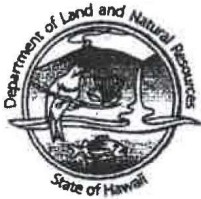


LINDA LINGLE  
GOVERNOR OF HAWAII



STATE OF HAWAII  
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HISTORIC PRESERVATION  
KAHOOLAWE ISLAND RESERVE COMMISSION  
LAND  
STATE PARKS

April 1, 2010

Dear Ken Kawahara:

As the result of the December 19, 2009 ruling from the Water Commission to further document the stream flows required to protect native animal species in the East Maui streams, DAR engaged in a series of meetings with CWRM, USGS, Bishop Museum, and HC&S in to attempt to provide clear information in a useable format that will facilitate agreement on the appropriate restoration flows. This document provides a narrative that is intended to accompany the report cards and spreadsheets which show the information used in the latest ranking of the restoration potential for East Maui Streams.

In a general sense, DAR supports the following positions regarding restoration efforts in East Maui Streams.

- Minimum viable habitat flow ( $H_{min}$ ) for the maintenance of suitable instream habitat is defined as 64% of Median Base Flow ( $BFQ_{50}$ )(also defined as  $H_{90}$  by USGS studies). DAR expects that these flows will provide suitable conditions for growth, reproduction, and recruitment of native stream animals.
- Minimum viable connectivity flow ( $C_{min}$ ) for the maintenance of a wetted pathway between the ocean and stream habitats is defined as 20%  $BFQ_{50}$ . These flows are expected to allow the animals to move among habitats. These flows are considered by DAR to be too low to expect suitable longterm growth and reproduction of native stream animals
- 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.
- Avoidance of entrainment at diversion locations is important to maximize populations of native stream animals while minimizing the negative impacts from stream diversions.
- Restoration of stream flow should reflect the water budget of the individual stream catchment. The use of trans-basin water diversions from ditches to restore stream sections should be avoided where at all possible.
- Co-mingling of stream and ditch flows should be avoided where at all possible to limit the potential spread of invasive aquatic species.
- Restoration of streams should be spread out in a geographic sense. This will provide a 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.

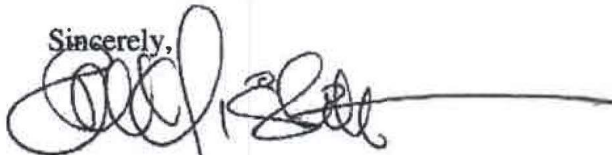
Based on the above philosophical management framework, DAR used several criteria to reassess the streams recommended for restoration in East Maui. First the amount of habitat units currently lost to diversion was considered. Greater amounts of habitat restored were considered a positive attribute. Second, seasonality (wet versus dry seasons) was considered by setting minimum connectivity flows during the dry season and minimum habitat flow during the wet season. Third, issues related to losing reaches were considered. Both Honomanū and Makapipi Streams were eliminated for consideration in consultation with CWRM, USGS, and Bishop Museum on the basis of losing reach concerns. Fourth, we considered restoration of the stream systems most biologically impacted by dewatering, assessed on the basis of missing faunal components. Fifth, the number and difficulty of modifications for diversions was considered. Our current assessment of this factor would be improved through consultation with HC&S, CWRM, and other experienced engineers and fish passage experts. Sixth, we also considered the efficient use of water in terms of the rate of Habitat Units restored per cfs of water returned. Seventh, we evaluated whether the restoration of stream flow along a given stream segment involved the co-mingling of stream and ditch water. Finally, we attempted to geographically distribute the streams proposed for restoration across the entire East Maui ecosystem.

The attached information is a synopsis of our recommendations for stream flow restoration on select East Maui streams and is based on recalculation of the Hawaii Stream Habitat Evaluation Procedure (HSHEP) model to include analysis of estimates for minimum connectivity and habitat flow for each stream segment to address seasonality. The recommendation for each stream and its diversions are included on the report card for each stream.

Additional information on the other 10 East Maui Streams are not included as DAR does not recommend habitat restoration actions in these streams as the habitat gains would be minimal and suggest to maintain them as status quo.

