STATE OF HAWAII
DEPARTMENT OF LAND AND NATURAL RESOURCES
COMMISSION ON WATER RESOURCE MANAGEMENT

PETITION TO AMEND AN INSTREAM FLOW STANDARD

For Official Use Only:

Instructions: Please print in ink or type and send completed form with attachments to the Commission on Water Resource Management, P.O. Box 621, Honolulu, Hawaii 96809. Petition must be accompanied by a non-refundable filing fee of **$25.00** payable to the Dept. of Land and Natural Resources. For assistance, contact the Stream Protection and Management Branch at (808) 587-0234. For further information and updates to this application form, visit http://www.hawaii.gov/dlnr/cwrm.

Pursuant to the State Water Code, Chapter 174C, Hawaii Revised Statutes, the Commission on Water Resource Management is required to 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. The information provided in this form shall aid the Commission in its duties in establishing instream flow standards.

PETITION TYPE: ☐ INTERIM INSTREAM FLOW STANDARD ☐ PERMANENT INSTREAM FLOW STANDARD

PETITIONER INFORMATION

1. PETITIONER'S NAME Mailing Address, or Principal Place of Business

Sierra Club P.O. Box 2577 Honolulu, HI 96803 Please see attached

Phone Number | Fax Number | E-mail Address

2. IS THIS PETITION BEING SUBMITTED IN CONJUNCTION WITH A STREAM DIVERSION WORKS PERMIT (SDWP) APPLICATION?
☐ No ☐ Yes

3. DO YOU RESIDE WITHIN THE HYDROLOGIC UNIT YOU ARE FILING THIS PETITION FOR?
☐ No ☐ Yes

4. ARE YOU FILING THIS PETITION AS AN INDIVIDUAL, OR AS A REPRESENTATIVE FOR ANOTHER PERSON OR GROUP?
☐ Individual ☐ Representative

5. IF YOU ANSWERED 'REPRESENTATIVE' TO ITEM 4 ABOVE, PLEASE DESCRIBE THE PERSON(S) OR GROUP YOU REPRESENT.

HYDROLOGIC UNIT INFORMATION

6. SURFACE WATER HYDROLOGIC UNIT: Island**:** Unit Name: Unit Code:

ASSESSMENT INFORMATION NOTE: *For any of the sections below, attach additional sheet(s) if necessary*

7. DESCRIBE THE CURRENT HYDROLOGIC CONDITION(S) OF THE STREAM.

FOR STAFF USE ONLY:				SDWP ID:
☐ Interim	☐ Status Quo	Date:	Region:	
	☐ Measurable	Date:	Flow (cfs):	
	☐ Other	Date:	Desctibe:	
☐ Permanent	☐ Measurable	Flow (cfs):	Date:	☐ Other (Describe):

PETITION TYPE: _X_ INTERIM INSTREAM FLOW STANDARD _PERMANENT INSTREAM FLOW STANDARD

PETITIONER INFORMATION

1.PETITIONER'S NAME Mailing Address, or Principal Place of Business

Sierra Club P.O. Box 2577 Honolulu, HI 96803
Please correspond with its attorney: David Kimo Frankel 1638-A Mikahala Way Honolulu 96816

Phone Number E-mail Address

(808) 345-5451 davidkimofrankel@gmail.com

2.IS THIS PETITION BEING SUBMITTED IN CONJUNCTION WITH A STREAM DIVERSION WORKS PERMIT (SDWP) APPLICATION?

No

3. DO YOU RESIDE WITHIN THE HYDROLOGIC UNIT YOU ARE FILING THIS PETITION FOR?

The question is not really applicable. The Sierra Club is a non-profit membership organization. The Sierra Club leads hikes along or to many of the streams flowing in east Maui, including the Huelo area. Many of its members reside in east Maui and they live near the streams that are being petitioned. Sierra Club members hike to or along these streams.

4.ARE YOU FILING THIS PETITION AS AN INDIVIDUAL, OR AS A REPRESENTATIVE FOR ANOTHER PERSON OR GROUP?

The Sierra Club is filing this petition on behalf of itself and on behalf of its members.

5.IF YOU ANSWERED 'REPRESENTATIVE' TO ITEM 4 ABOVE, PLEASE DESCRIBE THE PERSON(S) OR GROUP YOU REPRESENT.

