Limited Visual Dam Safety Inspection Summary Report

MA-133

Pukalani Reservoir

Maui, Hawaii

Prepared by:

U.S. ARMY CORPS OF ENGINEERS
HONOLULU ENGINEER DISTRICT

STATE OF HAWAII
DEPARTMENT OF LAND AND NATURAL RESOURCES

May 2006

Dam ID: MA-133
Name: Pukalani Reservoir

Limited Visual Dam Safety Inspection Conducted on: 07 April 2006

I. Purpose

Due to disaster occurrences of periodic heavy rains and flooding, which has caused extensive damage to property and loss of lives, the Governor has issued a State of Emergency Proclamation extending from February 20, 2006 to April 9, 2006. In light of the tragic failure of the Kaloko dam on Kauai and the continued forecast of heavy rains, emergency inspections of all regulated dams in all counties are being undertaken.

These inspections are for the purpose of determining if any of the regulated dams and reservoirs in the City and County of Honolulu, Maui County or Hawaii County, are suspect for immediate concern to the downstream area under the prolonged conditions of heavy rain showers.

II. Authority

Inspections are authorized under the Hawaii Dam Safety Act of 1987, Chapter 179D "Dams and Reservoirs" of Hawaii Revised Statues, and Title 13, Subtitle 7, Chapter 190, "Dams and Reservoirs" of the Hawaii Administrative Rules.

These inspections are being conducted under joint agreements of the U.S. Army Corps of Engineers (ACE), the U.S. Department of Agriculture Natural Resources Conservation Service (NRCS), and the State of Hawaii. The Memorandum of Agreement with the U.S. Army Corps of Engineers is entered into pursuant to 10 U.S.C. § 3036(d)(2), and the Intergovernmental Cooperation Act (31 U.S.C. §6505), and established via support agreement number DL-06-01.

III. Scope

Visual inspection will be made on parts of the embankment and appurtenant works readily available and visible for inspection by the inspection team at the time of the inspection. Such parts and appurtenant works would include the upstream slope, crest, downstream slope, abutments and toes, outlet works, and spillway.

On the date of this limited visual inspection, there may appear to be no immediate threat to the safety of the dam, however no assurance can be made regarding the dam's condition after this date. Subsequent adverse weather and other factors may affect the dam's condition.

IV. Limitations of Findings and Recommendations

The inspection is based only on visible features/areas of the dam on the day of inspection. The inspection does not entail detailed stability, hydrologic, hydraulic, or seismic investigations. This inspection is not a formal phase I or phase II dam safety inspection and does not include a review or evaluation from each specialist of an inspection team, such as a geologists, civil, geotechnical, structural, or hydraulics engineer. The owner should verify the findings of this report and take corrective actions. The owner may submit to the State alternative corrective actions that are certified by a licensed professional engineer in the State of Hawaii experienced in the design and construction of dams. This inspection does not relieve the owner/operator from their responsibility to conduct routine inspections, maintenance, repairs, modifications, monitoring, documentation, and/or investigative studies.

V. Inspection Team

Corps of Engineers	Troy O'Neal, P.E. Geotechnical Engineer
Corps of Engineers	Jon Kolber, P.E. Geotechnical Engineer
State of Hawaii, Dept. of Land and Natural Resources	Nelson Rodrigues Div. of Forestry and Wildlife
USDA, Natural Resources Conservation Services	Ranae Ganske-Cerizo

VI. Owner's Representatives Present

Maui Land and Pine, Co.	Steven Nikaido,

VII. Summary Report Team

Corps of Engineers	Derek Chow Bill Empson
State of Hawaii, Dept. of Land and Natural Resources	Denise Manuel Edwin Matsuda

VIII. Dam Type

The dam appeared to be an earthen embankment dam.

IX. Dam Classification

The current hazard classification of this dam is: Low

Hazard Potential Classification based on the following:

Category	Loss of Life	Economic Loss
Low	None Expected	Minimal (undeveloped to occasional structures or agriculture)
Significant	Few (No Urban development and no more than a small number of inhabitable structures)	Appreciable (Notable agriculture, industry or structures)
High	More than a few	Extensive community, industry or agriculture.

