**STATE OF HAWAII**
**DEPARTMENT OF LAND AND NATURAL RESOURCES**
**COMMISSION ON WATER RESOURCE MANAGEMENT**
**Stream Protection and Management Branch**

# FIELD INVESTIGATION REPORT

**FI2008121003 (East Maui, West Wailuanui Koolau Ditch)**

| | |
|---|---|
| **Date of Field Investigation:** December 10, 2008 **Time** (24-hour)**:** 1220 - 1340 | |
| **CWRM Staff:** | Ken Kawahara, Ed Sakoda, Dean Uyeno, and Chui Ling Cheng |
| **Individuals Present:** | Amanda Martin (President of Na Moku);<br>EMI - Garret Hew (Water Resources Manager), Mark Vaught (Operations Manager), Henry Robello (Field Superintendent);<br>DOCARE officers |
| **Hydrologic Unit:** | Wailuanui (6056) |
| **Stream Name:** | West Wailuanui Tributary |

**Findings:**

At 1220 hours, CWRM staff arrived at the Koolau Ditch bypass sluice gate on West Wailuanui tributary. The purpose of this field visit was to document the adjustment of the sluice gate. Following the adoption of IIFS, EMI had expressed interests in lowering the sluice gate so that the ditch could capture high flows during high rainfall events. CWRM staff was present to ensure that the height of the sluice gate opening after adjustment would allow enough flow to pass through, and satisfy the IIFS at the selected site further downstream on Wailuanui Stream. In other words, no water from the stream is diverted until the IIFS is met.

CWRM staff measured the dimensions of the sluice gate opening to be 2.8 x 3.0 feet (W x H). The depth of water at the sluice gate on the left bank was 0.31 feet and at the right bank was 0.17 feet. The average water depth was 0.24 feet, which was 0.06 feet lower than the water depth recorded on Monday, Dec. 8, 2008 (refer to FI2008120802). Staff also measured the gap between each notch on the sluice gate adjustment structure to be 0.18 feet.

Staff took flow measurements about 2 feet upstream of the sluice gate. This site was selected on Monday, Dec. 8, 2008 (refer to FI2008120802). The site was not flagged because this location was not intended to be an IIFS site. Flow measurement was completed in 30 minutes. Staff also recorded air temperature, water temperature and weather conditions. As computed back in the Honolulu Office, the flow was 1.242 cubic feet per second (0.803 million gallons per day), with no gage height readings. The flow was 0.007 cubic feet per second (0.005 million gallons per day) lower than the discharge recorded on Monday, Dec. 8, 2008.

The recorded flow measurement is an estimate of the discharge in West Wailuanui tributary. Staff compared this flow with the discharge in East Wailuanui tributary (refer to FI2008121002) and flow at the IIFS Site on Wailuanui Stream (refer to FI2008121001) to assess flow gains or losses in the stream reach between Koolau Ditch and the IIFS Site. This is discussed in Field Investigation Report FI2008121001 (East Maui, Wailuanui IIFS Site).

Based on Field Investigation Report FI2008121001, the discharge at the IIFS Site on Wailuanui Stream was 2.076 cubic feet per second (1.342 million gallons per day). Since the adopted IIFS of 3.05 cubic feet per second (1.97 million gallons per day) was not attained, no water from the stream can be diverted. However, the sluice gate can be lowered to a height that during average flow conditions, so that enough flow passes the sluice gate to satisfy the IIFS at the selected site further downstream on Wailuanui Stream. The height of the opening was estimated by 1) calculating the flow velocity at the sluice using the discharge measured 2 feet upstream from the sluice gate;

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Flow at W. Wailuanui | ÷ | ( | Depth of water | x | Width of sluice gate | ) | = | Flow velocity |
| 1.242 CFS | ÷ | ( | 0.24 feet | x | 2.8 feet | ) | = | 1.85 feet / sec |

and 2) calculating the discharge in E. Wailuanui using increments of the notch gap on the sluice gate adjustment structure.

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Flow velocity | x | ( | Height of sluice gate | x | Width of sluice gate | ) | = | Flow at W. Wailuanui |
| 1.85 feet / sec | x | ( | 0.18 feet | x | 2.8 feet | ) | = | 0.93 CFS |
| 1.85 feet / sec | x | ( | 0.36 feet | x | 2.8 feet | ) | = | 1.86 CFS |

As previously measured, each notch is 0.18 feet. If the sluice gate was opened to a height of 0.18 feet, only 0.93 cubic

feet per second of flow would pass the sluice gate. Not accounting for the possibility of flow gains below Koolau Ditch and head build-up behind the sluice gate during higher flows that may increase flow velocity, opening the sluice gate to a height of 0.36 feet (2 notches) was a more conservative approach.

The final height of the sluice gate opening after adjustment was 0.35 feet. CWRM staff used fluorescent yellow flagging tape to mark the height of the sluice gate opening.

Staff left East Wailuanui tributary at approximately 1340 hours, and proceeded to locate Kaleiomaui Stream from the service road. Refer to Field Investigation Report FI2008121004 (East Maui, Kaleiomaui) for more information.