Note in the photographs and accompanying text that references of left and right bank are based on the orientation of looking upstream. We look forward to working with all parties to reclaim ecological habitat for native stream animals, and to provide connectivity for the inland return of young, and the downstream exit of new hatches into the nearshore estuarine nursery areas along this coastline. We believe that adoption of our recommendations would provide a significant return of ecological function based on a modest investment in flow restoration, and will continue to refine them in consultation with all parties.

Sincerely,

A handwritten signature in black ink, appearing to read 'Robert T. Nishimoto', with a long horizontal line extending to the right.

ROBERT T. NISHIMOTO, Environmental Program Manager  
Division of Aquatic Resources

Attachments

References:

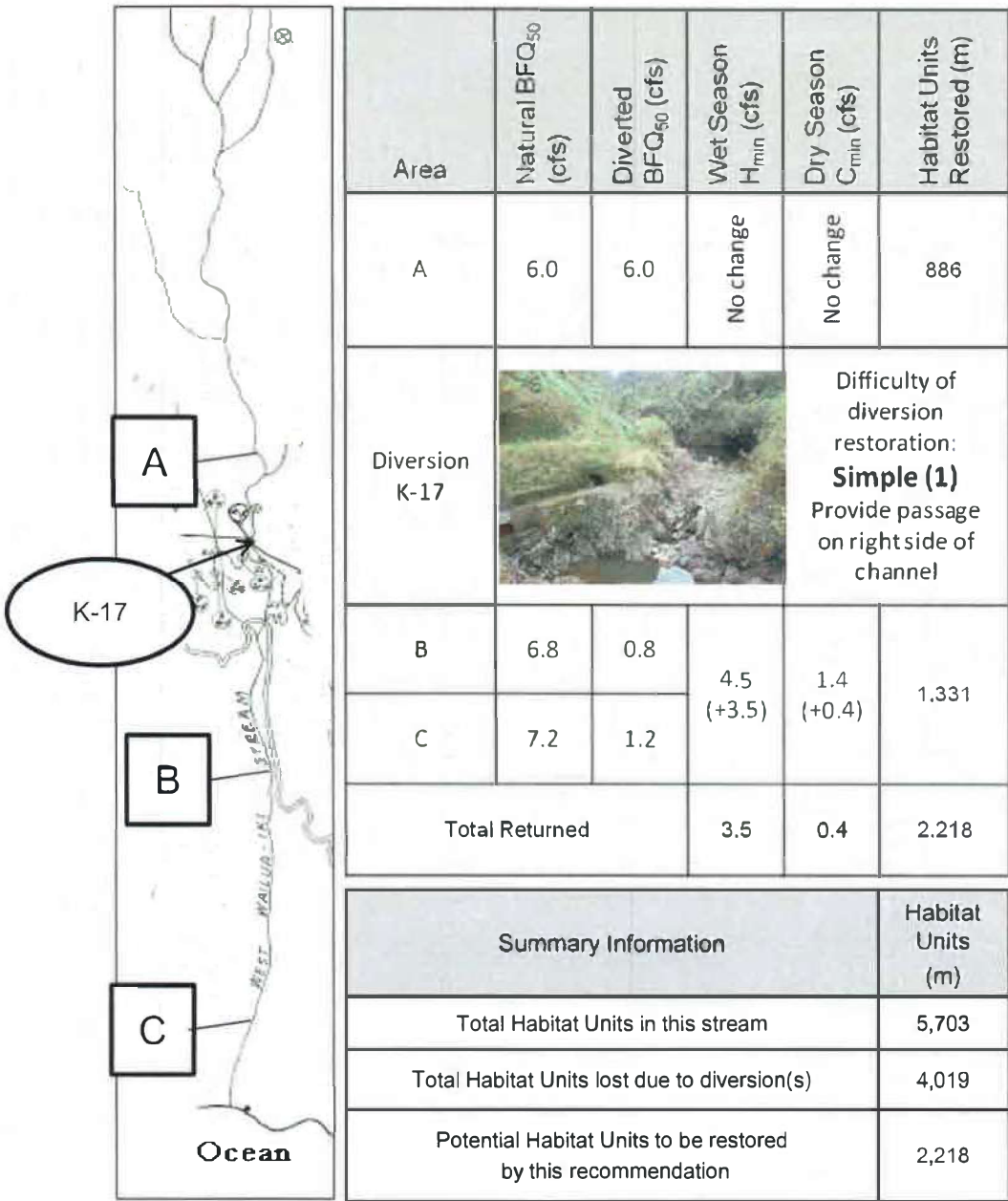
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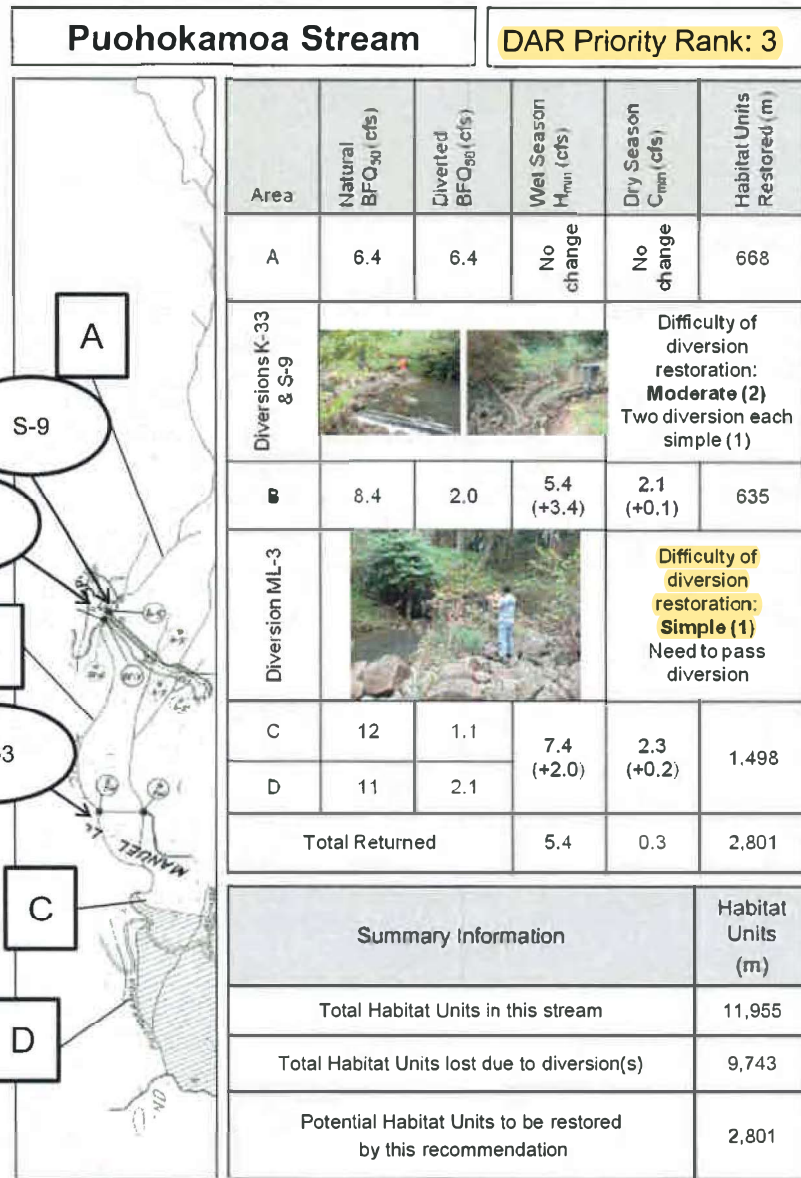
East Wailua Iki Stream		DAR Priority Rank: 1				
	Area	Natural BFO <sub>50</sub> (cfs)	Diverted BFO <sub>50</sub> (cfs)	Wet Season H <sub>min</sub> (cfs)	Dry Season C <sub>min</sub> (cfs)	Habitat Units Restored (m)
	A	5.8	5.8	No change	No change	951
	Diversion K-16			Difficulty of diversion restoration: <b>Simple (1)</b> Provide passage in left bypass channel		
	B	6.8	1.0	4.5 (+3.2)	1.4 (+0.2)	1.452
	C	7.2	1.5			
	Total Returned				3.2	0.2
Summary Information						Habitat Units (m)
Total Habitat Units in this stream						6,528
Total Habitat Units lost due to diversion(s)						4,375
Potential Habitat Units to be restored by this recommendation						2,402