Based on inventoried storage and height data, the size classification of the dam is: Small

Size Classification based on the following:

Category	Storage (Acre-Feet)	Height (feet)
Small	< 1000	< 40
Intermediate	> 1000 and < 50,000	> 40 and < 100
Large	> 50,000	> 100

X. Summary of Inspection

Condition Rating Criteria: The conditional terms in this report are used to generally describe the conditions below. Inspections, monitoring, and additional investigations are considered to be incidental to all condition ratings.

Satisfactory	Expected to fulfill intended function.
Fair	Expected to fulfill intended function, but maintenance is recommended.
Poor	May not fulfill intended function; maintenance or repairs are necessary.
Unsatisfactory	Is not expected to fulfill intended function; repair, replacement, or modification is necessary.
Unknown	Not visible, not accessible, not inspected, or unable to determine the condition rating based on the observation taken.

Dam ID: MA-133
Name: Pukalani Reservoir

A. General appearance:

The dam consists of earth slopes with a dam height of about 37 feet. The upslopes of the dam are lined with HDPE. In general, all sections of the dam were clear and easily viewed except for the downstream slope that contained high grass.
The inlet consisted of an 8-inch PVC pipe fed by the Kailiili reservoir. No dam incidents were known by the owner.

Findings and Corrective Actions:

a. The Owner shall maintain documentations including Construction plans, specifications, improvements, modifications, Operations and Maintenance Manuals and routine inspection logs for this dam facility.
b. An EAP is recommended for all dams regardless of hazard class. Submit EAP if developed for the facility.
c. Routine inspection logs were not inspected.
d. Access to site appears to be satisfactory.
e. Submit current Operations and Maintenance Manual or Procedures for this dam / reservoir facility.
f. Submit Site or Facility Map of this Dam which identifies the location of major features including outlet works controls and conduits.
g. Emergency Alarms / Monitors: There were no alarms or monitors observed on this reservoir.
h. Power / Communication: There were no communication systems observed on this reservoir. There were no utility or power poles visible nearby.

B. Access / Security:

Access to the dam was accomplished via a County roadway. Access also required a 4-wheel drive vehicle.

Any security issues: Access to the dam is via locked gates.

C. Intake Works: (Satisfactory)

The inlet consisted of an 8-inch PVC pipe feet by the Kailiili reservoir. The intake or inlets have the ability to be shut off or diverted away from the reservoir during periods of heavy rains. This is done manually.

Findings and Corrective Actions:

a. The intake works were not tested.
b. The intake works appeared to be in satisfactory condition, no corrective actions are required at this time.

D. Reservoir: (Fair)

The reservoir level during the inspection was about 4 feet below the spillway. No staff gage was located at the site. According to staff personnel, the reservoir is normally operated at about 4 ft below the spillway except during drought conditions. No Sinkholes or depressions were observed.

Findings and Corrective Actions:

a. The reservoir appeared to be in fair to poor condition and requires corrective action.
b. A staff gage was not observed at the reservoir. Provide some method of quantifying the water level within the reservoir.

E. Upstream Slope: (Satisfactory)

The upstream slope varied in slope and ranged from a 1 on 2.5. Slope protection consisted of the HDPE liner. Erosion were not observed, the slope was entirely visible. Cracks were not observed, the slope was entirely visible. Sinkholes were not observed, the slope was entirely visible.

Findings and Corrective Actions:

a. The upstream slope appeared to be in satisfactory condition, no corrective actions are required at this time.

F. Crest: (Satisfactory)

The dam crest was approximately 20 feet wide. There was a dirt access road on top of the crest, which appeared to be well utilized. Cracks were not observed, the crest was entirely visible. Sinkholes were not observed, the crest was entirely visible. Vegetation was observed on the edges of the crest. These were primarily small weeds.

Findings and Corrective Actions:

a. The dam crest appeared to be in satisfactory condition, no corrective actions are required at this time.
b. Access along the crest was satisfactory.

