations would greatly increase the amount of idle agricultural land in Maui, transforming the green fields in the Central Maui plain into an arid landscape. Pressure would likely mount to urbanize the former sugar land. But the continuation of HC&S sugar operations keeps those lands in agricultural use. Of the 29,000 acres of the HC&S plantation that are irrigated with water delivered by EMI, 22,254 acres have been designated as Important Agricultural Lands (IAL) pursuant to HRS Chapter 205, Part III. The IAL designation is a commitment to keep the designated lands in productive agriculture over the long term. (Exh. C-65, p. 6; Exh. C-68, p. 6.)

2. Impact on MDWS

[reserved]

IV. PROPOSED CONCLUSIONS OF LAW

A. Overview of Applicable Law

1. Interim Instream Flow Standards

1. The Water Code defines an "instream flow standard" as "a quantity of water or depth of water which is required to be present at a specific location in a stream system at certain specified times of the year to protect fishery, wildlife, recreational, aesthetic, scenic, and other beneficial instream uses." HRS § 174C-3.

2. "Each instream flow standard shall describe the flows necessary to protect the public interest in the particular stream. Flows shall be expressed in terms of variable flows of water necessary to protect adequately fishery, wildlife, recreational, aesthetic, scenic, or other beneficial instream uses in the stream, in light of existing and potential water developments including the economic impact of restriction of such use." HRS § 174C-71(1)(C).

3. An "interim instream flow standard" is defined as "a temporary instream flow standard of immediate applicability, adopted by the commission without the necessity of a public hearing, and terminating upon the establishment of an instream flow standard." HRS § 174C-3.

4. IIFS have been described as the surface water corollary to the groundwater "sustainable yield" in that both perform the function of guiding water planning and regulation by prescribing responsible limits to the development and use of public water resources. *See In re Water Use Permit Applications*, 94 Hawai'i 97, 148, 9 P.3d 409, 460 (2000) ("**Waiāhole I**").

5. In the IIFS-setting context, CWRM "need only reasonably estimate instream and offstream demands." *Nā Wai 'Ehā*, 128 Hawai'i at 258, 287 P.3d at 159; *Waiāhole I*, 94 Hawai'i at 155 n.60, 9 P.3d at 467 n.60.

2. **Process For Petition For Amendment of IIFS**

6. "Any person with the proper standing may petition the commission to adopt an interim instream flow standard for streams in order to protect the public interest pending the establishment of a permanent instream flow standard[.]" HRS § 174C-71(2)(A).

7. A petition to amend an IIFS "shall set forth data and information concerning the need to protect and conserve beneficial instream uses of water and any other relevant and reasonable information required by the commission." HRS § 174C-71(2)(C).

3. **Public Trust**

8. Under Article XI, Sections 1 and 7 of the Hawai'i Constitution, the public trust doctrine applies to all water resources without exception or distinction. *Waiāhole I*, 94 Hawai'i at 133, 9 P.3d at 445.

9. The public trust mandate is to conserve and protect water resources as well as to use and develop them in a reasonable and beneficial manner. "[T]he State . . . shall conserve and protect Hawai'i's . . . water . . . and shall promote the development and utilization of these resources in a manner consistent with their conservation and in furtherance of the self-sufficiency of the State." Haw. State Const., art. § 1. "The state water resources trust thus embodies a dual mandate of 1) protection and 2) maximum reasonable and beneficial use." *Waiāhole I*, 94 Hawai'i at 139, 9 P.3d at 451. "In short, the object is not maximum consumptive use, but rather the most equitable, reasonable, and beneficial allocation of state water resources, with full recognition that resource protection also constitutes 'use.'" *Id.* at 140, 9 P.3d at 452.

10. The currently identified purposes of the water resources trust are: 1) maintenance of waters in their natural state; 2) domestic water use of the general public; 3) Native Hawaiian and traditional and customary rights, including appurtenant rights; and 4) reservations of water for Hawaiian home lands. *Waiāhole I*, 94 Haw. at 136-138; 9 P.3d at 448-450. *In re Wai'ola O*

Moloka'i, Inc., 103 Hawai'i 401, 429, 431, 83 P.3d 664, 692, 694 (2004).

11. There are no absolute priorities among the trust purposes. Protection of the resource is not a "categorical imperative." CWRM must weigh competing public and private water uses on a case-by-case basis, according to any appropriate standards provided by law. *Waiāhole I*, 94 Hawai'i at 142, 9 P.3d at 454.

12. The public has a definite interest in the development and use of water resources for various reasonable and beneficial public and private offstream purposes, including agriculture. Therefore, apart from the question of historical practice, reason and necessity dictate that the public trust may have to accommodate offstream diversions inconsistent with the mandate of protection, to the unavoidable impairment of public instream uses and values. *Waiahole I*, 94 Hawai'i at 141, 9 P.3d at 453.

4. <u>Instream Uses</u>

13. The Water Code defines "instream use" as follows:

[B]eneficial uses of stream water for significant purposes which are located in the stream and which are achieved by leaving the water in the stream. Instream uses include, but are not limited:

(1) Maintenance of aquatic life and wildlife habitats;
(2) Outdoor recreational activities;
(3) Maintenance of ecosystems such as estuaries, wetlands, and stream vegetation;
(4) Aesthetic values such as waterfalls and scenic waterways;
(5) Navigation;
(6) Instream hydropower generation;
(7) Maintenance of water quality;
(8) The conveyance of irrigation and domestic water supplies to downstream points of diversion; and
(9) The protection of traditional and customary Hawaiian rights

HRS § 174C-3. The public trust doctrine recognizes that resource protection constitutes a "use." *Waiāhole I*, 94 Hawai'i at 140, 9 P.3d at 452.

5. **Noninstream Uses**

14. The Water Code defines "Noninstream use" as "use of stream water that is diverted or removed from its stream channel and includes the use of stream water outside of the channel for domestic, agricultural, and industrial purposes." HRS § 174C-3.

15. Consideration of impacts on offstream uses is essential to CWRM's fulfillment of the purpose of the public trust, which is to ensure that "all uses [of water], offstream or instream, public or private, promote the best economic and social interests of the people of the state." *Waiāhole I*, 94 Hawai'i at 141, 9 P.3d at 453.

16. The State has a public trust duty to "duly consider the significant public interest in continuing reasonable and beneficial existing offstream uses." *Id.* at 150, 9 P.3d at 462.

17. "The state water code shall be liberally interpreted to obtain maximum beneficial use of the waters of the State for purposes such as domestic uses, aquaculture uses, irrigation and other agricultural uses, power development, and commercial and industrial uses. However, adequate provision shall be made for the protection of traditional and customary Hawaiian rights, the protection and procreation of fish and wildlife, the maintenance of proper ecological balance and scenic beauty, and the preservation and enhancement of waters of the State for municipal uses, public recreation, public water supply, agriculture, and navigation. Such objectives are declared to be in the public interest." HRS § 174C-2(c).

18. The Hawai'i Supreme Court has recognized that "[t]he public has a definite interest in the development and use of water resources for various reasonable and beneficial public and private offstream purposes, including agriculture . . . ." *Id.*

19. The Hawai'i Supreme noted that "reason and necessity dictate that the public trust may have to accommodate offstream diversions inconsistent with the mandate of protection, to

the unavoidable impairment of public instream uses and values." *Id.*

20. The Commission's administrative rules pertaining to the setting of instream flow standards likewise provide that the economic value of present offstream uses of water must be considered. HAR § 13-169-20(4) provides:

> (4) In determining flow requirements to protect instream uses or in assessing stream channel alterations, ***consideration should be given to the maintenance of existing non-instream uses of economic importance*** and the preservation of stream waters for potential non-instream uses of public benefit.

(Emphasis added). Section 13-169-40(c) of the HAR similarly provides:

> (c) In considering a petition to adopt an interim instream flow standard, the commission shall weigh the importance of the present or potential instream values with the importance of the ***present or potential uses of water for non-instream purposes, including the economic impact of restricting such uses.***

(Emphasis added).

21. "[P]rivate commercial use for economic development, although not a cognizable trust objective, 'may produce important public benefits and . . . must figure into any balancing of competing interests of water.'" *In re Wai'ola*, 103 Hawai'i at 432, 83 P.3d at 695 (quoting *Waiāhole I*, 94 Hawai'i at 138, 9 P.3d at 450, ellipses in original).

6. Traditional and Customary Rights

22. The Water Code provides:

> Traditional and customary rights of ahupua'a 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 hihiwai, 'ōpae, o'opu, limu, thatch, ti leaf, aho cord, and medicinal plants for subsistence, cultural, and religious purposes.

HRS § 174C-101(c).

23. The Supreme Court of Hawai'i has taught that an administrative agency rendering a decision that might affect native Hawaiian rights must articulate:

> (1) the identity and scope of "valued cultural, historical, or natural resources" in the petition area, including the extent to which traditional and customary native Hawaiian rights are exercised in the petition area; (2) the extent to which those resources-including traditional and customary native Hawaiian rights-will be affected or impaired by the proposed action; and (3) the feasible action, if any, to be taken by the LUC to reasonably protect native Hawaiian rights if they are found to exist.