The Sierra Club is a 501c(4) membership nonprofit organization registered to do business in the State of Hawai'i, with its principal place of business in Hawai'i at 1164 Bishop Street, Honolulu, HI 96813.The Sierra Club's mission is to explore, enjoy and protect the wild places of the earth. The Sierra Club offers hikes that encourage people to explore and enjoy nature, including to and along east Maui streams. To help protect wild places, the Sierra Club also offers service trips to eradicate invasive species that crowd out native forests throughout the state, as well as planting native plants. One of the Sierra Club's purposes is the protection of natural resources, including our streams and native aquatic life. The Sierra Club and its members seek to preserve and enjoy free-flowing streams, a healthy stream ecosystem that provides habitat to native species. Sierra Club members enjoy the beauty of free-flowing streams. Sierra Club members enjoy the 12 streams that are the subject of this petition. Sierra Club members live in Huelo and enjoy the streams in the area for their recreational and spiritual importance. This includes, but is not limited to, hiking, fishing, swimming, and other recreational uses in and around the streams. The diversions harm the native stream life that Sierra Club members enjoy. The Sierra Club has led hikes to or along Nailiilihaele Stream, Kailua Stream, Hanawana Stream, Hoalua Stream, Mokupapa Stream and Ho'olawa Stream, and its members have hiked to or along all 12 streams.

HYDROLOGIC UNIT INFORMATION

6.SURFACE WATER HYDROLOGIC UNIT:

Island: Maui

Streams:	Unit Name	Unit Code
Kōlea Stream	Kōlea	6046
Punaluʻu Stream	Punaluʻu	6045
Kaʻaiea Stream	Kaʻaiea	6044
ʻOʻopuola Stream (Makanali tributary)	Oopuola	6043
Puehu Stream	Puehu	6042
Nailiilihaele Stream	Nailiilihaele	6041
Kailua Stream	Kailua	6040
Hanawana Stream (Ohanui tributary)	Hanawana	6039
Hoalua Stream	Hoalua	6038
Waipiʻo Stream	Waipiʻo	6036
Mokupapa Stream	Hoʻolawa	6035
Hoʻolawa Stream (Hoolawa ili and Hoolawa nui tributaries)	Hoʻolawa	6035

:

ASSESSMENT INFORMATION NOTE: *For any of the sections below, attach additional sheet(s) if necessary*

7.DESCRIBE THE CURRENT HYDROLOGIC CONDITION(S) OF THE STREAM.

CWRM has posted draft IFSARs on its website that contains preliminary information regarding current hydrologic conditions. https://dlnr.hawaii.gov/cwrm/surfacewater/ifs/eastmaui3/. The Sierra Club does not necessarily endorse all the conclusions and observations made in those reports.

8.DESCRIBE YOUR DESIRED AMENDMENT TO THE EXISTING INSTREAM FLOW STANDARD.

The Sierra Club would like to see more water flowing in these twelve streams and harmful and/or unsightly diversion structures removed. Instream flow standards should be established just below each of EMI's diversion ditches. The Sierra Club does not seek to reduce the amount of water that the County currently diverts from Kailua Stream into its lower Kula pipeline for Upcountry Maui domestic uses.

CWRM established interim instream flow standards for these twelve streams in 1988 for whatever was flowing on June 15, 1988, the height of the summer. HAR §13-169-44. As CWRM recognizes on its website, this "status quo" standard is "not adequate to protect streams." https://dlnr.hawaii.gov/cwrm/surfacewater/ifs/. The status quo standard is not based on the biological, ecological or recreational value of the streams.

Currently, East Maui Irrigation Company LLC and Alexander and Baldwin, Inc. (collectively herein "**A&B**") are authorized to take all the baseflow from these twelve streams. The diversions leave these streams dry below the diversions 80% of the year.

Taking all the water from any stream is wrong: ecologically, morally and legally. Just as one would not deprive a human of oxygen, it is simply wrong to deprive a stream of all of its water. There may be extraordinary circumstances that on rare occasions could justify the diversion of all of a stream's baseflow, but it is impossible to conceive of any in this case.

The Division of Aquatic Resources and CWRM have concluded that 64% of a stream's baseflow is the minimum viable flow necessary to provide suitable habitat conditions for recruitment, growth, and reproduction of native stream animals. At a minimum, 64% of the baseflow should remain in these streams to ensure that native species can grow and reproduce. In unusual circumstances leaving less that 64% of a stream's baseflow in a stream must be justified with clear and convincing evidence regarding the minimal impact and overwhelming need.

In 2020, the Division of Aquatic Resources identified four of these 12 streams (O'opuola, Nailiilihaele, Kailua, and Ho'olawa streams) as "high priority" for restoration. The Sierra Club supports full restoration of streams where it is practical. Substantial evidence should be required to demonstrate that it would be impractical to restore a stream to its natural condition and to justify any diversion.