G. Downstream Slope: (Fair)

The downstream slope was about 2.5H to 1V. The downstream slope was not entirely visible due to tall grass. There was access to the downstream slope by a walking path at the toe. There was no slope protection observed on the downstream slope. Erosion was not observed on the downstream slope; however the slope was not entirely visible. Sinkholes were not observed on the downstream slope; however the slope was not entirely visible. Seepage was not observed on the downstream toe; however the slope was not entirely visible.

Findings and Corrective Actions:

a. The downstream slope appeared to be in fair to poor condition and requires corrective action.
b. The down stream slope was not visible due to high grass and bush vegetation. Clear high vegetation and maintain low to enable easy visual inspection.

H. Abutments / Toe: (Satisfactory)
The abutments and toe were entirely visible and appeared in good condition. Erosion along the abutment or toe was not observed. Cracks in either direction were not observed. Seepage along the abutments or toe was not observed.

Findings and Corrective Actions:
a. The abutments/toe appeared to be in satisfactory condition, no corrective actions are required at this time.

I. Outlet Works: (Satisfactory)
The outlet consisted of a submerged 8-inch diameter PVC pipe but was not inspected in detail, not tested. The outlet works was controlled via a valve on the downstream side of the dam. Seepage was not observed flowing near the exit of the outlet works from the dam.

Findings and Corrective Actions:
a. The outlet works were not tested.
b. The outlet works appeared to be in satisfactory condition, no corrective actions are required at this time.

J. Spillway: (Satisfactory)
This spillway consisted of two 8-inch PVC pipes near the right downstream edge of the reservoir. The spillway channel then feeds a drainage swale that runs along the right downstream edge of the downstream toe. The spillway approach was clear. There was no erosion observed near the spillway. The downstream vegetation appears to be primarily woody vegetation.

Findings and Corrective Actions:
a. The Spillway appeared to be in satisfactory condition, no corrective actions are required at this time.

K. Down Stream Channel: (Fair)
The down stream channel was a ditch.

Findings and Corrective Actions:
a. The downstream channel was not inspected.
b. The downstream channel appeared to be in fair to poor condition and requires corrective action.

XI. Additional Comments:

Based on visual observations and discussion of operational procedures of the dam, there is no immediate threat to the safety of the dam at this time.

Tall grass needs to be removed on the downstream slope to promote visual inspection of slopes.