In re ʻĪao Water Management Area High-Level Source Water Use Permit Applications, 128 Hawaiʻi 228, 247, 287 P.3d 129, 148 (2012) ("**Nā Wai ʻEhā**") (quoting *Ka Paʻakai O Kaʻaina v. Land Use Comm'n*, 94 Hawaiʻi 31, 46-47, 7 P.3d 1068, 1083-84 (2000)).

24. A party seeking protection for native Hawaiian traditional and customary practices must make a factual showing of the practices for which the party seeks protection. *Kalipi v. Hawaiian Trust Co. Ltd.*, 66 Haw. 1, 656 P.2d 745 (1982); *Public Access Shoreline of Hawaiʻi v. Hawaii County Planning Comm'n*, 79 Hawaiʻi 425, 903 P.2d 1246 (1995); *State v. Hanapi*, 89 Hawaiʻi 177, 970 P.2d 485 (1998); *Ka Paʻakai O Kaʻina v. Land Use Commission*, 94 Hawaiʻi 31, 7 P.3d 1068 (2000).

7. Appurtenant rights

25. "[A]ppurtenant water right[s] to taro land attached to the land when title was confirmed by the Land Commission Award and title conveyed by the issuance of Royal Patent." *McBryde Sugar Co. v. Robinson*, 54 Haw. 174, 190, 504 P.2d 1330, 1340 (1973).

26. "[T]he right to the use of water acquired as appurtenant rights may only be used in connection with that particular parcel of land to which the right is appurtenant . . . ." *McBryde*, 54 Haw. at 191, 504 P.2d at 1341.

8. Balancing of Interests

27. The Water Code states that "[i]n considering a petition to adopt an [IIFS], the commission shall weigh the importance of the present or potential instream values with the importance of the present or potential uses of water for noninstream purposes, including the

economic impact of restricting such uses." HRS § 174C-71(2)(D). Engaging in this inquiry requires CWRM to "judge the value of a party's noninstream use against the other present or potential uses." *Nā Wai ʻEhā*, 128 Hawaiʻi at 257, 93 P.3d at 158. CWRM's ultimate task in setting IIFS is to identify relevant instream values and noninstream uses and determine the proper balance between them that best furthers the public interest.

28. Thus, CWRM's goal in setting instream flow standards should be to balance public and private water uses, whether instream or offstream, in order to effectuate the dual mandates of the public trust doctrine, which are protection and maximum and beneficial use. *See Waiāhole I*, 94 Hawaiʻi at 138-39, 9 P.3d at 450-51.

29. No particular category of water use should be elevated to the level of a "categorical imperative." *Id.* at 142, 9 P.3d at 454. Instead, CWRM must "weigh competing public and private water uses on a case-by-case basis, according to any appropriate standards provided by law." *Id.* The Court also "indicated a preference for accommodating both instream and offstream uses where feasible." *Id.*

9. <u>Public Interest</u>

30. The overarching goal of the CWRM in performing its weighing analysis of instream and noninstream uses is to promote the public interest. CWRM is to adopt an IIFS "in order to protect the public interest pending the establishment of a permanent instream flow standard[.]" *Id.* § 174C-71(2)(A). CWRM's rules similarly provide that "[e]xpressions of the public interest should be sought in the implementation of this chapter." HAR § 13-169-20(6).

10. <u>Burden of Proof</u>

31. The burden of proof in an IIFS-setting proceeding does not lie with any particular party. "In the context of IIFS petitions, the water code does not place a burden of proof on any particular party; instead, the water code and our case law interpreting the code have affirmed the

Commission's duty to establish IIFS that 'protect instream values to the extent practicable' and 'protect the public interest.'" *Nā Wai 'Ehā*, 128 Hawai'i at 254, 287 P.3d at 154 (quoting *In re Water Use Permit Applications*, 105 Hawai'i 1, 11, 93 P.3d 643, 653 (2004), and HRS § 174C-71(2)(A)).

11. Losses

32. The value of water that is diverted, only to be lost due to avoidable or unreasonable circumstances, is unlikely to outweigh the value of retaining the water for instream uses. Therefore, CWRM should consider whether system losses experienced by diverters are unreasonable, and whether reduction of such losses is reasonably practicable. *See Nā Wai 'Ehā*, 128 Hawai'i at 257-58, 287 P.3d at 158-59.

12. Alternative Sources

33. The availability of alternative water sources is a consideration in the weighing of instream values with offstream purposes when establishing IIFS because the availability of alternative sources diminishes the "importance" of diverting stream water for noninstream use. *See Nā Wai 'Ehā*, 128 Hawai'i at 259, 287 P.3d at 160.

B. Considerations Relevant to Setting IIFS

1. Instream Values

a. Stream biota and habitat restoration

34. The best scientific information currently available to CWRM indicates that 64% of natural median base flow (BFQ_{50}), is generally representive of the flow necessary to restore 90% of the habitat in a stream (H_{90}). Absent any physical barriers to upstream or downstream migration or interruptions in connectivity, the H_{90} flow provides suitable conditions for growth, reproduction, and recruitment of native stream animals. (FOF 76.)

35. Since the relationship between flow discharge rates and habitat availability for native species is not linear, and the relationship between habitat availability and animal populations is likewise not linear, any incremental benefit to habitat recovery, and in turn, animal populations, to be gained from restoring in excess of H_{90} would be minimal. (FOF 79, 80.)

36. Accordingly, achieving an H_{90} level of stream flow is generally a reasonable guide for CWRM to follow when determining the minimum stream flows necessary to satisfy the instream values of maintenance of aquatic life and wildlife habitats as well as protection of traditional and customary Hawaiian gathering rights, which are affected by the size of native animal populations in a stream. Restoration of H_{90} flows in streams where it is currently lacking could indirectly enhance other instream values as well, including maintenance of ecosystems and outdoor recreational activities. However, particular circumstances in a stream could contraindicate the effectiveness of restoring the flow in the stream to H_{90}. Such contraindicating circumstances are discussed in COL 39 to 41 below.

37. The available data are inconclusive as to the effect of seasonally adjusted flows—H_{min} during the wet season to sustain basic biological functions and C_{min} during the dry season to maintain connectivity—on stream biota and their habitat. The results of the Monitoring Study, which were collected over a relatively short period of time, were inconclusive. In two of the three streams that were studied, a greater number of animals and range of sizes were actually observed during summer water release months as opposed to winter release months. No consistent patterns as to the effects of the flow releases, including summer flow releases, on physical habitat were observed. (FOF 65, 66, 69.)

38. Consistent with CWRM's duty to weigh the relative importance of instream values and noninstream uses and determine the balance between the two that best effectuates the

public trust doctrine's dual mandates of protection and maximum and beneficial use, flow restoration should be undertaken in a manner that achieves maximum benefit to instream values while imposing the least amount of negative impact on reasonable-beneficial noninstream uses. Examples of such a cost-beneficial approach to setting IIFS include restoring flow to streams in which the most Habitat Units are restored per cfs of flow returned, or to streams with natural features that do not inhibit upstream or downstream passage of native stream species.

i. Naturally occurring physical barriers

39. The presence of a large waterfall in a stream is a circumstance that contraindicates restoring flow to the H_{90} standard. Waterfalls may impede upstream migration of certain amphidromous species, thereby attenuating the benefits of flow restoration to native stream animal populations. (FOF 19-24.)

ii. Losing streams

40. Streams with stretches that lose water due to infiltration into the ground prevent connectivity between the ocean and upstream reaches. The importance of restoring a particular level of flow to streams with such losing stretches is diminished because the amount of water needed to achieve connectivity in East Maui Streams with losing reaches, assuming connectivity is even possible, is unknown. Moreover, restoring flow to a losing stream puts at risk stream animals who initiate recruitment in response to water returns, but get stranded upon reaching a dry stretch. (FOF 82; Gingerich, Tr., 3/3/15, p. 91, l. 14 to p. 92, l. 4.)

iii. Commingling of stream and ditch flows

41. DAR has recommended against co-mingling stream and ditch flows to limit the potential spread of invasive aquatic species. According to DAR, flow restoration of a stream should be undertaken with water from that stream rather than with water in ditches collected

from other watersheds. Therefore, streams that are utilized to convey water from other streams between ditches or ditch sections are not good candidates for restoration. (FOF 53.C.)

iv. Regional approach to flow restoration

42. The benefits of restoring adequate flow to support healthy populations of native aquatic biota in a single stream extend to other streams in the region and beyond. Restoring flow to streams that are spread out geographically provides greater protection against localized habitat disruptions, produces a wider benefit to estuarine and nearshore marine species, and results in more comprehensive ecosystem function across the entire East Maui sector. Individual amphidromous animals do not necessarily return to their natal stream; they move from stream to stream and exchange from a common inter-island oceanic larval pool. Therefore, management actions that improve instream habitat across a group of streams will increase the chance that suitable habitat will be encountered as the larvae end their oceanic phase and begin recruitment. (Appendix A to Higashi WDT, pp. 5, 6; Appendix C to Higashi WDT, p. 1; Appendix D to Higashi WDT, p. 3; Exh. C-66, p. 28; Exh. C-91, p. 43; Higashi, Tr., 3/16/15, p. 159, l. 15 to p. 160, l. 8.)