To be clear, the Sierra Club is **not** asking that any other stream be sacrificed in order to provide restoration of these streams. Rather, off-stream uses should stop wasting water and rely on alternatives sources of water in conjunction with any water diverted from east Maui streams. The Sierra Club rejects any effort to pit streams against each other in some sort of Sophie's Choice. Given the amount of water wasted, the demonstrated agricultural needs, and the alternative sources of water, there is no scenario in which increasing flows to any of the 12 streams will result in reduced flows to other streams.

9.DESCRIBE HOW STREAM HYDROLOGY OR STREAM FLOW CHARACTERISTICS MAY BE IMPACTED BY A MODIFICATION TO THE INSTREAM FLOW STANDARD.

More water would flow in the streams. Natural streambed contours would be restored. Increased flows will allow for the re-birth of natural springs and pools. Increased recharge of the aquifer would result. Dry stream beds would be filled with water.

10.DESCRIBE HOW THE FOLLOWING INSTREAM USES MAY BE IMPACTED BY A MODIFICATION TO THE INSTREAM FLOW STANDARD.

MAINTENANCE OF FISH AND WILDLIFE HABITAT:

According to A&B's consultant James Parham, under natural flow conditions, there would be far more habitat for native species. Existing diversions on these 12 streams destroy more than 88% of the habitat that would be there if there was no diversion. Improved baseflow downstream of diversions would decrease standing water habitat for the introduced mosquito species. Mosquito populations may decrease slightly as more flowing water and less stagnant water would exist.

In November 2009, the Division of Aquatic Resources concluded that for east Maui streams:

> • From a management perspective, the maintenance of adequate stream flow from upstream adult habitat to the stream mouth is critical for amphidromous animals. Given

the vagaries of the timing recruitment and the short development window for upstream movement, minimizing the time that barriers to upstream movement exist will increase the chance that suitable upstream habitat will be colonized by newly recruiting animals.

• Typical stream diversion structures divert 100% of the water at low to moderate flows. Under these conditions, 100% of downstream moving individuals would be entrained by the diversion.
• In general, the diversions were engineered to capture low to moderate stream flows and results in 100% removal of water approximately 70 to 80% of the time (Gingerich 2005). The removal of 100% of flow blocks upstream passage and entrains downstream moving animals.

• The streams of northeast Maui in this analysis had a range of surface water diversions affecting their stream flow and, therefore, the amount of instream habitat for native amphidromous animals. . . . In most cases where diversions did occur, the diversions blocked the stream and captured 100% of the stream flow at low and moderate rates of discharge.

The Division of Aquatic Resources also identified Kōlea Stream, as having "a large amount of potential habitat in the middle and upper reach" for native species. It concluded that restoration of water flow to Kōlea Stream would "greatly improve the productivity of the stream and increase the availability of potential habitat for native species."

U.S. Fish & Wildlife Service recognized that Hoolawanui Stream "represents potential suitable habitat for *Megalagrion* damselfly species."

Increased recharge of the aquifer will support the watershed ecology. Mosquito breeding habitat in stagnant pools would be eliminated under most weather conditions. Increased flows reaching the ocean will support nearshore fisheries.

OUTDOOR RECREATIONAL ACTIVITIES:

More water flowing in these streams would support swimming, wading, fishing, relaxing, and enjoying the wilderness experience. The presence of more stream life and better water quality would support recreational nature studying.

MAINTENANCE OF ECOSYSTEMS:

See "Maintenance of Fish and Wildlife Habitat" above.

AESTHETIC VALUES:

The streams would be far more beautiful. Waterfalls would be more glorious. Judging a stream's aesthetic values cannot be limited to the view from the highway (as some of the draft IFSARs suggest). While views from the highway are significant, so too are the views of those who enjoy the wilderness experience away from the highway.

Figure 4-39 of A&B's FEIS depicts the trails and roads by which the public accesses the streams in the Huelo revocable permit area. In addition, people can access these streams ma kai of the revocable permit area through neighborhood roads and trails. The aesthetic value from these areas are important to people who visit the streams in these less visited areas.

NAVIGATION:

No known impact.

INSTREAM HYDROPOWER GENERATION:

No known impact.

MAINTENANCE OF WATER QUALITY:

Water quality would improve. There would be fewer fetid pools of water. Continual scouring would provide better habitat for native species.

CONVEYANCE OF IRRIGATION AND DOMESTIC WATER SUPPLIES:

Increasing the amount of water that flows in these dozen streams will reduce the amount of water available for irrigation. To be clear, the Sierra Club does not seek to reduce the amount of water that the County currently diverts from Kailua Stream into its lower Kula pipeline for Upcountry Maui domestic uses.