DAR Recommendations - East Wailua Iki has great potential for restoration as increased stream flow would restore extensive habitats lost to flow diversion and the modifications needed for the diversion are limited. DAR recommends the release of 3.2 cfs of water during the wet season to provide for minimum habitat flows and 0.2 cfs of water during the dry season to provide connectivity. Modification would involve a v-notch on the upstream dam wall on the left bank on the diversion structure (K-16 Ko'olau Ditch). This would allow passage up and down stream without entrainment of native animals to the gravel basin and ditch system. These restoration actions would provide over 2.4 km of additional native animal habitat.

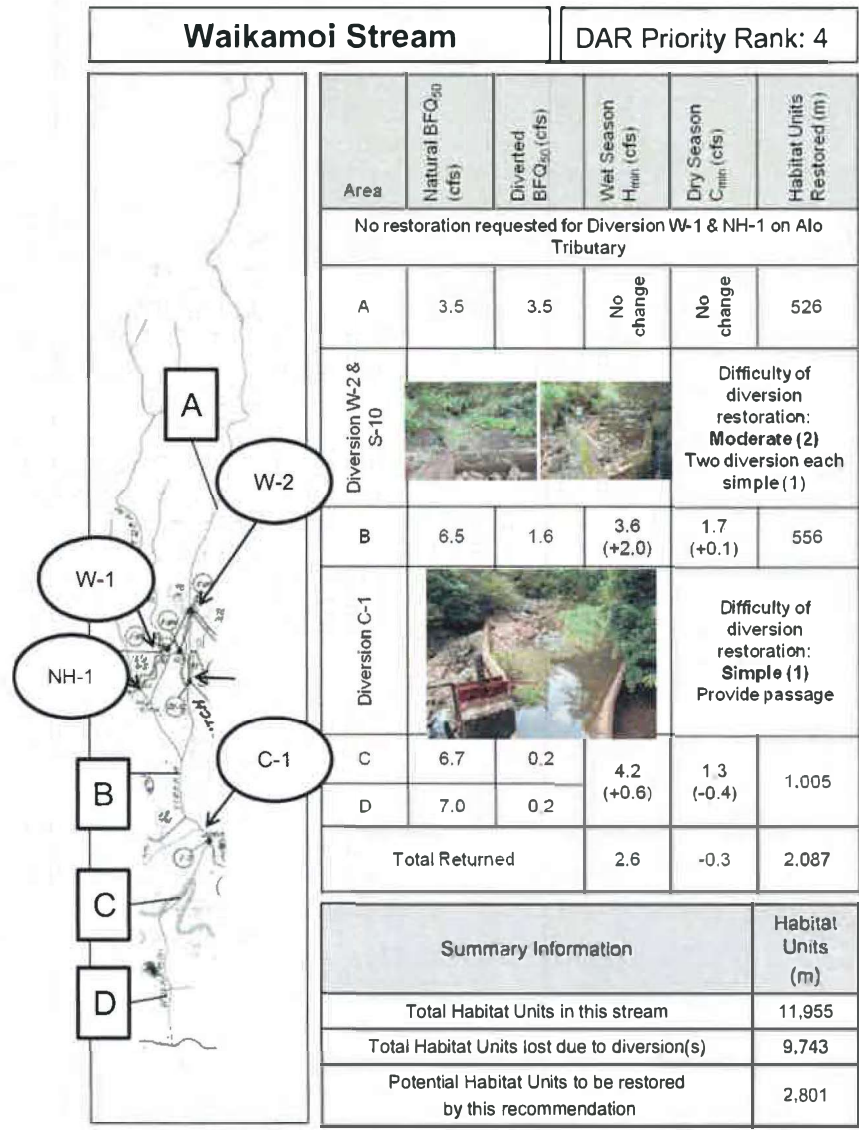
<b>West Wailua Iki Stream</b>	<b>DAR Priority Rank: 2</b>
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DAR Recommendations - West Wailua Iki has very good restoration potential as increased stream flow would restore extensive habitats lost to flow diversion and the modifications needed for the diversion are straightforward. DAR recommends the release of 3.5 cfs of water during the wet season to provide for minimum habitat flows and 0.4 cfs of water during the dry season to provide connectivity. Modifications to the diversion structure (K-17 Ko'olau Ditch) would involve a v-notch on the dam wall below the waterfall pool away from the ditch on the right bank. These restoration actions would provide over 2.2 km of additional native animal habitat.