2. <u>Protection of traditional and customary Hawaiian rights</u>

43. Insofar as the practice of traditional and customary Hawaiian rights is regarded as an instream value, it pertains to rights that are exercised within the stream and are enhanced by leaving or restoring water in the streams. They are distinct from traditional and customary rights that are included in noninstream purposes, i.e., appurtenant rights exercised through traditional and customary methods. As such, the instream value of protection of traditional and customary Hawaiian rights largely coincides with the interest of flow restoration in general, and flow restoration to support native stream biota in particular. (Exh. C-120, pp. 118-19 (COL 49).)

C. Flows Reasonably Needed to Satisfy Instream Values

1. Honopou (6034)

44. The flow in Honopou Stream needed to achieve H_{90} is unknown. (FOF 100)

45. EMI currently allows all low flows, i.e., the flows naturally occurring in dry conditions, to pass into Honopou Stream. (FOF 92.)

46. Any increase to the IIFS for Honopou Stream from the current status quo will not result in more water in the stream at low flow conditions and is therefore not reasonably necessary to satisfy instream values.

2. Hanehoi (6037)

47. The flow needed in Hanehoi to achieve H_{90} is unknown. (FOF 145.)

48. The IIFS that was set for Hanehoi in 2008 was based on USGS regression estimates that were not verified with any field measurements and were apparently overstated given the current inability to meet the IIFS by releasing flows at the level of the Haiku Ditch.

49. Until implementation measures are completed to determine whether the current IIFS can be met by further modifications to EMI's diversions at the Wailoa, New Hamakua and Lowrie ditches, it would be premature to consider increasing the IIFS for the purpose of satisfying instream values.

3. Waikamoi (6047)

50. The estimated natural (undiverted) median baseflow of Waikamoi Stream is 6.60 cfs (4.26 mgd). The amount of flow in Waikamoi Stream below the confluence with Alo Stream needed to achieve H_{90} is 4.20 cfs (2.71 mgd). In 2010, DAR recommended restoration to Waikamoi to provide for minimum habitat flows for native species. Likewise, CWRM staff recommended Waikamoi Stream for restoration because it supported DAR's position of a geographic approach to flow restoration, which would enhance biological diversity in the East

Maui area and regional diversity in traditional gathering opportunities. However, both DAR and CWRM staff recommended flow releases less than H_{90}. DAR and CWRM staff recommended wet season flow releases of 2.60 cfs (1.40 mgd) and 2.80 (1.81 mgd), respectively. Neither recommended any flow releases during the dry season. In 2010, CWRM adopted CWRM staff's recommendation. These restoration efforts were estimated to create over 2 km of habitat for native species. Accordingly, no increase in the IIFS for Waikamoi Stream from the present amount of 2.80 cfs (1.81 mgd) during the wet season and 0 cfs during the dry season at an altitude of 550 feet, just above Hana Highway, is required to reasonably satisfy instream values. (FOF 173, 175, 176, 178; COL 36, 37, 38, 42.)

51. Neither DAR nor CWRM staff recommended flow releases into the Alo tributary of Waikamoi Stream, and CWRM in 2010 did not establish an IIFS for Alo Stream. Restoration of additional flow would not result in significant biological flow in Alo Stream. Accordingly, no IIFS for Alo Stream is required to reasonably satisfy instream values. (FOF 174, 175, 176.)

52. The estimated natural (undiverted) median baseflow of Wahinepe'e Stream is 0.90 cfs (0.58 mgd). The amount of flow in Wahinepe'e Stream needed to achieve H_{90} is 0.58 cfs (0.37 mgd). However, neither DAR nor CWRM staff recommended flow releases into Wahinepe'e Stream, and CWRM acted accordingly in 2010. Restoration of additional flow would not result in significant biological flow in Wahinepe'e Stream. Accordingly, no increase in the IIFS for Wahinepe'e Stream from the present amount of 0.50 cfs (0.32 mgd) is required to reasonably satisfy instream values. (FOF 174, 175, 176.)

53. The presence of terminal waterfalls in both Waikamoi Stream and Wahinepe'e Stream further create natural barriers to upstream migration, further reducing the potential for restoration of suitable habitat for native amphidromous species. (FOF 164.)

4. Puohokamoa (6048)

54. The estimated natural (undiverted) median baseflow of Puohokamoa Stream is 8.40 cfs (5.43 mgd). The amount of flow in Puohokamoa Stream needed to achieve H_{90} is 5.40 cfs (3.49 mgd). (FOF 200.)

55. Puohokamoa Stream is used to convey water from one ditch to another. For this reason, Puohokamoa Stream is not a good candidate for restoration. (FOF 192; COL 41.)

56. Accordingly, no increase in the IIFS for Puohokamoa Stream from the present amount of 0.40 cfs (0.26 mgd) below all EMI diversions and just above Hana Highway, near an altitude of 565 feet, is required to reasonably satisfy instream values. (COL 38, 41.)

5. Haipuaena (6049)

57. Haipuaena Stream is used for conveyance of water from one ditch to another. Commingled water exists for a considerable distance upstream of the diversion structures on the stream. Modification to the existing diversion infrastructure on Haipua'ena Stream would result in release of water from sources other than the natural flow of the stream. For this reason alone, Haipua'ena Stream is not a good candidate for restoration. (FOF 219; COL 41.)

58. The presence of a terminal waterfall also creates a natural barrier to upstream migration that reduces the potential for restoration of suitable habitat for native amphidromous species. (FOF 212.)

59. Near the coast, Haipua'ena Stream loses water and retains just 50% of the otherwise expected habitat availability. (FOF 216.)

60. Accordingly, no increase in the IIFS for Haipua'ena Stream from its present amount of 0.10 cfs (0.07 mgd) below all EMI diversions and just above Hana Highway, near an altitude of 565 feet, is required in order to reasonably satisfy instream values. (COL 38, 39, 40, 41.)

6. Punalau (6050)

61. The estimated natural (undiverted) median baseflow of Punalau Stream is 3.90 cfs (2.52 mgd). The amount of flow in Punalau Stream needed to achieve H_{90} is 2.50 cfs (1.62 mgd). However, CWRM staff did not recommend flow restoration for Punalau Stream because restoration of additional flow would not result in significant biological return in the stream. Likewise, DAR did not recommend restoration for Punalau Stream. In 2010, CWRM adopted CWRM staff's recommendation. Accordingly, no increase in the IIFS for Punalau Stream from its present amount of 0.20 cfs (0.13 mgd) below all EMI diversions and just above Hana Highway, near an altitude of 565 feet, is required in order to reasonably satisfy instream values. (FOF 239, 240, 241, 243; COL 36, 38)

7. Honomanū (6051)

62. The reach from the waterfall at the head of the canyon to the seaward terminus of Honomanu Stream does not contain surface flow under base flow conditions. Because Honomanu Stream is a losing stream in its terminal reach, it would not be a good candidate for restoration. (FOF 260; COL 38, 40.)

63. Accordingly, no increase in the IIFS for Honomanu Stream from its present amount of 0 cfs below all EMI diversions just above Hana Highway, near an altitude of 20 feet, is required in order to reasonably satisfy instream values. (COL 38, 40.)

8. Nua'ailua (6052)

64. The estimated natural (undiverted) median baseflow of Nua'ailua Stream is 0.28 cfs (0.18 mgd). The amount of flow in Nua'ailua Stream needed to achieve H_{90} is 0.18 cfs (0.12 mgd). The current IIFS for Nua'ailua Stream, which is estimated at 3.10 cfs (2.00 mgd), already exceeds the H_{90} flow. (FOF 281, 283.)

65. Accordingly, no increase in the IIFS for Nua'ailua Stream from the present amount of 3.10 cfs (2.00 mgd) below all EMI diversions and just above Hana Highway, near an altitude of 110 feet, is required in order to reasonably satisfy instream values. (COL 36.)

9. <u>Pi'ina'au (6053)</u>

66. Because no estimates of flow-duration statistics for natural (undiverted) streamflow for Pi'ina'au Stream are available, the flow needed to achieve H_{90} in this stream is unknown. (FOF 297; Exh. HO-1.)

67. A waterfall above Waialohe Pond on Pi'ina'au Stream restricts upstream migration of certain native amphidromous species. (FOF 300.)

68. CWRM staff did not recommend Pi'ina'au Stream for restoration citing, among other things, the fact that, "With the current flow, Pi'ina'au Stream exhibits a rich native species diversity, most of which was observed in Waialohe Pond." (FOF 300.)

69. Based on the foregoing, no increase in IIFS A for Pi'ina'au Stream is required in order to reasonably satisfy instream values. (COL 39, 40.)

70. The estimated natural (undiverted) median baseflow of Palauhulu Stream is 3.40 cfs (2.20 mgd). The amount of flow in Palauhulu Stream needed to achieve H_{90} is 2.20 cfs (1.42 mgd). Thus, the current IIFS for Palauhulu Stream, which is estimated at 5.50 cfs (3.56 mgd), already exceeds the H_{90} flow. (FOF 306.)

71. Currently, EMI allows the low flows in Palauhulu Stream to bypass its diversion but these flows do not make it past its middle reach below Plunkett Spring and above Store Spring, in which the water is lost to filtration through the streambed. (FOF 304.)