On the other hand, increasing the amount of water flowing past the EMI diversions will allow Huelo residents who live along these streams to use more water from them for irrigation and domestic water.

Moreover, much of the water diverted from these streams is not used.

Some water is also lost in the EMI ditch itself. In 2012, USGS completed a study titled Measurements of Seepage Losses and Gains, East Maui Irrigation Diversion System, Maui, Hawai‘i. https://pubs.usgs.gov/of/2012/1115/of2012-1115_full-text.pdf

- 11 miles of the EMI ditch system consists of unlined ditches;
- 2.5 miles are only partially lined;
- The partially-lined Ko‘olau ditch has seepage losses of 3 cubic feet per second per mile, constituting losses of up to 32.2%;
- Ko‘olau Ditch and Spreckels Ditch at Pāpa‘a‘ea generally had seepage losses; and
- Discharge measurements in the open-ditch seepage-run measurement reaches—lined and unlined—generally indicated seepage losses

A&B has long argued and assumed that because there are seepage gains in the tunnels, that the seepage in the unlined ditches do not matter. The seepage gains in the tunnels are irrelevant, however. Seepage losses can be reduced (and more water kept in our streams) by lining the unlined ditches.

After passing through the unlined ditches, most of the water is wasted, as is demonstrated in A&B's quarterly reports:

Month	MGD taken from E. Maui streams	Maui County domestic use	Kula Ag Park	Mahi Pono	Industrial & miscl uses	System losses; seepage & evaporation; unaccounted for water[1]
January 2020	30.10	1.07	.39	2.45	1.1	25.09
February 2020	25.28	1.17	.37	2.46	1.1	20.19
March 2020	27.98	.95	.37	2.58	1.1	22.98
April 2020	25.70	.91	.35	3.58	1.1	19.77
May 2020	21.60	1.86	.39	3.62	1.1	14.63
June 2020	20.50	2.64	.51	3.73	1.1	12.53
July 2020	16.8	3.2	.45	2.6	1.1	9.47
August 2020	19.7	2.5	.46	2.5	1.1	13.20
Sept. 2020	20.1	3.4	.69	2.4	1.1	12.49
October 2020	11.51	3.81	.56	2.51	1.1	3.53
Nov. 2020	25.34	2.16	.53	3.44	1.1	18.11
Dec. 2020	28.13	2.19	.50	4.43	1.1	19.91
January 2021	28.09	1.4	.36	3.91	1.1	21.33
February 2021	25.90	.88	.38	3.93	1.1	19.61
March 2021	23.55	.61	.40	3.01	1.1	18.44
April 2021	23.59	2.0	.59	3.98	1.1	15.91
May 2021	24.95	2.41	.60	4.48	1.1	16.37
June 2021	14.78	3.82	1.01	4.34	1.1	4.31

Except in the two months when less than 15 mgd were taken, far more than half the water taken is wasted. The rate is far higher than the 22.7% rate of system losses that CWRM determined was reasonable. Just a few months ago, CWRM restricted Mahi Pono and Wailuku Water Company system from losing more than five percent of the water diverted from Nā Wai 'Ehā. D&O ¶193(b).

Instead of allowing water to be wasted, Mahi Pono could use water more efficiently. The reservoirs, which are more than a century owned, could be lined and covered. Doing so would allow approximately twenty million gallons of water that is diverted daily to remain in streams.

[1] A&B has attempted to disguise the system losses by creating categories of non-consumptive uses and lumping in those uses that constitute a trivial amount of the water used. First, the water that goes through the hydroelectric plant is then subsequently used for irrigating crops (so it cannot be counted as a consumptive use of water). Second, EMI's Mark Vaught testified under oath that approximately 100,000 gallons per day are used for dust control. That estimate seems quite high given that a fire tanker discharges 7,000 gallons per hour. In any case, dust control constitutes a small fraction of the water used. Third, very little water is actually used to fight fires (a fire that takes 72 hours to extinguish, using 10,000 gallons of water an hour takes less than one million gallons of water). The water that sits in the reservoirs is not actually used (and if it is used, it is recorded instead in the Mahi Pono Diversified Ag column of the Monthly Water Usage chart). Virtually all the water in the category A&B calls "Reservoir/Fire Protection/Evaporation/Dust Control/Hydroelectric" is lost due to evaporation and seepage.

Finally, there are alternative sources of water that can be used to irrigate crops in Central Maui. Mahi Pono has approximately 17 million gallons of groundwater available (from its own wells) as well as a portion of the approximately 11 million gallons of water from streams west of Honopou Stream. These alternative sources would allow more water to remain in these streams.