PHOTOGRAPHS

MA-133 Pukalani Reservoir

MA-133 Pukalani Reservoir

133 Crest and lined upslope - crest upkeep and dam liner.

MA-133 Pukalani Reservoir

133 Downstream slope

MA-133 Pukalani Reservoir

133 Downstream view below dam

MA-133 Pukalani Reservoir

133 Downstream view reservoir showing inlet pipe

MA-133 Pukalani Reservoir

133 Dual Spillway Pipes - View of dual 8-inch pipe spillway existing into DS ditch.

MA-133 Pukalani Reservoir

133 Inlet Pipe 8 inch - View of 8-inch inlet pipe from Ka'ili'ili Reservoir.

MA-133 Pukalani Reservoir

133 Outlet control valve - View of outlet work valve box

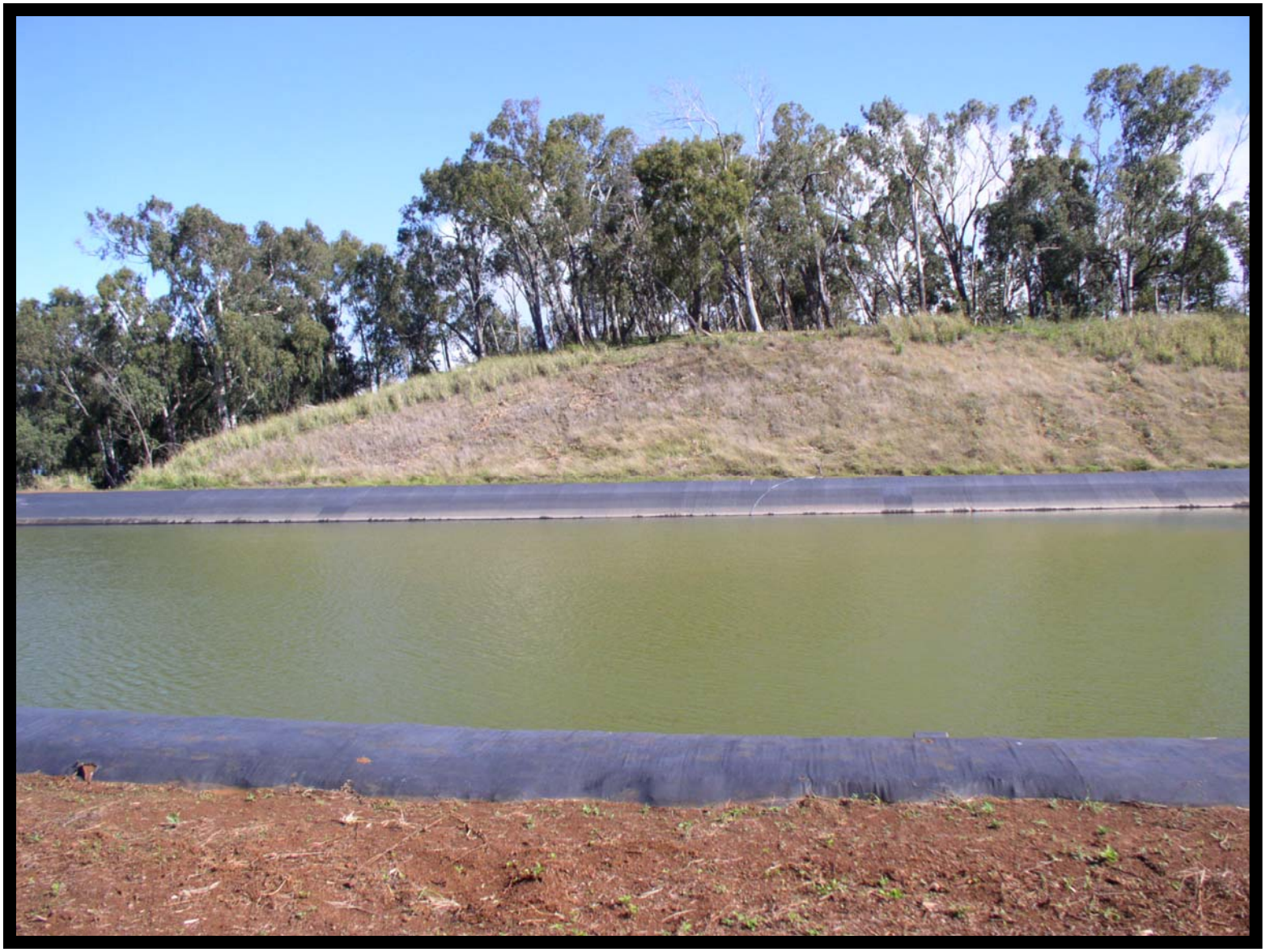
MA-133 Pukalani Reservoir

133 Panoramic view of dam 1

MA-133 Pukalani Reservoir

133 Panoramic view of dam 2

MA-133 Pukalani Reservoir



133 panoramic view of dam 3

MA-133 Pukalani Reservoir

133 Panoramic view of dam 4

MA-133 Pukalani Reservoir

133 Panoramic view of dam 5

MA-133 Pukalani Reservoir

133 Panoramic view of dam 6 (right)

MA-133 Pukalani Reservoir

133 Spillway pipe outlet downstream - View of dual pipe spillway outlet to daylight and downstream.

FIELD INSPECTION SHEETS

Dam ID: MA-0133 PUKALANI RESERVOIR	Vulnerability Index: Extreme 1 High 2 Moderate 3 Low 4	Inspection No: ____ Date: 4/7/06

STATE OF HAWAII - DLNR
DAM SAFETY INSPECTION SHEET

Inspection Type: Visual Dam Safety Inspection

Persons Present	Affiliation	Phone Number
TROY O'NEAL	US Army Corps of Engineers	
JON KOLBER	"	
Ranae Ganske-Cerizo	USDA - NRCS	
NELSON RODRIGUES	(FORRESTRY DEPT.) DLNR	
STEVEN NIKAIDO	MAUI LAND + PINE CO.	