72. Based on the foregoing, no change to IIFS B for Palauhulu Stream is required to reasonably satisfy instream values. (COL 36, 38, 40.)

10. <u>Ohia (6054)</u>

73. Ohia Stream is not diverted by any major surface water diversion system. (FOF 327.)

74. The estimated natural (undiverted) median baseflow of Ohia Stream is 4.70 cfs (3.04 mgd). The amount of flow in Ohia Stream needed to achieve H_{90} is 3.00 cfs (1.94 mgd). (FOF 333.) The current stream flow exceeds the amount needed to achieve H_{90}.

75. Accordingly, no increase in the IIFS for Ohia Stream is required in order to reasonably satisfy instream values. (COL 36.)

11. <u>Waiokamilo (6055)</u>

76. The estimated natural (undiverted) median baseflow of Waiokamilo Stream is 3.90 cfs (2.52 mgd). The amount of flow in Waiokamilo Stream needed to achieve H_{90} is 2.50 cfs (1.62 mgd). Thus, the current IIFS for Waiokamilo Stream, which is estimated at 4.90 cfs (3.17 mgd), already exceeds the H_{90} flow. (FOF 353.)

77. EMI ceased all diversions within the Waiokamilo hydrologic unit after the BLNR ruled in March 2007 that EMI should release 6 mgd from Waiokamilo Stream. (FOF 345.)

78. HC&S has stipulated to an IIFS that provides for no diversions in the Waiokamilo hydrologic unit. (Tr., 3/30/15, p. 8, l. 21 to p. 9, l. 22.)

79. Accordingly, no increase in the IIFS for Waiokamilo Stream from the present amount of 4.90 cfs (3.17 mgd) at the lower reach of Waiokamilo Stream at USGS gaging station 16521300 near Dam 3, and no increase in the IIFS for Kualani Stream, is required in order to reasonably satisfy instream values. (COL 36.)

12. <u>Wailuanui (6056)</u>

80. The estimated natural (undiverted) median baseflow of Wailuanui Stream is 4.50 cfs (2.91 mgd). The amount of flow in Wailuanui Stream needed to achieve H_{90} is 2.90 cfs (1.87

mgd). Thus, the current IIFS for Wailuanui Stream, which is estimated at 3.05 cfs (1.97 mgd), already exceeds the H_{90} flow. (FOF 377.)

81. Accordingly, no increase in the IIFS for Wailuanui Stream from the present amount of 4.50 cfs (2.91 mgd) at the lower reach of Wailuanui Stream near inactive USGS gaging station 16521000 at 620 feet elevation is required in order to reasonably satisfy instream values (COL 36.)

13. <u>West Wailuaiki (6057)</u>

82. The amount of flow in West Wailuaiki Stream needed to achieve H_{90} is 3.80 cfs (2.46 mgd). In 2010, CWRM staff recommended flow restoration of 3.80 cfs (2.46 mgd) for West Wailuaiki Stream because it, along with East Wailuaiki Stream, would result in the most biological return from additional flow, the presence of an estuary in both streams would further enhance the biological diversity of the stream, and flow restoration would provide increased opportunities for traditional gathering practices. DAR recommended the release of 3.50 cfs (1.88 mgd) during the wet season and 0.40 cfs (0.26 mgd) during the dry season. In 2010, CWRM adopted CWRM staff's IIFS recommendation of 3.80 cfs (2.46 mgd) for the wet season, which coincides with H_{90}, and DAR's IIFS recommendation of 0.40 cfs (0.26) for the dry season. EMI has implemented DAR's recommended modifications of the diversion structure on West Wailuaiki Stream at the Ko'olau Ditch to provide passage for native species. These restoration efforts were estimated to create over 2.2 km of additional habitat for native species. Accordingly, no increase in the IIFS for West Wailuaiki Stream from the present amount of 3.80 cfs (2.46 mgd) during the wet season and 0.40 cfs (0.26 mgd) during the dry season below all EMI diversions and just above Hana Highway, near an altitude of 1,235 feet, is required in order to reasonably satisfy instream values. (FOF 399, 400, 401, 402, 403, 405; COL 36, 37, 38, 42.)

14. East Wailuaiki (6058)

83. The amount of flow in West Wailuaiki Stream needed to achieve H_{90} is 3.70 cfs (2.40 mgd). In 2010, CWRM staff recommended flow restoration of 3.70 cfs (2.40 mgd) for East Wailuaiki Stream because it, along with West Wailuaiki Stream, would result in the most biological return from additional flow, the presence of an estuary in both streams would further enhance the biological diversity of the stream, and flow restoration would provide increased opportunities for traditional gathering practices. DAR recommended the release of 3.20 cfs (2.07 mgd) during the wet season and 0.20 cfs (0.13 mgd) during the dry season. In 2010, CWRM adopted CWRM's IIFS recommendation of 3.70 cfs (2.40 mgd) for the wet season, which coincides with H_{90}, and DAR's IIFS recommendation of 0.20 cfs (0.13) for the dry season. EMI has implemented DAR's recommended modifications of the diversion structure on East Wailuaiki Stream at the Ko'olau Ditch to provide passage for native species. These restoration efforts were estimated to create over 2.4 km of additional habitat for native species. Accordingly, no increase in the IIFS for East Wailuaiki Stream from the present amount of 3.70 cfs (2.40 mgd) during the wet season and 0.20 cfs (0.13 mgd) during the dry season below all EMI diversions and just above Hana Highway, near an altitude of 1,235 feet, is required in order to reasonably satisfy instream values. (FOF 420, 421, 422, 423, 424, 426; COL 36, 37, 38, 42.)

15. Kopili'ula (6059)

84. Kopili'ula Stream is used to convey water from one ditch section to another. For this reason alone, Kopili'ula Stream is not a good candidate for restoration. (FOF 439; COL 41.)

85. The estuary in Kopili'ula Stream is also relatively small compared to other estuaries surveyed in east Maui, and not much estuarine habitat is available. Thus, restoration of flow to Kopili'ula Stream would be of limited benefit in terms of increasing estuarine habitat. (FOF 448.)

86. Accordingly, no increase in the IIFS for Kopili'ula Stream from the present amount of 0.50 cfs (0.32 mgd) below all EMI diversions and just above Hana Highway, near an altitude of 1,235 feet, is required in order to reasonably satisfy instream values. (COL 38, 41.)

87. The estimated natural (undiverted) median baseflow of Puakaa Stream is 1.10 cfs (0.71 mgd). The amount of flow in Puakaa Stream needed to achieve H_{90} is 0.70 cfs (0.45 mgd). In 2010, CWRM staff and DAR did not recommend flow restoration for Puakaa Stream because the amount of Habitat Units to be gained would be minimal. Accordingly, no increase in the IIFS for Puakaa Stream from its present amount of 0.60 cfs (0.39 mgd) below all EMI diversions and just above Hana Highway, near an altitude of 1,235 feet, is required in order to reasonably satisfy instream values. (COL 36, 38.)

16. <u>Waiohue (6060)</u>

88. The estimated natural (undiverted) median baseflow of Waiohue Stream is 5.00 cfs (3.23 mgd). The amount of flow in Waiohue Stream needed to achieve H_{90} is 3.20 cfs (2.07 mgd). In 2010, DAR recommended restoration to Waiohue to provide for minimum habitat flows for native species. Likewise, CWRM staff recommended Waiohue Stream for restoration because the presence of an estuary would further enhance the biological diversity of the stream, and the stream was used for traditional gathering practices. DAR recommended wet season flow releases of 2.70 cfs (1.45 mgd) and and dry season flow releases of 0.10 cfs (0.06 mgd). CWRM staff recommended an anuual IIFS of 3.20 cfs (2.10 mgd). In 2010, CWRM adopted CWRM staff's IIFS recommendation of 3.20 cfs (2.10 mgd) for the wet season, which coincides with H_{90}, and DAR's IIFS recommendation of 0.10 cfs (0.06 mgd) for the dry season. EMI has implemented DAR's recommended modifications of the diversion structure on Waiohue Stream at the Ko'olau Ditch to provide passage for native species. These restoration efforts were

estimated to create over 1.5 km of habitat for native species. Accordingly, no increase in the IIFS for Waiohue Stream from the present amount of 3.20 cfs (2.10 mgd) during the wet season and 0.10 cfs (0.06 mgd) during the dry season below all EMI diversions and just above Hana Highway, near an altitude of 1,195 feet, is required in order to reasonably satisfy instream values. (FOF 465, 466, 467, 468, 469, 471; COL 36, 37, 38, 42.)

17. Pa'akea (6061)

89. The estimated natural (undiverted) median baseflow of Pa'akea Stream is 0.90 cfs (0.58 mgd). The amount of flow in Pa'akea Stream needed to achieve H_{90} is 0.58 cfs (0.37 mgd). Accordingly, no increase in the IIFS for Pa'akea Stream from its present amount of 1.50 cfs (0.97 mgd) below all EMI diversions and just above Hana Highway, near an altitude of 1,265 feet, is required in order to reasonably satisfy instream values. (FOF 489, 491; COL 36.)