Reducing waste and increasing alternative sources of water in Central Maui reduces the impact of amending the instream flow standard on irrigation. Over the past 18 months, less than 5 million gallons of water per day on average has been used for irrigation.

The Sierra Club supports allowing the County to continue to divert up to 5 million gallons of water daily (as averaged per month) to meet existing domestic needs. Thus, the amendment to the interim instream flow standard should not reduce the amount of water available for current domestic water needs. The County does not take water from the New Hāmākua, Lowrie, Haiku, Center or Manuel Luis ditches. Any changes to the instream flow standards below these ditches will have no affect on the County of Maui's domestic water supplies – and may allow residents living below the diversions to have more water for their needs.

PROTECTION OF TRADITIONAL AND CUSTOMARY HAWAIIAN RIGHTS:

An increase in the amount of water flowing in these streams will allow for the restoration and creation of loʻi kalo and allow for the gathering of hihiwai, ʻoʻopu and ʻōpae.

11. DESCRIBE HOW NONINSTREAM USES MAY BE IMPACTED BY A MODIFICATION TO THE INSTREAM FLOW STANDARD, AND IDENTIFY THE ECONOMIC IMPACT OF RESTRICTING OFFSTREAM USES.

Increasing the amount of water that flows in these dozen streams will reduce the amount of water available for noninstream uses. Doing so should provide an incentive for those non-instream users to use water more efficiently, reduce waste, and rely on alternative sources of water.

Alexander and Baldwin, Inc. may well suffer an economic impact. It is contractually obligated to rebate to Mahi Pono $62 million if Mahi Pono is unable to receive at least 30 million gallons of water per day from east Maui streams. *See* https://app.quotemedia.com/data/downloadFiling?webmasterId=101533&ref=112523490&type=PDF&symbol=ALEX&companyName=Alexander+%26+Baldwin+Inc.+REIT+Holding+Company&formType=8-K&dateFiled=2018-12-20&CK=1545654 pages 6-7 and 47.

Mahi Pono itself should not suffer any economic impact by an increase in the instream flow standard because it is entitled to a rebate of up to $62 million from Alexander and Baldwin, Inc. if EMI is unable to deliver at least 30 million gallons of water per day.

If Mahi Pono uses that $62 million to line and cover its reservoirs, not only would much less water be wasted, but Maui's economy would receive a shot in the arm due to the jobs created working on the reservoir improvements. The multiplier effect of this money circulating through the economy would provide additional economic benefits. In the past, EMI estimated that it would cost approximately $40 million to line the reservoirs. Once the reservoirs are improved,

Mahi Pono would be able to use the water that is currently being wasted.

12. PLEASE PROVIDE ANY REFERENCES OR OTHER SOURCES OF INFORMATION THT MAY ASSIST IN THE COMMISSION'S ANALYSIS.

Trutta Environmental Solutions, LLC has produced two versions of its Assessment of the Environmental Impact of Stream Diversions on Instream Habitat in East Maui Streams using the Hawaiian Stream Habitat Evaluation Procedure (HSHEP) Model. One is found in the Final Environmental Impact Statement for the Proposed Lease (Water Lease) for the Nāhiku, Keʻanae, Honomanū, and Huelo License Areas and the other is in the Draft EIS. The Draft EIS can be found at: http://oeqc2.doh.hawaii.gov/EA_EIS_Library/2019-09-23-MA-DEIS-East-Maui-Water-Lease.pdf

Report on Kōlea Stream, Division of Aquatic Resources and Bishop Museum (August 2009)

April 1, 2010 letter from Robert Nishimoto, Environmental Program Manager of the Division of Aquatic Resources to Ken Kawahara that is found at http://files.hawaii.gov/dlnr/cwrm/cch/cchma1301/CCHMA1301-20141230-DAR.pdf .

May 17, 2010 memorandum from Robert Nishimoto, Environmental Program Manager of the Division of Aquatic Resources to Ken Kawahara that is found at http://files.hawaii.gov/dlnr/cwrm/cch/cchma1301/CCHMA1301-20141230-DAR.pdf .