Weather Condition: ☐ Rain previous day ☐ Rainy ☐ Drizzle / Mist ☐ Cloudy/Overcast ☒ Partly Cloudy ☐ Sunny ☐ Dry

Comments: ____

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1. General: *(Information currently on file, update as required)*

Dam/Res. Name	PUKALANI RESERVOIR		
Owner	Maui Land & Pineapple Co., Haliimaile Div. *(C022)*		
Owner Contact	Mr. Bobby Brooks	Owner Ph.	
Lessee	N/A	Lessee Ph.	
O & M Contractor	Owner	O & M Ph.	
Nearest Town		Latitude	20.8333 ° (decimal)
County	MAUI	Longitude	156.3333 ° (decimal)
Tax Map Key(s)			

Dam Status	A:	Hazard Potential	L:	Dam Size	
Year Completed	1984	Dam Length	225 ft.	Dam Height	37 ft.
Normal Storage	16 ac.ft.	Max. Storage	16 ac.ft.	Max. Surface Area	1.3 ac.
Drainage Area	mi.	Spillway Type	TWO 8" PVC PIPES	Max. Spillway Q	100 cfs

Owner owns land under dam facility: ____

Emergency Action Plan on file with the Department: NR

Reports on file with the Department: None on file.

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PUKALANI RESERVOIR

Inspection No: _____
Date: 4/7/06

2. Questions for Owner's Rep.:	Yes	No	Unknown	Comments
Construction Plans Available	☐	☒	☐	REPORTED TO BE AT MAIN OFFICE
Site / Facility Map	☐	☒	☐	
Operation & Maintenance Manual	☐	☒	☐	REPORTED TO BE UNDER DEVELOPMENT
Emergency Action Plan	☐	☒	☐	REPORTED TO BE UNDER DEVELOPMENT
Modifications / Improvements	☐	☒	☐	
Conduct Routine Inspections	☒	☐	☐	
Conduct Routine Maintenance	☒	☐	☐	
Vehicle access to site	☒	☐	☐	☐ Not accessible ☒ With Standard car ☐ Requires 4-Wheel Drive
Access during heavy rains	☒	☐	☐	☐ Not accessible ☒ With Standard car ☐ Requires 4-Wheel Drive
Access when spillway is flowing	☒	☐	☐	☐ Not accessible ☒ With Standard car ☐ Requires 4-Wheel Drive
Other Studies Conducted	☐	☒	☐	☐ Phase I ☐ Phase II ☐ Hydraulics ☐ Stability ☐ Hazard ☐ Seismic ☐ Other:
Incident History	☐	☒	☐	☐ Breached ☐ Overtop ☐ Slide ☐ Down stream Flooding ☐ Other:
Reservoir's Current Use	☒	☐	☐	☐ Sediment ☒ Irrigation ☐ Recreation ☐ Flood Control ☐ Drinking Water ☐ Power Generation ☐ Other:

Findings and Corrective Actions:

- ☒ a. The Owner shall maintain documentations including Construction plans, specifications, improvements, modifications, Operations and Maintenance Manuals and routine inspection logs for this dam facility.
- ☐ b. An Emergency Action Plan (EAP) is on file with the department, submit any updates as applicable.
- ☐ c. An EAP is required for High Hazard Dams. Submit an updated EAP for this facility.
- ☒ d. An EAP is recommended for all dams regardless of hazard class. Submit EAP if developed for the facility.
- ☐ e. Submit narrative and additional information detailing the improvements, modifications, and/or alterations at the dam site, unless covered by approved dam permit.
- ☒ f. Routine inspection logs were not inspected.
- ☐ g. Dam owners shall provide for routine inspection of the dam.
- ☐ h. The dam did not appear to be maintained on a regular basis.
- ☒ i. Access to site appears to be satisfactory.
- ☐ j. There is no vehicular access to the dam site. Operational and emergency plans need to reflect this deficiency or access provided.
- ☐ k. Access to dam is questionable during severe weather conditions and/or spillway overflows. Operational plans and emergency plans need to reflect this deficiency or access provided.
- ☐ l. Provide a detailed narrative of the incident, responses taken, and any damages incurred. Dam owners are required to promptly advise the department of any sudden or unprecedented flood or unusual or alarming circumstance or occurrences which may adversely affect the dam or reservoir.
- ☒ m. Submit current Operations and Maintenance Manual or Procedures for this dam / reservoir facility.
- ☒ n. Submit Site or Facility Map of this Dam which identifies the location of major features including outlet works controls and conduits.
- ☐ o. _____