18. Waiaaka (6062)

90. The estimated natural (undiverted) median baseflow of Waiaaka Stream is 0.77 cfs (0.50 mgd). The amount of flow in Waiaaka Stream needed to achieve H_{90} is 0.49 cfs (0.32 mgd). In 2010, CWRM staff and DAR did not recommend flow restoration for Waiaaka Stream because restoration of additional flow would not result in significant biological return in this stream. Accordingly, no increase in the IIFS for Waiaaka Stream from its present amount of 0.49 cfs (0.32 mgd) below all EMI diversions and just above Hana Highway, near an altitude of 1,235 feet, is required in order to reasonably satisfy instream values. (FOF 506, 507, 508, 511; COL 36, 38)

19. Kapaula (6063)

91. Neither CWRM staff nor DAR recommended flow restoration for Kapaula Stream. According to CWRM staff, restoration of additional flow would not result in significant biological return in this stream. (FOF 527-529.)

92. The presence of a terminal waterfall creates a natural barrier to upstream migration that reduces the potential for restoration of suitable habitat for native amphidromous species. (FOF 523.)

93. Accordingly, no increase in the IIFS for Kapaula Stream from its present amount of 0.20 cfs (0.13 mgd) below all EMI diversions and just above Hana Highway, near an altitude of 1,194 feet, is required in order to reasonably satisfy instream values. (COL 38, 39.)

20. <u>Hanawī (6064)</u>

94. Hanawī Stream had adequate flow to sustain a viable biota population even prior the amendment of the IIFS for the stream in 2010. CWRM staff proposed restoration of a modest amount of flow (0.10 cfs/0.60 mgd) to provide connectivity in the dry reach immediately below the Koʻolau Ditch diversion. (FOF 548.)

95. Accordingly, no increase in the IIFS for Hanawī Stream from its present amount of 0.10 cfs (0.06 mgd), below all EMI diversions and just above Hana Highway near an altitude of 1,300 feet, is required in order to reasonably satisfy instream values.

21. <u>Makapipi (6065)</u>

96. Makapipi Stream was not among the streams recommended for restoration by DAR. (FOF 571.)

97. CWRM adopted CWRM staff's recommendation subject to a conditional release of water by EMI and monitoring by CWRM staff. (FOF 573.)

98. The release of flow into Makapipi stream in 2010 confirmed the existence of losing stretches on Makapipi Stream upstream of Hana Highway. This was consistent with the earlier 2001 flow release in response to a dengue fever outbreak, which release was suspended after two days because most of the water disappeared into the ground, increasing the number of pools of standing water in which mosquitos could breed instead of resulting in the hoped for

continuously flowing stream. The release of additional flow into the stream will not, therefore, provide the connectivity to the ocean that native amphidromous species depend upon for downstream larval drift and upstream recruitment. (FOF 565, 573.)

99. The presence of a terminal waterfall creates a further natural barrier to upstream migration that reduces the potential for restoration of suitable habitat for native amphidromous species. (FOF 564.)

100. Accordingly, no increase in the IIFS for Makapipi Stream from the amount of water flowing in the stream on October 8, 1988, just above Hana Highway at an altitude of 935 feet, is required in order to reasonably satisfy instream values. (COL 38, 39, 40.)

D. Noninstream Uses

1. HC&S

a. Agricultural use

101. HC&S' use of East Maui surface water clearly constitutes agricultural use, which Hawai'i law recognizes as reasonable and beneficial use of water. (COL 17, 18; *see also* Haw. Const. art. XI, § 3 ("The State shall conserve and protect agricultural lands, promote diversified agriculture, increase agricultural self-sufficiency and assure the availability of agriculturally suitable lands.").)

b. Need for water

102. HC&S is not using an excessive amount of water from East Maui streams. HC&S' water needs of 5,146 gad for the East Maui Fields are less than those CWRM found to be reasonable in the Nā Wai 'Ehā contested case hearing, and which the Hawai'i Supreme Court upheld on appeal. HC&S has consistently operated below the full irrigation requirements of sugarcane as calculated by its water balance model. (FOF 628-629, 630; *Nā Wai 'Ehā*, 128 Hawai'i at 225, 287 P.3d at 156.)

103. For the 24-year period from 1986 to 2009, HC&S has been operating on 85% of its water needs. Based on average need of 270 mgd, the plantation's water demands are not met 10 months out of the year. Only during the winter months of November and December are the water needs of the plantation satisfied with available water. (Exh. C-71, Appendix G thereto, p. G-3; Exh. C-103, pp. 14-15.)

104. More recent data continue to show that HC&S lacks water to meet its irrigation requirements. For the six-year period from 2008 to 2013, HC&S operated at an average of 89% of its required irrigation needs (FOF 629.)

105. HC&S needs adequate water to meet its production target of 12-14 TSA, or 200,000 tons of sugar per year. Failure to meet this target roughly correlates with a decline in HC&S' profitability, even to the point of sustaining losses. (FOF 672-674.)

c. **System losses**

106. The majority of the EMI Ditch System is lined, so system losses experienced by HC&S occur primarily within the HC&S irrigation and reservoir system. (FOF 600.)

107. HC&S estimates that it loses approximately 22.7% of water from surface deliveries from EMI and groundwater pumped from brackish well servicing the East Maui fields due to seepage, evaporation, back-flushing of filters, drip tube ruptures or breaks, animal damage, and pipeline breaks, among other things. (FOF 637.)

108. Based on seepage rate factors published by the USDA in the National Engineering Handbook, seepage in a system of similar size as HC&S' system would be expected to range between 30.75 mgd and 65.06 mgd, which equates to 16.76% and 35.46% of average daily water deliveries of surface water and groundwater to HC&S, respectively. (FOF 638.) Loss due to evaporation in the HC&S system is estimated to be 2.64 mgd. Therefore, the estimated range of

expected losses from seepage and evaporation would be from 33.40 mgd to 67.60 mgd, or between 18.20% and 36.90% of average daily water deliveries. (FOF 639-640.)

109. The average of the low and high seepage/evaporation loss factors is 27.55% of average daily water deliveries. Given that HC&S' estimated 22.7% system loss rate falls below this average, the losses from HC&S' ditch and reservoir system are reasonable for a system of its size. (Exh. C-139.)

110. Although 36 of HC&S' reservoirs are unlined, water loss due to infiltration from unlined reservoirs occurs mostly during times of high rainfall, when there is enough water to store in the reservoirs. In times of low flow, when reservoir levels are low and water does not remain long in reservoirs, infiltration would be less than average. Therefore, lining the unlined reservoirs would not significantly reduce system losses under low flow conditions when water is most scarce. (FOF 641.)

111. Water that seeps from unlined reservoirs does not lose its importance to HC&S because infiltration serves to recharge the underlying aquifers, which HC&S depends upon to sustain withdrawal of brackish groundwater to supplement surface water supplies. (FOF 642; Volner, Tr., 3/23/15, p. 35, ll. 6-19.)

112. Lining HC&S' 31 unlined reservoirs would cost an estimated $43.5 million. The exercise of lining the reservoirs would not provide HC&S with additional water when it needs it most in the summer months, however. Little water is stored in the reservoirs during the summer months, so little water could be reclaimed. Lining the reservoirs to enhance their ability to retain water when there water is available for storage is also of limited value to HC&S due to the small sizes of the reservoirs, their limited service areas, and their less-than-ideal location for drip irrigation at field elevation—limitations due to the fact that the reservoirs are a carry-over from

the days of furrow irrigation. Additionally, lining the reservoirs would eliminate the benefit of recharging the underlying aquifers. For these reasons, it would not be cost-effective to line the 31 unlined reservoirs. (FOF 615, 642, 643; Exh. C-71, Appendix C thereto, p. C-4; Volner, 3/23/15, p. 35, ll. 6-19.)

d. Alternative water resources

113. Increased reliance on pumped groundwater is not a reasonably practicable alternative to diverting surface water from East Maui streams for sugarcane irrigation. Existing infrastructure can supply groundwater to 17,200 acres on the HC&S plantation, but even the irrigation needs of these fields cannot be satisfied solely with pumped groundwater. HC&S lacks infrastructure to service the remaining 11,800 acres with pumped groundwater on a consistent basis. Significantly increasing groundwater pumping would also degrade the aquifer and increase salinity levels. (FOF 644-646.)

114. With regard to the alternative of using recycled wastewater, it would require in excess of $16.9 million in capital costs to to make R-2 treated effluent available to HC&S. That cost estimate corresponds to the capital cost of improvements to make R-2 recycled wastewater available to HC&S' West Maui Fields; it would be much more difficult and costly to design and construct a system to transport reclaimed water to irrigate the East Maui fields that are located much farther away from the Kahului WWRF and at much higher elevations. (FOF 654, 655, 656.)

115. For the Kahului WWRF to produce R-1 water, which HC&S prefers, certain upgrades to the Kahului WWRF are necessary to enable it to produce R-1 water. These upgrades will be completed, if at all, no earlier than 2020. No system for distribution of R-1 water can be developed until after the upgrades are complete, and the County has no established timeline for

constructing a distribution system. Even if the upgrade were made, it is uncertain how much R-1 water would be available to HC&S. Moreover, the capital costs to produce and distribute R-1 water are prohibitively high. The upgrade to the Kahului WWRF is estimated to cost $4.97 million; Option 1 for the distribution system (which must be constructed before other options are considered) is estimated to cost $24.02 million; and the two options for developing a distribution system that delivers R-1 water to HC&S (Options 3 and 3A) are each estimated to cost $3.97 million and $11.38 million, respectively. For these reasons, HC&S cannot reasonably rely on recycled wastewater as a practicable alternative to East Maui surface water. (FOF 647-653.)