U.S. Fish and Wildlife Services' December 21, 2018 letter on the preparation of an environmental impact statement on the diversion of east Maui streams that is published in the Environmental Impact Statement Preparation Notice for the Proposed Lease (Water Lease) for the Nāhiku, Keʻanae, Honomanū, and Huelo License Areas (February 2017): http://oeqc2.doh.hawaii.gov/EA_EIS_Library/2017-02-08-MA-EISPN-East-Maui-Water-Lease.pdf#search=title%3Awater

U.S. Fish and Wildlife Services' Field Survey Report: East Maui Irrigation Ditch System (October 2019)

A&B's Quarterly Reports for the Revocable Permits submitted to BLNR

United States Department of Interior Surface Water Supply of Hawaii July 1, 1928 to June 30, 1929 found at https://pubs.usgs.gov/wsp/0695/report.pdf

One reference that CWRM should be extremely cautious about relying upon is the 1990 HAWAII STREAM ASSESSMENT: A **PRELIMINARY** APPRAISAL OF HAWAII'S STREAM RESOURCES. Right up front, the Assessment declares that is "of a general nature, is incomplete." (page xix). While compiling a list of 376 streams (xx), CWRM had biological information on only 176 of them. The HAWAII STREAM ASSESSMENT specifically cautions, "It may well be that some streams otherwise ranked **would qualify as Outstanding if their resources were sufficiently understood**. **The process should not be used to disregard those streams not ranked as Outstanding**. (page xxii). The Assessment also warns:

> A rank of "unknown" was assigned to many streams when there was little or no published information available upon which to make an assessment. Streams with missing data should not be interpreted as without resources, but merely as without enough data to support a rank other than unknown.

Id. This three-decade old report alerts the reader that "this report is merely a snapshot of the state of Hawaii's streams in 1990, and is limited by the data available as of that time. . . . The information can become outdated quickly." *Id.* In other words, no one should be relying on the 1990 HAWAII STREAM ASSESSMENT: A **PRELIMINARY** APPRAISAL OF HAWAII'S STREAM RESOURCES to disparage the value of these streams.

DECLARATION OF MICHAEL H. KIDO
30 October 2019

In Sierra Club - Plaintiff vs. Board of Land and Natural Resources, Alexander and Baldwin Inc. and East Maui Irrigation Inc., LLC – Defendants (CIVIL NO. 19-1-0019-01 JPC – ENVIRONMENTAL COURT)

I earned a Master's Degree in Zoology from the University of Hawaii (UH) in 1973 and worked as a research biologist for UH from 1990 retiring in November 2015. My primary research focus was in Hawaiian stream ecology, establishing the Hawaii Stream Research Center and Long-term Ecological Ecological Research Site (LTER) in Limahuli Stream (Kauai) in 1996 within UHM's Center for Conservation Research and Training (UH-CCRT). My early research in the 90's focused on the diet ecology of native Hawaiian stream gobiid fishes (*'o'opu*) publishing a series of scientific journal papers that provided previously undocumented spatial-temporal information on the algal – invertebrate assemblage living on the stream bottom being selected as foods by our five native *'o'opu* species. These projects provided a basis for the development of robust methodologies to monitor spatial-temporal changes in population densities of native stream animals as well as the algal-invertebrate availability of their preferred foods in Hawaiian stream environments.

These data led to a better understanding of the natural ecological structure and function of Hawaiian stream environments related to the dynamics of flow variation from "mountain-to-sea". This research resulted in scientific papers quantifying stream monitoring – assessment methodologies in the Hawaii Stream Bioassessment Protocol (1999), the Hawaii Stream Index of Biotic Integrity (HS-IBI) (2012), the Hawaii Watershed Health Index (2012) and application of these monitoring tools in natural and human-impacted streams on Kauai, Oahu, Maui, Molokai and Hawaii islands (2000 – 2019). These methods incorporated a core perspective that pristine (i.e. least human-impacted) Hawaiian streams exhibit inherent high "biological integrity" flowing continuously from "mountain-to-sea" within *ahupua'a* and that native *'o'opu - 'opae* are driven to find species-specific preferred habitat locations along this continuum upon entering a stream as juveniles from the ocean. This "reference condition " of high biological integrity was used as a standard to which the biophysical condition encountered in a Hawaiian stream could be compared. The initial set of "reference streams" selected in 1998 included Hanakapiai (Kauai), Lower Hanawi (Maui) and Wailau (Molokai).

Physicochemical factors that degrade Hawaiian stream environments, moving them away from the reference biophysical condition, either disrupt the continuous flow to the ocean (dams – diversions), modify the natural stream channel (culverts, road-crossings, channelization for flood control, etc.), input chemical pollutants and run-off from impervious surfaces into stream environments or modify natural vegetated lands in the watersheds – riparian zones.