Additional Requirements:

The following investigative study(s) are:

Required	Recommended	
☐	☐	Phase I Study
☐	☐	Phase II Study (Including ☐ Seepage ☐ Hydrology/Hydraulics ☐ EAP)
☐	☐	Hydrology and Hydraulics (including Probable Maximum Flood and spillway capacity)
☐	☐	Stability Analysis
☐	☐	Seismic Analysis
☐	☐	Hazard Classification
☐	☐	Other: _____

Dam ID: MA-0133 PUKALANI RESERVOIR	Inspection No: ____ Date: 4/7/06

Physical Dam Features: (Check All Applicable. Provide description of Items Observed and/or Take Photos. Indicate photo # in description.)

3. Reservoir:

Level during inspection 4 FT BELOW SPILLWAY ft per NO GAGE (gage / other)

Normal Operating Level/Range ≈ 4 FT " " (SEASONAL) ft per NO GAGE (gage / other)

Description: ____

Typical Operation ☐ Spillway always flowing ☒ Kept within normal range ☐ Kept Empty ☐ Drained Daily ☐ Only filled by Storms

☐ Other: ____

Sinkhole in Res.: ☐ # Observed: ____ Size: ____ by ____ in. Deep ☐ Not Visible ☒ None Observed

Description: ____

Staff Gage: Description: NONE

Findings:

- ☐ a. The reservoir was not inspected.
- ☐ b. The reservoir appeared to be in satisfactory condition, no corrective actions are required at this time.
- ☒ c. The reservoir appeared to be in fair to poor condition and requires corrective action.
- ☐ d. The reservoir appeared to be in unsatisfactory condition, urgent corrective action is required.

Corrective Actions:

- ☐ e. The staff gage needs maintenance and/or repair. Description: ____
- ☒ f. A staff gage was not observed at the reservoir. Provide some method of quantifying the water level within the reservoir.
- ☐ g. A sinkhole was observed in the upstream reservoir. Conduct additional investigations and monitoring to identify the cause, risk and appropriate action.
- ☐ h. ____

4. Intake Works Description:

☒ Number of Intakes 1

☐ Intake Culvert / Pipe

Size: 8 in. ☐ DIP ☐ Corrugated Metal ☒ PVC ☐ HDPE ☐ Concrete ☐ Other ____

Control: ☐ Gate ☒ Valve ☒ Flow can either be Shut off or Bypassed

From: ☐ Stream Diversion ☐ Pump ☒ Reservoir ☐ Other ____

☐ Ditch / Flume

Dimension: ____ (Size x Depth) Shape ____

Surface: ☐ Dirt ☐ Wood ☐ Concrete ☐ Lined w/ ____

Control: ☐ Gate ☐ Valve ☐ Flow can either be Shut off or Bypassed

From: ☐ Stream Diversion ☐ Pump ☐ Reservoir ☐ Other ____

Findings:

- ☐ a. The intake works were not inspected.
- ☒ b. The intake works were not tested.
- ☒ c. The intake works appeared to be in satisfactory condition, no corrective actions are required at this time.
- ☐ d. The intake works appeared to be in fair to poor condition and requires corrective action.
- ☐ e. The intake works appeared to be in unsatisfactory condition, urgent corrective action is required.