116. According to the ATA Report, there is approximately 2.95 mgd of R-2 treated effluent that could potentially be reliably made available to HC&S 365 days a year from the WWRF upon a definitive agreement being reached between HC&S and the County of Maui and the construction of improvements at an estimated capital cost of approximately $16.9 million associated with making the water accessible to HC&S for its Nā Wai ʻEhā fields. Upon completion of the improvements, projected to be sometime in 2020 at the earliest, there would then be an additional annual operating and maintenance ("***O&M***") cost to HC&S of approximately $521,000, which includes $161,512.50 in fees that the County of Maui would charge for treated effluent at the rate of $0.15/1,000 gallons as stated in the County of Maui's letter to ATA dated January 15, 2014 (attached as Appendix A to the ATA Report). (Volner, WDT 1/27/15, ¶ 3; Exh. C-119, p. 35.)

117. The ATA Report, like the Verification Study, was focused on the potential use of reclaimed water on fields that are in relatively close proximity to the Kahului WWRF utilizing existing pipelines formerly operated to transport cannery wastewater from the now closed Maui Land & Pineapple Company, Inc. facility in Kahului. It would be much more difficult and costly

to design and construct a system to transport reclaimed water to irrigate the East Maui fields that would be most impacted by reductions in EMI water since they are located much farther away from the KWWRF and at much higher elevations. (Volner, WDT 1/27/15, ¶ 4; Exh. C-119.)

118. Building a large reservoir to store water for use during periods of low flow would not be a reasonably practicable alternative for HC&S. For a reservoir to meet HC&S' daily water needs of 200-300 mgd during the dry summer months, it must have a minimum capacity of one billion gallons and be sited at the highest elevation at the head of Wailoa Ditch to maximize the flexibility of the reservoir to supply water to various parts of the plantation. A reservoir of that capacity would occupy approximately 30 acres. Siting a reservoir of that size would be challenging and cost in excess of $150 million. It would also create safety concerns and potentially result in in significant impacts to the surrounding environment and ecosystem. A large reservoir would be of limited value to HC&S in the dry summer months when HC&S needs water most because under low-flow conditions, it is more efficient to apply ditch water directly to fields so as to minimize system losses. Thus, building a billion-gallon reservoir would not be cost-effective. (FOF 657-663.)

119. Green harvesting methods, which involves mechanical harvesting, would not significantly reduce HC&S' irrigation needs. Water lost due to soil surface evaporation, which is potentially reduced by trash blanketing, is not an issue for HC&S because HC&S installs drip irrigation tubes underground. Annual water usage is actually likely to increase over the two-year crop cycle under a mechanical harvesting approach because of the need to irrigate the sugarcane crop after each of the multiple times it is ratooned. The rocky conditions and desert-like climate characteristic of significant portions of the HC&S plantation also are not conducive to widespread adoption of green harvest methods. Therefore, the minimal water savings that could

be realized from green harvesting do not constitute a reasonably practicable alternative water source for HC&S. (FOF 664-668.)

2. MDWS

a. Domestic use

[reserved]

b. System losses

[reserved]

c. Alternative water resources

[reserved]

3. Kuleana uses

120. For kalo lo'i, 130,000 to 150,000 gad, or about 260,000 to 300,000 gad when adjusted for the 50 percent of the time that no water is needed to flow into the lo'i, is sufficient for proper kalo cultivation. (FOF 83-85.)

a. Honopou

121. Sanford Kekahuna and Lurlyn Scott claim appurtenant rights to water to cultivate approximately one acre of taro on their family's property in Honopou. (FOF 116.)

122. Given that kalo cultivation requires 130,000 to 150,000 gad, or about 260,000 to 300,000 gad when adjusted for the 50 percent of the time that no water is needed to flow into the lo'i, the flow in Honopou Stream is currently adequate to support cultivation of one to two acres of taro in the Kekahuna lo'i system. At the current IIFS of 1.29 mgd below the Haiku Ditch, this irrigation requirement can be satisfied without dewatering the stream between the lo'i intake diversion and the outflow ditch. (FOF 115, 123-125.)

123. The recorded temperatures of the water flowing through the 'auwai that services the Kekahuna lo'i system were generally below the threshold point of 27°C (80.6°F) at which

wetland taro becomes more susceptible to fungi and rotting diseases. This is another indication that the complex is receiving adequate flow. The daily mean inflow temperature recorded at Gage '3901 installed at the 'auwai at the top of the lo'i complex ranged between 64°F and 76°F. The daily mean outflow temperature recorded at Gage '3601 in Lo'i Outlet #1 installed on the 'auwai near the bottom on the western boundary of the complex ranged between 65°F and 77°F. The exception is Gage '3602 in Lo'i Outlet #2 installed on an 'auwai situated near the middle of the complex—at a point where the water in the 'auwai has passed through a series of taro patches above—where the daily mean outflow temperature at ranged between 68°F and 82°F. However, cooler water from the 'auwai in which Gage '3601 was installed could be diverted to the middle 'auwai to irrigate taro patches. (FOF 118-121.)

b. Hanehoi

124. Ernest Schupp cultivates one acre of taro on Puolua stream just below the Haiku Ditch. Based on the 130,000 to 150,000 gad irrigation requirement for taro, the current IIFS amount for Hanehoi Site A of 0.89 cfs (0.57 mgd) provides for adequate flow for Mr. Schupp's taro needs. (FOF 155.)

125. Solomon Lee claims an appurtenant or riparian right to enough water to irrigate up to three acres of taro on properties abutting Hanehoi Stream below its confluence with Puoloa Stream. Based on the 130,000 to 150,000 gad irrigation requirement for taro, this would amount to a total irrigation requirement of 390,000 to 450,000 gad. The current IIFS amount of 0.89 cfs (0.57 mgd) at Hanehoi IIFS Site A added together with the current IIFS amount for Hanehoi IIFS Site B of 0.63 cfs (0.41 mgd) equals 1.52 cfs (0.98 mgd), which is an adequate flow for Mr. Lee's taro needs. (FOF 158.)

c. Pi'ina'au

126. No person has asserted a claim of appurtenant rights to use water from Pi'ina'au Stream. Other than a few lo'i in the Ke'anae Arboretum on State-owned land that are irrigated directly from Pi'ina'au Stream above EMI's flume intake on Palauhulu, there is no evidence of other users claiming to use water from Pi'ina'au Stream to cultivate taro. (FOF 316.)

127. Palauhulu Stream is the sole water source for the taro cultivated in Ke'anae. Based on the 130,000 to 150,000 gad irrigation requirement for taro, the 10.53 acre Ke'anae lo'i complex requires 1.37 to 1.58 mgd, which is less than half of the current IIFS of 5.50 cfs (3.56 mgd) for Palauhulu Stream. Since at least Septembe 15, 2010, EMI has been releasing water into Palauhulu Stream from the Ko'olau Ditch, but the water is lost in the leaky sections of the streambed between the release point and the origin of Store Spring, which is the source of the water in Palauhulu Stream that supplies the Ke'anae lo'i complex. Accordingly, increasing the IIFS for Palauhulu Stream would not supply Ke'anae taro farmers with any more water. (FOF 318, 321, 322, 323, 324.)

d. <u>Waiokamilo</u>

128. Given that EMI has agreed to the setting and implementation of an IIFS that would preclude EMI from diverting any water from the entirety of the hydrologic unit of Waiokamilo, it is unnecessary to make specific findings or conclusions regarding the water rights or needs of taro farmers in the hydrologic unit. (FOF 365, 366.)

e. <u>Wailuanui</u>

129. Based on the 130,000 to 150,000 gad irrigation requirement for taro, the current the 2.80 acres of taro that are served by Waikani Pond results in a taro water need of 0.36 to 0.42 mgd, which is more than adequately satisfied with the current IIFS setting of 3.05 mgd. Even assuming the additional parcels of land owned by Nā Moku members for which appurtenant rights are claimed double the acreage that has recently been irrigated with water from Waikani

Pond, under current conditions, there is enough water available to satisfy the irrigation of needs of those parcels without dewatering the stretch between Waikani pond and the seaward terminus of Wailunanui Stream. Further, when the current IIFS is occasionally not met when stream flows are low, increasing the IIFS will not result in any greater amount of water being available during low flows since, during such periods, no water is being diverted by EMI. (FOF 390, 391, 392.)

f. Other hydrologic units

130. There is no evidence of claims of appurtenant rights to use water for taro cultivation from streams in the following hydrologic units: Waikamoi, Puohokamoa, Haipuaena, Punalau, Honomanu, Nuaailua, West Wailuaiki, East Wailuaiki, Kopili'ula, Waiohue, Pa'akea, Waiaaka, Kapaula, and Hanawi. (FOF 188, 209, 232, 252, 272, 292, 414, 435, 459, 480, 500, 520, 541, 561).

131. There is insufficient evidence in the record to support a claim of appurtenant rights to water from Makapipi Stream for purposes of taro cultivation. (FOF 586-589.)