The only comprehensive statewide inventory of streams in Hawaii, published in 1978 (41 years ago)(Timbol and Maciolek 1978), concluded that 53% of perennial streams in Hawaii were impacted by some form of water diversion primarily for agricultural or hydropower development. I have looked at stream diversions statewide and they generally fall into three categories: 1) concreted dam structures that impound water behind them with various designs of grated systems to divert water into ditch networks often used to trap additional water from side-tributaries; 2) cut-off trenches dug in to underlie the stream channel so that flow drops directly in the streambed through a grate into the ditch network and; 3) *taro loi* diversions where a portion of streamflow is directed into *auwai* at strategic natural bends in the channel sometimes with stream rocks loosely piled into walls to direct flow as in traditional systems. Dam structures are designed to take 100% of flow up to some predetermined flood level when the barriers are overtopped. *Taro loi* diversions I've seen never take more than 50% of natural flow with traditional systems as in Waipio Valley (Hawaii) diverting less than 30% with used water always returned to the stream.

The obvious negative ecological impact of hardened across-stream diversion structures (types 1 & 2 above), depending on where they are situated on the continuum, is to cut-off continuous flow from "mountain-to-sea" so that juvenile *'o'opu* and *'opae* returning from the ocean may not be able to reach their preferred *mauka* habitat. Moreover adults moving downstream from *mauka* locations to spawn are ensnared by flow into the ditch systems with no way out. The same fate faces newly hatched larvae trying to reach the ocean from spawning grounds above diversion intakes. In stream systems where such diversion structures were in place for decades (e.g. Anahola-Hanalei-Wailua-Waimea-Wainiha (Kauai); Iao (Maui); Waipio-Wailoa (Hawaii)) populations of native stream animals are depauperate or nearly absent in often perfectly good *mauka* habitat upstream of the diversions.

Some of this biological impairment, depending on the magnitude – duration - location of flow disruption, may be attributed to chronic impacts on natural fluvial processes which are critical to nutrient processing, downstream movement of sediments – substrate and nutrient export into the ocean. Streambed habitat downstream of diversion structures can be severely degraded by excessive soil-sediment-organic matter deposits to the point where little or no natural cobble-boulder substrate is visible which is the case in the lower reaches of the Waimea River on Kauai. Flow reduction below diversion structures also lowers the stream's water level and raises water temperature particularly during extended droughts. I have witnessed large numbers of dead *'o'opu* in dried out stream habitat below the Wainiha River dam during such a drought period. Upstream migrating *'o'opu* will wait in shrinking available pools in habitat below diversions until they succumb to high temperatures and lack of oxygen. Flow reduction in stream habitat below diversion structures also enhances habitat for alien slow-water aquatic species like Poeciliid fishes (e.g. mosquito fish, swordtails, mollies, etc.) which harbor lethal internal parasites that are transferred to *'o'opu* species in locations where they coexist. The biological trajectory of chronic, unmanaged water diversion by

hardened systems and accumulating human-impact is towards increasingly degraded biological integrity in the stream system as a whole characterized first by lowering population densities of native stream animals in their preferred habitat locations along the stream continuum, followed by the absence of sensitive species (i.e. *'o'opu alamo'o* and *'o'opu-nopili*), ending in degraded habitat where alien aquatic species predominate.

While I believe that surface-water diversion from streams in Hawaii is necessary to support human populations it must be done responsibly and adequately justified as to the specific quantity – duration – location of the water withdrawn and for what purpose. When - where we do divert water we should use the best available technologies, minimize waste through active management – monitoring of leakage in the diversion systems and design in routes for stream animals to pass. With climate change upon us we are already seeing rising sea-levels that will soon affect estuaries and low elevation aquifers – reservoirs. Catastrophic rain and drought events are becoming the norm as storms intensify, land temperatures increase and rain-producing trade-wind patterns become more variable. Sustainability of water resources and protection of the long-term health (i.e. biological integrity) of Hawaiian streams from "mountain-to-sea" must be at the core of our decision-making process if society hopes to manage in this coming age of water resources limited by an increasingly unpredictable climate.

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Signed By:

Michael H. Kido

Michael H. Kido
30 October 2019

Supplemental Expert's Report/Declaration of Michael Kido
February 27, 2020

Since submitting my Declaration in October 2019, I have reviewed James Parham's Assessment of the Environmental Impact of Stream Diversions on 33 East Maui Streams using the Hawaiian Stream Habitat Evaluation Procedure (HSHEP) Model (June 8, 2019), including the appendices that were omitted from Alexander & Baldwin's Draft Environmental Impact Statement.