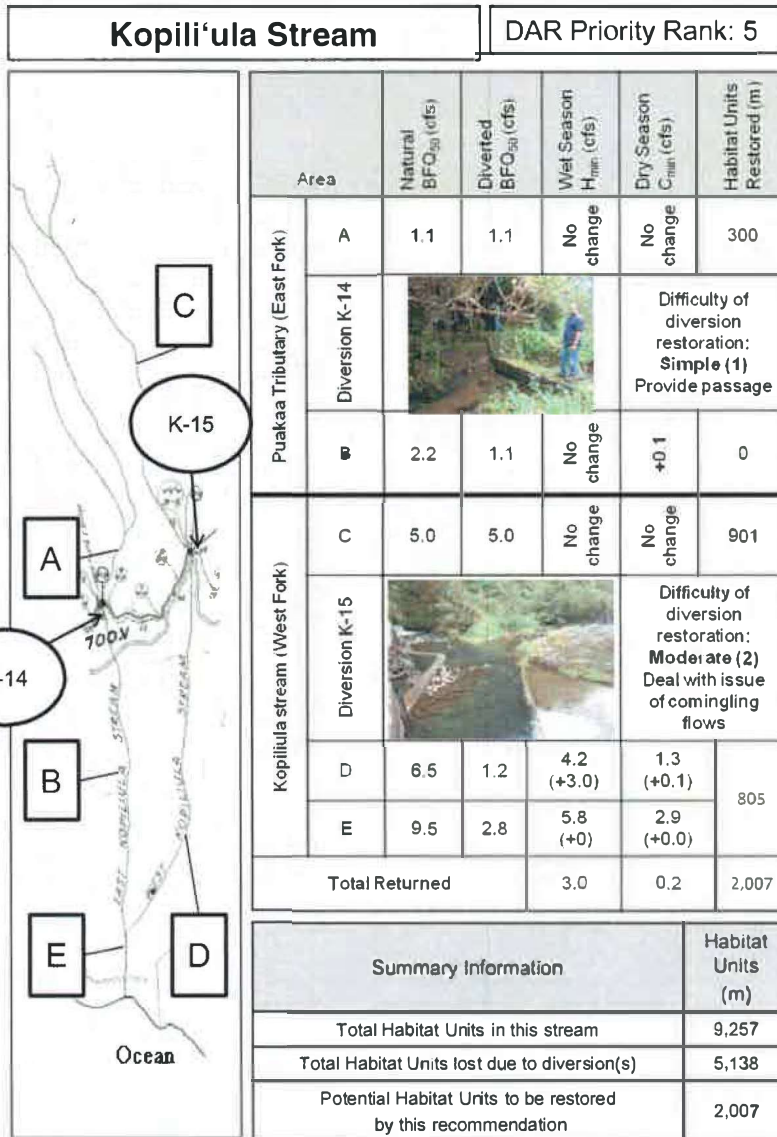


DAR recommendations - Puohokamoa Stream has the largest amount of habitat currently lost to diversions and the biota appears to be in the poorest condition. Restoration actions on Puohokamoa Stream would require modifications to three different diversions (ML-3 Manuel Luis Ditch, K-33 Ko'olau Ditch, S-9 Spreckels Ditch). The modifications to the diversions are relatively simple, with v-notches incorporated in the dam walls of all three diversions to allow flow downstream to provide suitable connectivity and instream habitat and to allow animal passage at the three diversion sites. DAR recommends the release of 5.4 cfs of water during the wet season to provide for minimum habitat flows and 0.3 cfs of water during the dry season to provide connectivity. These water releases would be apportioned among the different diversions. While Puohokamoa Stream would require more effort to restore than either East or West Wailua Iki Streams, a greater amount of native species habitat would be restored (2.8 km).