Corrective Actions:

- ☐ f. The intake works needs maintenance and/or repair. Description: ____
- ☐ g. ____

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5. Upstream Slope: **(Typical Slope ± 2.5 : 1)**

Slope Protection: ☐ None ☐ Dumped Rock ☐ Fitted Rip Rap ☐ Grouted Rip Rap ☒ Liner HDPE ☐ Other: _____

☐ Defect in Protection: Description: _____

Erosion: ☐ Loose soil w/ little vegetation ☐ Rut (<6") ☐ Gully (>6" deep) ☐ Not Visible ☒ None Observed

Description: _____

Cracks: ☐ Parallel with crest ☐ Perpendicular to crest ☐ Slide visible ☐ Not Visible ☒ None Observed

Description: _____

Sinkholes: ☐ # Observed: _____ Size: _____ and _____ Depth ☐ Not Visible ☒ None Observed

Description: _____

Vegetation: ☒ None ☐ Low Ground Cover ☐ Bushes or Tall Grass ☐ Trees #_____ ☐ <6" ☐ >6" & <20" ☐ >20"

Description: _____

Findings:

☐ a. The upstream slope was not inspected.

☒ b. The upstream slope appeared to be in satisfactory condition, no corrective actions are required at this time.

☐ c. The upstream slope appeared to be in fair to poor condition and requires corrective action.

☐ d. The upstream slope appeared to be in unsatisfactory condition and not expected to fulfill its intended function. Urgent corrective action is required.

Corrective Actions:

☐ e. Slope protection needs maintenance or repair. Description: _____

☐ f. Rut and/or Gully erosion was observed on the slope, which requires maintenance and/or repair. Description: _____

☐ g. A crack was observed on the slope, which requires further investigation to determine the underlining cause. Monitor the area and/or repair as required.

☐ h. A sinkhole was observed on the slope, which requires further investigation to determine the underlining cause. Repair and monitor the area.

☐ i. The upstream slope was not visible due to high grass and bush vegetation. Clear high vegetation and maintain low to enable easy visual inspection.

☐ j. Tree(s) were observed on the dam embankment. Trees have been identified as the probably cause of piping failures, and can possibly cause sever damage to the embankment if they are uprooted during a high winds. Corrective action is required to remove the tree hazards from the dam. Acceptable remedies include removal of the tree and its root structure down to a 2" diameter and reconstructing the damaged embankment section. All repair work shall be accomplished as per the requirements of licensed geotechnical or structural engineer. Routinely monitor the damaged area for signs of settlement and seepage.

☐ k. _____

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6. Crest: Approximate Crest Width: 20 FT

Access: ☐ None ☒ Walking Path ☐ Roadway, Surface / Width / Usage: _____

Erosion: ☐ Loose soil w/ little vegetation ☐ Rut (<6") ☐ Gully (>6" deep) ☐ Not Visible ☒ None Observed

Description: _____

Cracks: ☐ Parallel with crest ☐ Perpendicular to crest ☐ Slide visible ☐ Not Visible ☒ None Observed

Description: _____

Sinkholes: ☐ _____ in. Wide x _____ in. Long x _____ in. Deep ☐ Not Visible ☒ None Observed

Description: _____

Vegetation: ☒ None ☐ Low Ground Cover ☐ Bushes or Tall Grass ☐ Trees #_____ ☐ <6" ☐ >6" & <20" ☐ >20"

Description: SOIL W/ OCCASIONAL WEEDS

Findings:

☐ a. The dam crest was not inspected.

☒ b. The dam crest appeared to be in satisfactory condition, no corrective actions are required at this time.

☐ c. The dam crest appeared to be in fair to poor condition and requires corrective action.

☐ d. The dam crest appeared to be in unsatisfactory condition and not expected to fulfill its intended function. Urgent corrective action is required.

Corrective Actions:

☒ e. Access along the crest was satisfactory.

☐ f. Access along the crest was not possible. Description: _____

☐ g. Rut and/or Gully erosion was observed on the crest, which requires maintenance and/or repair. Description: _____

☐ h. A crack was observed on the crest, which requires further investigation to determine the underlining cause. Monitor the area and/or repair as required.

☐ i. A sinkhole was observed on the crest, which requires further investigation to determine the underlining cause. Repair and monitor the area.