E. Economic Impacts of Restricting Noninstream Uses

132. At the outset, it should be noted that while this contested case proceeding replaces the prior IIFS proceedings and decisions made by the CWRM for the subject 27 streams in 2008 and 2010, those decisions have been already implemented by HC&S. Thus, the economic impacts of restricting noninstream uses discussed herein address any further reductions in the amount of East Maui surface water available for diversion and irrigation of HC&S' plantation in addition to the impacts currently being borne by HC&S as a result of the IIFS amendments to East Maui streams in 2008 and 2010. Table 1 below summarizes the 2008 amendments to the IIFS for streams covered in the 8 Prioritized IIFS Petitions and their estimated annual economic impact on HC&S. The estimates of economic impact were calculated using HC&S' incremental

economic impacts model discussed above. Table 2 below summarizes the 2010 amendments to the IIFS for the remaining 19 East Maui streams and their estimated annual economic impact on HC&S. The economic impact varies depending on whether surface water deliveries are made to the upper terminal ditches (Wailoa or Kauhikoa) or the lower terminal ditches (Lowrie or Haiku). (FOF 695, 696, 697.)

133. The 2008 IIFS amendments reduced the amount of surface water available for diversion by a total of 7.29 cfs (4.70) mgd. On an annual basis, the economic impact of the 2008 IIFS amendments on HC&S is approximately $296,307. The 2010 IIFS amendments reduced the amount of surface water available for diversion by a total of 14.33 cfs (9.26 mgd) during the wet season and 0.70 cfs (0.45 mgd) during the dry season. On an annual basis, the economic impact of the 2010 IIFS amendments on HC&S is approximately $2.34 million. The combined economic impact of the 2008 and 2010 IIFS amendments on HC&S is approximately $2.64 million. (Table 1 and Table 2, *infra.*)

Table 1: Economic Impacts to HC&S of the 2008 IIFS Decision

	TERMINAL EMI DITCH	CURRENT IIFS		RESTORATION AMOUNTS		ECONOMIC IMPACT TO HC&S (ANNUAL)
		cfs	*mgd*	*cfs*	*mgd*	
Honopou Site A	Haiku	2.00	1.29	1.87	1.21	$90,539
Honopou Site B	Haiku	0.72	0.47			
Hanehoi (Puolua)	Haiku	0.89	0.57	0.89	0.57	$42,650
Hanehoi Site B	Haiku	0.63	0.41	0.63	0.41	$30,678
Hanehoi Site C	Haiku	1.15	0.74	1.15	0.74	
Pi'ina'au	Wailoa	Status quo	Status quo	--	--	$0
Palauhulu	Wailoa	5.50	3.56	0.70*	0.45*	$33,671
Waiokamilo	Wailoa	4.90	3.17	--	--	$0
Kualani	Wailoa	Status quo	Status quo	--	--	$0
Wailuanui	Wailoa	3.05	1.97	2.05	1.32	$98,769
Waikani	n/a	Status quo	Status quo	--	--	$0
	TOTALS	**16.97**	**10.97**	**7.29**	4.70	**$296,307**

*The flow HC&S is required to release to meet the IIFS for Palauhulu appears to be more than the stated restoration amount for that stream because of the losing section below the release point at Ko'olau Ditch

Table 2: Economic Impacts to HC&S of Restoring H_{90} Flow to Streams Addressed in CWRM's 2010 IIFS Decision

	TERMINAL EMI DITCH	CURRENT IIFS				RESTORATION AMOUNTS				ECONOMIC IMPACT TO HC&S (ANNUAL)
		Wet		Dry		Wet		Dry		
		cfs	*mgd*	*cfs*	*mgd*	*cfs*	*mgd*	*cfs*	*mgd*	
Waikamoi	Lowrie	2.80	1.81	0	0	2.60	1.68	0	0	$145,026 (wet) $0 (dry)
Alo	Lowrie	--	--	--	--	--	--	--	--	$0
Wahinepe'e	Lowrie	0.50	0.32	*(Annual)*		--	--	--	--	$0
Puohokamoa	Lowrie	0.40	0.26	*(Annual)*		--	--	--	--	$0
Haipua'ena	Lowrie	0.10	0.06	*(Annual)*		--	--	--	--	$0
Punalau	Lowrie	0.20	0.13	*(Annual)*		--	--	--	--	$0
Honomanū	Wailoa	0	0	*(Annual)*		--	--	--	--	$0
Nua'ailua	Wailoa	3.10	2.00	*(Annual)*		--	--	--	--	$0
Ohia	n/a	4.60	2.97	*(Annual)*		--	--	--	--	$0
W. Wailuaiki	Wailoa	3.80	2.46	0.40	0.26	3.80	2.46	0.40	0.26	$624,665 (wet) $66,022 (dry)
E. Wailuaiki	Wailoa	3.70	2.39	0.20	0.13	3.70	2.39	0.20	0.13	$606,890 (wet) $33,011 (dry)
Kopili'ula	Wailoa	0.50	0.32	*(Annual)*		--	--	--	--	$0
Puakaa	Wailoa	0.60	0.39	*(Annual)*		--	--	--	--	$0
Waiohue	Wailoa	3.20	2.07	0.10	0.06	3.20	2.07	0.10	0.06	$525,633 (wet) $15,236 (dry)
Pa'akea	Wailoa	1.50	0.97	*(Annual)*		--	--	--	--	$0
Waiaaka	Wailoa	0.00	0.00	*(Annual)*		--	--	--	--	$0
Kapaula	Wailoa	0.20	0.13	*(Annual)*		--	--	--	--	$0
Hanawī	Wailoa	0.10	0.06	*(Annual)*		0.10	0.06	*(Annual)*		$30,417
Makapipi	Wailoa	0.93	0.60	*(Annual)*		0.93	0.60	*(Annual)*		$304,715
	TOTALS	**26.23**	**16.94**	**0.70**	**0.45**	**14.33**	**9.26**	**0.70**	**0.45**	**$2,351,669**

134. Nā Moku and MT have argued in favor of restoring H_{90} flow to all streams that are the subject of this proceeding. Because the IIFS for the streams covered in the 8 Prioritized IIFS Petitions either meet or exceed the H_{90} flow standard or the H_{90} flow for certain of these streams is unknown, only the economic impacts of restoring H_{90} flow to the streams covered in the 19 East Maui IIFS Petitions are estimated in Table 3 below. Setting the IIFS for all 19 streams at the H_{90} flow year-round would return a total of 40.83 cfs (26.38 mgd). The total economic impact to HC&S of reductions in surface water resulting from the amendments is estimated at $5.79 million. This would be in addition to the $2.64 million in annual economic impact resulting from the 2008 and 2010 IIFS amendments.

Table 3: Economic Impacts to HC&S of Restoring H_{90} Flow to Streams Within Scope of the 19 East Maui IIFS Petitions

	DAR RANK	TERMINAL EMI DITCH	CURRENT IIFS Wet		CURRENT IIFS Dry		H_{90} FLOW		THEORETICAL RETURNED AMOUNTS (ANNUAL)		ECONOMIC IMPACT TO HC&S (ANNUAL)
			cfs	*mgd*	*cfs*	*mgd*	*cfs*	*mgd*	*cfs*	*mgd*	
Waikamoi	4	Lowrie	2.80	1.81	0	0	4.20	2.71	0.7 (wet) 2.1 (dry)	0.45 (wet) 1.71 (wet)	$72,113[a] $217,139[a]
Alo	n/a	Lowrie	--	--	--	--	--	--	--	--	$0
Wahinepe'e	n/a	Lowrie	0.50	0.32	*(Annual)*		0.58	0.37	0.08	0.05	$8,013
Puohokamoa	3	Lowrie	0.40	0.26	*(Annual)*		5.40	3.49	5.00	3.23	$517,608
Haipua'ena	6	Lowrie	0.10	0.06	*(Annual)*		2.80	1.81	2.70	1.75	$280,438
Punalau	n/a	Lowrie	0.20	0.13	*(Annual)*		2.50	1.62	2.30	1.49	$238,773
Honomanū	n/a	Wailoa	0	0	*(Annual)*		1.80	1.16	1.80	1.16	$589,115
Nua'ailua	n/a	Wailoa	3.10	2.00	*(Annual)*		0.18	0.12	0	0	$0
Ohia	n/a	n/a	4.60	2.97	*(Annual)*		3.00	1.94	0	0	$0
W. Wailuaiki	2	Wailoa	3.80	2.46	0.40	0.26	1.70	1.10	0 (wet) 1.70 (dry)	0 (wet) 1.10 (dry)	$0 $558,644[b]
E. Wailuaiki	1	Wailoa	3.70	2.39	0.20	0.13	1.75	1.13	0 (wet) 1.75 (dry)	0 (wet) 1.13 (dry)	$0 $573,880[c]
Kopili'ula	5	Wailoa	0.50	0.32	*(Annual)*		3.20	2.07	1.70	1.10	$888,752
Puakaa	n/a	Wailoa	0.60	0.39	*(Annual)*		0.70	0.45	0.10	0.06	$30,471
Waiohue	7	Wailoa	3.20	2.07	0.10	0.06	1.55	1.01	0 (wet) 1.55 (dry)	0 (wet) 1.01 (dry)	$0 $510,397[d]
Pa'akea	n/a	Wailoa	1.50	0.97	*(Annual)*		0.58	0.37	0	0	$0
Waiaaka	n/a	Wailoa	0.00	0.00	*(Annual)*		0.49	0.32	0.49	0.32	$162,515
Kapaula	n/a	Wailoa	0.20	0.13	*(Annual)*		1.80	1.16	1.60	1.03	$523,094
Hanawi	8	Wailoa	0.10	0.06	*(Annual)*		2.90	1.87	2.80	1.81	$919,223
Makapipi	n/a	Wailoa	0.93	0.06	*(Annual)*		0.00	0.00	-0.93	-0.06	($304,715)
						TOTALS	**40.83**	**26.38**	**26.44**	**17.63**	**$5,785,457**

[a] Economic impact shown is based on replacing current seasonal IIFS with IIFS set at H_{90} year-round. If CWRM had set annual IIFS for Waikamoi based on H_{90} flow in 2010, the annual economic impact to HC&S would have been $290,053.