DAR Recommendations – Waikamoi has substantial habitat lost to flow diversions, yet the complexity of these diversion makes complete restoration more difficult. DAR recommends restoration actions be focused on the main channel of Waikamoi Stream and none on Alo tributary. DAR recommends the release of 2.6 cfs of water during the wet season to provide for minimum habitat flows and small amounts of water (0.1 to -0.3 cfs) during the dry season to provide connectivity. These water releases would be apportioned among the different diversions. Modifications in this restoration effort involve three of the five major diversion structures in the watershed (C-1 intake into Center Ditch, W-2 intake into Wailoa Ditch, S-10 Skimming Dam Intake into Spreckels Ditch). Modification of C-1, W-2 and S-10 intakes would involve a v-notch on each dam wall. Waikamoi Stream has additional diversions upstream of the Wailoa Ditch, but modifications of these diversions would provide less benefit to native species and are not proposed herein. The recommended restoration actions on Waikamoi Stream would result in the creation of over 2 km habitat for native species.





DAR Recommendations - Kopili'ula Stream is located near East and West Wailua Iki Streams and would provide more habitat than either of those streams, but the modifications to the diversions are more extensive. DAR recommends the release of 3.0 cfs of water during the wet season to provide for minimum habitat flows and 0.2 cfs of water during the dry season to provide connectivity. Flow release would be focused on the K-15 Diversion. Modifications to restore flow and allow passage would involve two diversion structures (K-15 Ko'olau Ditch, K-14 Ko'olau Ditch on Pua'aka'a tributary) to provide for suitable habitat downstream and animal passage at the diversion site. The modification of the K-15 diversion structure would involve a box flume from the upstream area of Kopili'ula stream bypassing the area of comingling of the ditch and stream water and downstream of the diversion wall. The K-14 modification will likely involve a v-notch on the dam wall farthest away from the ditch entrance. These restoration actions would result in an additional 2 km of native species habitat.

Haipua'ena Stream		DAR Priority Rank: 6					
	Area	Natural BFO <sub>90</sub> (cfs)	Diverted BFO <sub>90</sub> (cfs)	Wet Season H <sub>min</sub> (cfs)	Dry Season C <sub>min</sub> (cfs)	Habitat Units Restored (m)	
	A	3.6	3.6	No change	No change	0	
	Diversion S-8			Difficulty of diversion restoration: <b>Difficult (3)</b> No passage required			
	B	4.3	0.8	2.8 (+2.0)	0.8 (+0)	548	
	Diversion ML-2			Difficulty of diversion restoration: <b>Difficult (3)</b> Need to bypass road			
	C	4.9	0.5	3.3 (+0.5)	0.9 (+0.1)	951	
	D	5.5	1.1				
	Total Returned				2.5	0.1	1,499
	Summary Information						Habitat Units (m)
	Total Habitat Units in this stream						5,968
Total Habitat Units lost due to diversion(s)						5,173	
Potential Habitat Units to be restored by this recommendation						1,499	

DAR Recommendations – Haipua'ena Stream replaced Honomanū Stream based on the March 3, 2010 meeting with DAR, CWRM, Bishop Museum, and USGS agreement was reached regarding the recalibration of Honomanū Stream in the current HEP analysis, based on the consensus that the reach from the waterfall at the head of the canyon to the seaward terminus does not contain surface flow under base flow conditions. Haipua'ena Stream has the potential to recover 1.5 km of lost native species habitat although the diversion modification are more difficult. Modifications would involve two diversion structures (ML-2 Manuel Luis Ditch, S-8 Spreckels Ditch) to provide for suitable habitat downstream and to increase upstream migration of native animals. DAR recommends the release of 2.5 cfs of water during the wet season to provide for minimum habitat flows and 0.1 cfs of water during the dry season to provide connectivity. These water releases would be apportioned among the different diversions. The modifications for ML-2 and S-8 diversions are complex in that the dam wall is supporting the road so the ability to achieve adequate fish passage will still require more analysis.