**Image Listing:** (Attach PDF of image contact sheet)

| File Name: | Brief Description: |
|---|---|
| 20081210022 | CWRM staff conducting flow measurement at the Koolau Ditch bypass sluice gate on West Wailuanui Stream. |
| 20081210024 | CWRM staff conducting flow measurement at the Koolau Ditch bypass sluice gate on West Wailuanui Stream. |
| 20081210025 | CWRM staff conducting flow measurement at the Koolau Ditch bypass sluice gate on West Wailuanui Stream. |
| 20081210026 | Koolau Ditch bypass sluice gate on West Wailuanui Stream before gate adjustment. |
| 20081210029 | Koolau Ditch bypass sluice gate on West Wailuanui Stream before gate adjustment. |
| 20081210030 | EMI staff adjusting the Koolau Ditch bypass sluice gate on West Wailuanui Stream. |
| 20081210033 | CWRM staff measuring the height of the Koolau Ditch bypass sluice gate on West Wailuanui Stream after the adjustment. |
| 20081210034 | CWRM staff measuring the height of the Koolau Ditch bypass sluice gate on West Wailuanui Stream after the adjustment. |
| 20081210039 | Notches of the Koolau Ditch bypass sluice gate on West Wailuanui Stream after adjustment. |
| 20081210040 | Notches of the Koolau Ditch bypass sluice gate on West Wailuanui Stream after adjustment. |
| 20081210041 | Notches of the Koolau Ditch bypass sluice gate on West Wailuanui Stream after adjustment. |
| 20081210046 | Dean Uyeno, Dexter Tom, Amanda Martin, Ken Kawahara, and Garret Hew at the Koolau Ditch bypass sluice gate on West Wailuanui Stream. |
| 20081210048 | Amanda Martin, Ken Kawahara, and Garret Hew at the Koolau Ditch bypass sluice gate on West Wailuanui Stream. |
| 20081210051 | CWRM staff flagging the height of the Koolau Ditch bypass sluice gate opening after adjustment. |
| 20081210052 | Notches of the Koolau Ditch bypass sluice gate on West Wailuanui Stream after adjustment. |
| 20081210053 | Notches of the Koolau Ditch bypass sluice gate on West Wailuanui Stream after adjustment. |
| 20081210054 | Amanda Martin, Ken Kawahara, and Garret Hew at the Koolau Ditch bypass sluice gate on West Wailuanui Stream. |
| 20081210055 | Notches of the Koolau Ditch bypass sluice gate on West Wailuanui Stream after adjustment. |
| 20081210057 | Koolau Ditch (#8) minor diversion intake on Wailuanui Stream. |
| 20081210059 | Koolau Ditch (#7) diversion intake on Wailuanui Stream. |

**GPS Listing:**

**Shapefiles:** (List file names of all shapefiles created and a brief description of each)

| File Name: | Brief Description: |
|---|---|
| East_Maui_POI.shp | Points of interest (POI) recorded with the GPS unit during the field visit. The file includes POI recorded from all the East Maui field investigations. |

**Waypoints:** (List all waypoints in decimal degrees and provide a brief description of each)

| WP No. | Latitude | Longitude | Brief Description: |
|---|---|---|---|

**Attachments:**

**Brief Description:**

1. Image Contact Sheet
2. Discharge Measurement and Gage Inspection Notes

**Recommendations:**

# IMAGE CONTACT SHEET

*20081210022.JPG*

*20081210024.JPG*

*20081210025.JPG*

*20081210026.JPG*

*20081210029.JPG*

*20081210030.JPG*

*20081210033.JPG*

*20081210034.JPG*

*20081210039.JPG*

*20081210040.JPG*

*20081210041.JPG*

*20081210046.JPG*

# IMAGE CONTACT SHEET

*20081210048.JPG*

*20081210051.JPG*

*20081210052.JPG*

*20081210053.JPG*

*20081210054.JPG*

*20081210055.JPG*

*20081210057.JPG*

*20081210059.JPG*

Form 9-275F
(Apr. 2001)

# U.S. DEPARTMENT OF THE INTERIOR
## U.S. Geological Survey
### WATER RESOURCES DIVISION
### DISCHARGE MEASUREMENT AND GAGE INSPECTION NOTES

Meas. No. _____

Comp. by Chui

Checked by DPM

Sta. No. W. Wailuanui

Sta. Name _____

Date 12/10 , 20 08 Party Dean (H) Chui, Ecl.

Width 3.55 Area 1.141 Vel. 1.09 G.H. ✓ Disch. 1.242 CFS

Method Wading No. secs. 40 G.H. change ✓ in _____ hrs.

Method coef. _____ Horiz. angle coef. _____ Susp. _____ Tags checked _____

Meter Type _____ Meter No. _____ Meter _____ ft. above bottom of wt.