[b] Economic impact shown is based on replacing current seasonal IIFS with IIFS set at H_{90} year-round. If CWRM had set annual IIFS for West Wailuaiki based on H_{90} flow in 2010, the annual economic impact to HC&S would have been $1,249,331.

[c] Economic impact shown for East Wailuaiki is based on replacing current seasonal IIFS with IIFS set at H_{90} year-round. If CWRM had set annual IIFS for East Wailuaiki based on H_{90} flow in 2010, the annual economic impact to HC&S would have been $1,213,781.

[d] Economic impact shown for Waiohue is based on replacing the current seasonal IIFS with IIFS set at H_{90} year-round. If CWRM had set annual IIFS for Waiohue based on H_{90} flow in 2010, the annual economic impact to HC&S would have been $1,051,266.

F. Balancing of Instream Values and Noninstream Uses

135. If satisfying the instream values of maintenance of aquatic life and wildlife habits was the sole or overriding criterion for setting IIFS, achieving an H_{90} level of stream flow is generally a reasonable benchmark for determining minimum stream flows. However, blanket application of the H_{90} flow standard to all East Maui streams would not constitute a balanced approach to setting IIFS, as is mandated by the State Water Code. The $5.79 million of additional economic impact of restoring additional flow such that all streams covered by the 19 East Maui IIFS Petitions achieve the H_{90} flow standard is more than double the approximately $2.64 million in economic impact already borne by HC&S as a result of the 2008 and 2010 IIFS amendments. The combined impacts of the prior IIFS decisions and releasing additional flow to meet the H_{90} flow standard in all streams—i.e., over $8.43 million—would jeopardize the economic viability of HC&S, and, in turn, the public benefits of keeping HC&S in operation. (COL 34, 35, 36.)

136. The current IIFS for the following streams already meet or exceed H_{90}: Nua'ailua, Palauhulu, Ohia, Waiokamilo, Wailuanui, Pa'akea. The incremental benefits to be gained from restoring more flow to the foregoing streams would be minimal. Accordingly, no change to the present IIFS for the foregoing streams is reasonably necessary to satisfy instream values in those streams. (COL 34, 35, 36, 64, 70, 74, 76, 80, 89.)

137. Further restoration to streams in the Waiokamilo hydrologic unit, including Waiokamilo Stream and Kualani Stream, is unnecessary because EMI has ceased all diversions within the unit, and HC&S has stipulated to an IIFS that provides for no diversions in the unit. (COL 78.)

138. The presence of naturally occurring physical barriers (e.g., large waterfalls),

losing stretches, and commingling of stream and ditch flows in a stream diminish any benefit to instream values to be gained from be restoring flow to H_{90}. On this basis, the following streams are not good candidates for restoration: Waikamoi, Wahinepe'e, Puohokamoa, Haipua'ena, Honomanū, Kopili'ula, and Makapipi. Moreover, restoration to these streams would result in an aggregate economic impact of $2.57 million to HC&S, or over 40% of the $5.79 million impact to HC&S if the IIFS for all 19 East Maui were set to H_{90}. On balance, restoration to the foregoing streams would not serve the public interest because the potential instream values enhanced by restoration would be questionable while the negative impact of restricting noninstream uses would be severe. (COL 38, 39, 40, 41, 53, 55, 57, 58, 59, 62, 84, 98, 99.)

139. The following streams were not recommended for restoration by DAR or CWRM staff due to the low biological return to be gained from restoration: Alo, Punalau, Puakaa, Waiaaka, and Kapaula. The economic impact to HC&S of restoration of these streams to H_{90} on an annual basis would be nearly $1 million. On balance, restoration to the foregoing streams would not serve the public interest because the potential instream values enhanced by restoration would be minimal while the negative impact of restricting noninstream uses would be disproportionately high. (COL 38, 51, 61, 87, 90, 91, 134 (Table 3).)

140. Hanawī Stream had adequate flow to sustain a viable biota population even before amendment of the IIFS for the stream in 2010. The amendment further added 0.10 cfs (0.60 mgd) to provide connectivity in the dry reach immediately below the Ko'olau Ditch diversion. Accordingly, restoration of additional flow to Hanawī to meet the H_{90} flow standard would not materially benefit the public interest. (COL 94.)

141. Departure from CWRM's prior decision to establish seasonal IIFS for West Wailuaiki Stream, East Wailuaiki Stream, Waiohue Stream, and Waikamoi Stream is not

warranted. Seasonal flows mimic the natural variability in flow conditions, a circumstance that DAR has observed and cited in the Monitoring Study as a factor potentially obscuring its findings as to changes relating to flow restoration. According to DAR, the monitoring period to date has been of too short a duration (FOF 74), which is borne out by the inconclusiveness of the data regarding the effectiveness of seasonal flows. Moreover, the combined economic impact of adopting annual IIFS for the four streams identified above is disproportionately high—\$1.93 million or roughly one-third of the \$5.79 million total impact to HC&S if the IIFS for the 19 East Maui streams were set to H_{90}. On balance, it is not in the public interest to amend the IIFS for the foregoing four streams to establish annual IIFS based on the H_{90} flow standard. (FOF 73, 74; COL 37, 38, 134 (Table 3).)

142. Restoration of Honopou Stream to H_{90} is impracticable because the H_{90} flow for that stream is unknown. Furthermore, EMI currently allows all low flows to pass into the stream. Further flow releases to support the offstream needs of Sanford Kekahuna and Lurlyn for kalo cultivation are unnecessary because the current flow in Honopou is adequate to support the Kekahuna lo'i system. (COL 44, 122.)

143. It is unknown whether there is enough naturally occurring base flow in Hanehoi Stream to meet the current IIFS amount. The current IIFS, however, is already set high enough to provide adequate water to meet the needs of both Ernest Schupp, who is cultivating one acre of taro, and Solomon Lee, who is claiming the right to adequate water to open three acres of taro on his properties that abut Hanehoi Stream. Until it is known whether the current IIFS can be complied by further modifications to EMI's Wailoa, New Hamakua and Lowrie Ditch diversions, it would be premature to consider any change to the IIFS amounts for Hanehoi Stream. (COL 47, 49.)

144. It has been confirmed that Makapipi Stream has losing stretches upstream of Hana Highway. Accordingly, no IIFS should be established for Makapipi Stream. (COL 40, 98.)

145. CWRM's IIFS decisions in 2008 and 2010 properly weighed the relative importance of present or potential instream values against the importance of present or potential noninstream uses and achieved a balance between the two that best served the public interest. The IIFS decisions resulted in the return of a total of 21.62 cfs (13.96 mgd) to East Maui streams during the wet season and 0.70 cfs (0.45 mgd) during the dry season. For the most part, restoration efforts were focused on streams where DAR determined that flow releases would achieve the most "bang for the buck" in terms of Habitat Units restored per cfs of water returned. CWRM managed negative economic impacts on offstream users by selecting for restoration those streams in which the most benefits to instream values could be gained relative to the amount of flow returned. Restoration efforts were also spread out geographically, as streams east and west of Ke'anae Valley received return flows. (COL 36, 38, 42, 133 (Tables 1 and 2); Exh. HO-1.)

COMMISSION ON WATER RESOURCE MANAGEMENT

STATE OF HAWAII

PETITION TO AMEND INTERIM INSTREAM FLOW STANDARDS FOR HONOPOU, HUELO (PUOLUA), HANEHOI, WAIKAMOI, ALO, WAHINEPEE, PUOHOKAMOA, HAIPUAENA, PUNALAU/KOLEA, HONOMANU, NUAAILUA, PIINAAU, PALAUHULU, OHIA (WAIANU), WAIOKAMILO, KUALANI, WAILUANUI, WEST WAILUAIKI, EAST WAILUAIKI, KOPILIULA, PUAKAA, WAIOHUE, PAAKEA, WAIAAKA, KAPAULA, HANAWI, AND MAKAPIPI STREAMS	Case No. CCH-MA13-01 **CERTIFICATE OF SERVICE**

CERTIFICATE OF SERVICE

The undersigned hereby certifies that, on this date, a true and correct copy of the foregoing document was duly served on the following parties as stated below:

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