Waiohue Stream		DAR Priority Rank: 7				
	Area	Natural BFO <sub>50</sub> (cfs)	Diverted BFO <sub>50</sub> (cfs)	Wet Season H <sub>min</sub> (cfs)	Dry Season C <sub>min</sub> (cfs)	Habitat Units Restored (m)
	A	5.0	5.0	No change	No change	562
	Diversion K-13			Difficulty of diversion restoration: <b>Simple (1)</b> Provide passage at waterfall pool		
	B	6.0	1.0	4.4 (+2.7)	1.3 (+0.1)	932
	C	7.5	2.1			
	Total Returned				2.7	0.1
Summary Information						Habitat Units (m)
Total Habitat Units in this stream						4,428
Total Habitat Units lost due to diversion(s)						2,718
Potential Habitat Units to be restored by this recommendation						1,494

DAR Recommendations – Waiohue is one of the better streams in the region biologically and would be enhanced by additional flow. DAR recommends the release of 2.7 cfs of water during the wet season to provide for minimum habitat flows and 0.1 cfs of water during the dry season to provide connectivity. **Modification of K-13 intake into Ko’olau Ditch would involve digging of channel to lower elevation for overflow water to go down the right bank.** This restoration action would provide an additional 1.5 km of suitable habitat for native stream animals.

Hanawī Stream		DAR Priority Rank: 8					
	Area	Natural BFC <sub>50</sub> (cfs)	Diverted BFC <sub>50</sub> (cfs)	Wet Season H <sub>min</sub> (cfs)	Dry Season C <sub>min</sub> (cfs)	Habitat Units Restored (m)	
	A	4.6	4.6	No change	No change	1,296	
	Diversion K-4				Difficulty of diversion restoration: <b>Simple (1)</b> Provide passage on right side of diversion		
	B	24	19	No change	0.1	0	
	C	26	21				
	Total Returned				0	0.1	1,296
	Summary Information						Habitat Units (m)
Total Habitat Units in this stream						7,585	
Total Habitat Units lost due to diversion(s)						3,456	
Potential Habitat Units to be restored by this recommendation						1,296	

DAR Recommendations - DAR recommends no additional flow restoration for this stream except that necessary to provide a wetted pathway past the diversion structure (approximately 0.1 cfs). This restoration action would provide an additional 1.3 km of suitable habitat for native stream animals. The only modification would be to the K-4 intake into Ko'olau Ditch to provide for animal passage and reduce entrainment of newly hatched larvae at the diversion site. This would involve a v-notch on the dam wall right bank. The lower section of Hanawī Stream is highly productive habitat for native stream animals and has large springs which provide flow and habitat even during drought periods. Overall, Hanawī Stream is an outstanding stream with a healthy and diverse population of native species, and therefore reconnecting the upper and lower sections would protect and enhance the ecological integrity of this particularly valuable stream.

Table 1. Recommended East Maui Stream Flow Ranks

Stream	Habitat Units (HU in m)	# of Diversions	C <sub>min</sub> - dry season (= 20% tbf)	H <sub>min</sub> - wet season - cfs at H90 (= 64% tbf)	Terminal Falls	HU	Rankings						Watershed Atlas Rating		
							Poorest Condition - Species	POD - Effort to fix	Efficient Water Use	Average	FINAL RANK	Geography	TWR	TBR	COR
E. Wailua Iki	2,402	1	0.2	3.2	No	2	2	1	3	2	1	e	7	7	8
W. Wailua Iki	2,218	1	0.4	3.5	No	3	4	1	5	3.25	2	e	7	7	8
Puohokamoa	2,801	3	0.3	5.4	No	1	1	3	8	3.25	3	w	8	5	7
Waikamoi	2,087	5	0	2.6	Yes	4	6	3	2	3.75	4	w	7	7	8
Kopili'ula	2,007	2	0.2	3	No	5	5	3	4	4.25	5	e	8	7	8
Haipua'ena	1,499	3	0.1	2.5	Yes	6	3	6	5	5	6	w	8	5	6
Waiohue	1,494	1	0.1	2.7	No	7	7	1	7	5.5	7	e	7	8	8
Hanawi <sup>(1)</sup>	1,296	1	0.1	0	No	8	8	1	1	4.5	8	e	8	8	9
Total	15,804	17	1.4	22.9											

Hanawi<sup>(1)</sup> no flow amounts are provided as no change in current flow condition are recommended.