Rating used _____ Spin test before meas. _____ ; after _____

Meas. plots _____ % diff. from rating no. _____ Indicated shift _____

| GAGE READINGS | | | | | | |
|---|---|---|---|---|---|---|
| Time | | | | | Inside | Outside |
| | | | | | | |
| | | | | | | |
| | Start | LEW @ 1250 | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | Finish | REW @ 1323 | | | ~ | 30 min |
| | | | | | | |
| Weighted MGH | | | | | | |
| GH correction | | | | | | |
| Correct MGH | | | | | | |

Samples collected: water quality, sediment, biological, other _____

Measurements documented on separate sheets: water quality, aux./base gage, other _____

Rain gage serviced/calibrated ____

Weather: sunny

Air Temp. 23 °C at 1302

Water Temp. 20.5 °C at 1315

Check bar/chain found _____

Changed to _____ at _____

Correct _____

Wading, cable, ice, boat, upstr., downstr., side bridge, 1.5 (ft), mi. upstr., downstr. of gage. Sluice gate

Measurement rated excellent (2%), good (5%), fair (8%), poor (> 8%); based on following conditions: Flow: laminar in center, angled flow on sides.

Cross section: dirt, cobbles, pebbles, bedrock.

Gage operating: _____ Record Removed _____

Battery voltage: _____ Intake/Orifice cleaned/purged: _____

Bubble-gage pressure, psi: Tank _____ , Line _____ ; Bubble-rate _____ /min.

Extreme-GH indicators: max _____ , min _____ .

CSG checked: _____ HWM height on stick _____ Ref. elev. _____ HWM elev. _____

HWM inside/outside: _____

Control: _____

Remarks: _____

GH of zero flow = GH _____ - depth at control _____ = _____ ft., rated _____

Sheet No. _____ of _____ sheets

River at -

| ANGLE COEFFICIENT | DIST. FROM INITIAL POINT | WIDTH | DEPTH | OBSERVATION DEPTH | REVOLUTIONS | TIME IN SECONDS | VELOCITY AT POINT | VELOCITY MEAN IN VERTICAL | ADJUSTED FOR HOR. ANGLE OR ..... | AREA | DISCHARGE | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | LEW | @ | 1250 | | | | | | | | | .80 |
| | | | | | | | | | | | | .85 |
| | 4.05 | .075 | 0 | | | | | | | 0 | — | |
| | 3.9 | .125 | .32 | | | 40 | | .29 | | .040 | .012 | |
| | 3.8 | .10 | .38 | | | 40 | | .23 | | .038 | .009 | .90 |
| | 3.7 | .10 | .38 | | | 40 | | .35 | | .038 | .013 | .92 |
| | 3.6 | .10 | .37 | | | 40 | | .47 | .153 | .037 | .017 | |
| | 3.5 | .10 | .38 | | | 40 | | .44 | | .038 | .017 | .94 .068 |
| | 3.4 | .10 | .33 | | | 40 | | .64 | .224 | .033 | .021 | .96 .089 |
| | 3.3 | .10 | .36 | | | 40 | | .70 | | .036 | .025 | .97 |
| | 3.2 | .10 | .34 | | | 40 | | .66 | .294 | .034 | .022 | .98 .136 |
| | 3.1 | .15 | .34 | | | 40 | | .73 | | .051 | .037 | .99 |
| | 2.9 | .20 | .32 | | | 40 | | .81 | | .064 | .052 | |
| | 2.7 | .20 | .30 | | | 40 | | .86 | | .060 | .052 | |
| ⊙ | 2.5 | .20 | .32 | | | 40 | | 1.07 | | .064 | .068 | 1.00 |
| | 2.3 | .20 | .31 | | | 40 | | 1.08 | .595 | .062 | .067 | .412 |
| | 2.1 | .20 | .32 | | | 40 | | 1.14 | | .064 | .073 | |
| | 1.9 | .20 | .32 | | | 40 | | 1.28 | | .064 | .082 | .99 |
| | 1.7 | .20 | .34 | | | 40 | | 1.23 | | .068 | .084 | .98 |
| | 1.5 | .15 | .35 | | | 40 | | 1.40 | | .053 | .074 | .97 |
| | 1.4 | .10 | .33 | | | 40 | | 1.47 | | .033 | .049 | .96 |
| | 1.3 | .10 | .32 | | | 40 | | 1.61 | .909 | .032 | .052 | |
| | 1.2 | .10 | .32 | | | 40 | | 1.55 | | .032 | .050 | .94 .876 |
| | 1.1 | .10 | .32 | | | 40 | | 1.80 | | .032 | .058 | .92 |
| | 1.0 | .10 | .32 | | | 40 | | 1.85 | 1.085 | .032 | .059 | .90 .993 |
| | 0.9 | .10 | .33 | | | 40 | | 1.86 | 1.038 | .033 | .061 | 1.054 |
| | 0.8 | .10 | .30 | | | 40 | | 2.10 | 1.068 | .030 | .063 | 1.117 |
| | 0.7 | .10 | .30 | | | 40 | | 2.14 | | .030 | .064 | .85 |
| | 0.6 | .10 | .28 | | | 40 | | 2.18 | | .028 | .061 | |
| | 0.5 | .05 | .29 | | | | | 0 | | .015 | 0 | |
| | 3.55 | 3.55 | | | | | AVE= | 1.09 | | 1.141 | 1.242 | .80 |
| | REW | @ | 1323 | | | | | | | | | |