Parham recognizes that stream diversions cause "the loss of instream habitat from constriction or diversion of stream flow, creation of barriers to stream animal upstream movement and entrainment of downstream drifting larvae." He notes: "The diversions and aqueduct system were built to capture 100% of normal low flow plus some smaller amount of storm runoff." For the 13 streams that were not subject to the 2018 CWRM decision, Parham concludes: " Under the Full Diversion Scenario only 15% of the habitat units remain than compared to the Natural Flow Scenario in this group of streams. The loss of habitat was both from loss of instream habitat to water diversion and to passage and entrainment issues at each diversion." Although Parham's quantified the harm, his overall conclusion is no different than mine. The quantification Parham provides is particularly important because native aquatic organisms do not return to the same stream from where they emerged; thus the impact is cumulative across a broad geographic region.

During the period of February 25-27, 2020, I visited EMI diversion sites on Hoolawa Nui, Hoolawa Ili, Hoalua, Hanehoi, Oopuola, Waikamoi (Alo Tributary), Puohokamoa, Kolea, Waiohue, East Kopiliula, West Kopiliula and East Wailuaiki Streams. The site visit confirmed my prior conclusion regarding the negative impacts that EMI stream diversions are having on native Hawaiian amphidromous stream fish and macroinvertebrates that require continuous streamflow connection from mauka watersheds to the ocean. Post larval individuals recruiting into streams from the ocean aggressively migrate to preferred habitat locations along the stream continuum from mountain-to-sea. Depending upon species, reproductively mature adults must also migrate from these preferred mauka habitat locations to downstream locations to spawn and newly hatched larvae must enter the ocean in order complete their development.

Major diversion structures observed typically incorporated a steel grate over a concrete-line channel embedded to bisect the streambed itself which directed captured flow into a particular ditch system depending on location. Water diversion was observed into the Wailoa, New Hamakua, Center, Spreckles, and Koolau Ditches at various elevations depending upon stream and elevation. In every case this type of diversion structure was impassible by upstream migrating native fish and macroinvertebrates which would fall through the grate into the ditch and be transported into the irrigation system. Similarly, downstream migrating reproductively-mature adults seeking preferred low elevation spawning habitat (like the 'o'opu-nakea) would be captured and transported away from the stream. Any larvae hatching in a stream location above a diversion structure would similarly be captured by the ditch system.

In stream diversion locations where 100 % of flow is captured (e.g. Hoolawa Ili and Hoolawa Nui Streams at New Hamakua Ditch) the streambed was observed to be dry to varying distances below the diversion. The dry stream channel obviously acts as an effective type of physical barrier to migrating native fish and macroinvertebrates.

Other examples of problematic features of diversion structures observed include pipe culverts that extend beyond the wall barriers and water flow-over barriers which create spaces not in contact with wall structures both of which upstream migrating native stream animals cannot negotiate to pass to upstream stream reaches.

On February 25, 2020, I was able to observe the overall effects of water diversion on Hoolawa Stream, including three of its tributaries, at various elevations by the Wailoa, New Hamakua and Haiku Ditches. The EMI ditch system effectively disconnected flow to the ocean at several elevations along the natural stream continuum. At Hoolawa Nui (Intake W-19) the diversion structure took 100% of the water in the stream. The same was true for one branch of Hoolawa Nui at intake W-20. These conditions made it virtually impossible for native fish and macroinvertebrates to make it past diversion structures (either swimming upstream, or downstream) to reach preferred habitat as well as make any existing populations more vulnerable to capture by the intersecting ditches. Below both intakes, stagnant pools of water created provide opportune mosquito breeding grounds. In the section of Hoolawa Stream historically diverted by the Haiku Ditch (near the old Hana Highway) water was allowed more recently to flow past the diversion structure creating flowing stream habitat which presumably reaches the ocean. In this flow-restored reach I observed one juvenile ‘o’opu-nakea which I assumed fairly recently had recruited in from the ocean.

In all stream reaches dewatered below by EMI diversion structures, I conducted limited visual reconnaissance in shallow water above diversions when possible walking along the stream bank with polarized glasses. I observed no native stream fish or macroinvertebrates in good habitat where high population densities should exist. In these reaches, underwater visual census (UVC) should be conducted at some future time to determine the extent to which populations of native stream animals exist.

Therefore, direct observation of stream diversion by the EMI ditch system conducted on select East Maui streams (2/25-2/27/20) substantiate my belief that the diversion structures deployed have: 1) severely disrupted natural flow regimes; 2) degraded ecological habitat making conditions conducive to alien aquatic species and; 3) limited the mountain-to-sea connectivity required by native stream fish and macroinvertebrates. The result over time has been to severely degrade the biological integrity of East Maui streams which is characterized by the absence of robust populations of native fish and macroinvertebrates expected along the stream continuum from mountain-to-sea.

Michael H. Kido
27 February 2020