**Habitat Units** reflect the total amount of habitat for the native species of concern currently lost to flow diversion or barriers based on H90

**# of diversion** is based on the surveys by DAR and CWRM

**C<sub>min</sub> - dry season** are the minimum flow to provide connectivity

**H<sub>min</sub> - wet season-H90** are the percent of habitat based on the USGS IFIM study for East Maui Streams

**Terminal Falls** are waterfalls at the mouth of a stream that restrict upstream movement of non-climbing species

In the ranking sections:

**Habitat Units** are the ranked order from column 1

**Poorest Condition - Species** ranks stream that are in the worst condition first and lack some native species

**POD - Effort to fix** the Point of Diversion (POD) and an estimate of the difficulty of providing fish passage. Diversion was scored 1 to 3 for increasing difficulty and resulting sum of all diversion scores were ranked lowest to highest.

**Efficient Water Use** was the ranking of HU/cfs at H90. More habitat per cfs scored better. Hanawi does not require water return thus we ranked it 8 (n/a).

**Average** was the average of the first four ranking columns.

**FINAL RANK** was the ranking of the average with West Wailua Iki ranked ahead of Kopiliula due to its easier diversion fix.

**Geography** show in which section of the area the streams were located in. We wanted to spread out the stream restoration if possible.

Watershed Atlas ratings are shown in the last three columns

TWR = Total watershed rating

TBR = Total biological rating

COR = Combined overall rating

Table 2. Habitat Units for the three categories of Native Species-'o'opu, hihiwai, and 'opae

Stream	Habitat Units (HU in m)										total of all spp
	'o'opu						hihiwai	'opae			
	'o'opu akupa	'o'opu naniha	'o'opu nakea	'o'opu nopili	'o'opu hi'ukole	total 'o'opu		'opae 'oeha'a	'opae kala'ole	total 'opae	
Waikamoi	0	0	208	142	1,049	1,399	325	363	0	363	2,087
Puohokamoa	12	3	405	288	1,178	1,886	426	443	45	488	2,801
Haipua'ena	23	7	252	154	721	1,157	191	122	28	151	1,499
W. Wailua lki	10	3	213	181	913	1,322	182	685	29	714	2,218
E. Wailua lki	12	4	272	308	959	1,555	298	510	39	549	2,402
Kopili'ula	5	1	152	152	863	1,174	165	651	16	668	2,007
Waiohue	7	1	192	173	651	1,024	206	241	23	265	1,494
Hanawi	0	0	25	14	587	626	17	652	0	652	1,296
Total	70	20	1,721	1,413	6,920	10,144	1,811	3,668	181	3,849	15,804

Habitat Units reflect the total amount of habitat for the three categories of native species: 'o'opu, hihiwai, and 'opae and they are all based on H100 for the entire watershed therefore, the total of all species is larger than the total habitat units for the streams in Table 1. which reflects habitat units below and between the diversions.

Table 3. Points of Diversions on each stream and effort of modification for fish passage and entrainment

Stream	Points of Diversion-effort of modification					Total
	Diversion 1	Diversion 2	Diversion 3	Diversion 4	Diversion 5	
Puohokamoa (3)	(ML-3)=1	(K-33)=3	(S-9)=3			7
Waikamoi (5)	(C-1)=1	(S-10)=1	(W-2)=2	(NH-1)=3	(W-1)=3	8
Haipua'ena (3)	(ML-2)=3	(S-8)=3				6
Kopili'ula (2)	(K-15)=2	(K-14)=1				3
E. Wailua lki (1)	(K-16)=1					1
W. Wailua lki (1)	(K-17)=1					1
Waiohue (1)	(K-13)=1					1
Hanawi (1)	(K-4)=1					1

Streams listed with number and designation (EMI) of diversions considered for modification

Points of Diversion-effort of modification reflect the difficulty in modifying the diversions to allow fish passage on each stream starting at the lowest diversion

Diversions were scored 1 to 3 for increasing difficulty with resulting sum of all diversion scores