☐ j. Portions of the crest were not visible due to high grass and bush vegetation. Clear high vegetation and maintain low to enable easy visual inspection.

☐ k. Tree(s) were observed along the dam crest. Trees have been identified as the probably cause of piping failures, and can possibly cause sever damage to the embankment if they are uprooted during a high winds. Corrective action is required to remove the tree hazards from the dam. Acceptable remedies include removal of the tree and its root structure down to a 2" diameter and reconstructing the damaged embankment section. All repair work shall be accomplished as per the requirements of licensed geotechnical or structural engineer. Routinely monitor the damaged area for signs of settlement and seepage.

☐ l. _____

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7. Downstream Slope: **(Typical Slope ± 2.5 : 1)**

Access: ☐ lower roadway along toe ☐ roadway to outlet works ☒ walkway to outlet works ☐ None Observed

Slope Protection: ☒ None ☐ Dumped Rock ☐ Rip Rap ☐ Grouted Rip Rap ☐ Concrete

Erosion: ☐ Loose soil w/ little vegetation ☐ Rut (<6") ☐ Gully (>6" deep) ☒ Not Visible ☐ None Observed

Description: _____

Cracks: ☐ Parallel with crest ☐ Perpendicular to crest ☐ Slide visible ☒ Not Visible ☐ None Observed

Description: _____

Sinkholes: ☐ _____ in. Wide x _____ in. Long x _____ in. Deep ☒ Not Visible ☐ None Observed

Description: _____

Vegetation: ☐ None ☐ Low Ground Cover ☒ Bushes or Tall Grass ☐ Trees #_____ ☐ <6" ☐ >6" & <20" ☐ >20"

Description: _____

Seepage:

Seep Spot Number 1

☐ Green Vegetation ☐ Wet or Muddy Ground ☐ Ponding Water ☐ Not Visible ☒ None Observed

☐ Flowing, Description: _____

Water Clarity: ☐ Clear ☐ Some particles ☐ Muddy ☐ Other: _____

Description: _____

Seep Spot Number 2

☐ Green Vegetation ☐ Wet or Muddy Ground ☐ Ponding Water ☐ Not Visible ☒ None Observed

☐ Flowing, Description: _____

Water Clarity: ☐ Clear ☐ Some particles ☐ Muddy ☐ Other: _____

Description: _____

Findings:

☐ a. The downstream slope was not inspected.

☐ b. The downstream slope appeared to be in satisfactory condition, no corrective actions are required at this time.

☒ c. The downstream slope appeared to be in fair to poor condition and requires corrective action. (TALL GRASS OVERGROWTH)

☐ d. The downstream slope appeared to be in unsatisfactory condition and not expected to fulfill its intended function. Urgent corrective action is required.

Corrective Actions:

☐ e. Slope protection needs maintenance or repair. Description: _____

☐ f. Rut and/or Gully erosion was observed on the slope, which requires maintenance and/or repair. Description: _____

☐ g. A crack was observed on the slope, which requires further investigation to determine the underlining cause. Monitor the area and/or repair as required.

☐ h. A sinkhole was observed on the slope, which requires further investigation to determine the underlining cause. Repair and monitor the area.

☒ i. The down stream slope was not visible due to high grass and bush vegetation. Clear high vegetation and maintain low to enable easy visual inspection.

☐ g. Tree(s) were observed on the downstream slope. Trees have been identified as the probably cause of piping failures, and can possibly cause sever damage to the embankment if they are uprooted during a high winds. Corrective action is required to remove the tree hazards from the dam. Acceptable remedies include removal of the tree and its root structure down to a 2" diameter and reconstructing the damaged embankment section. All repair work shall be accomplished as per the requirements of licensed geotechnical or structural engineer. Routinely monitor the damaged area for signs of settlement and seepage.

☐ h. Seepage/Ponding water was observed. Monitor and conduct further investigation to locate the source of water and extent of any possible hazardous or developing condition.

☐ i. Seepage was observed flowing and particles were observed to be removed by the flow. Take immediate action to stop the loss of soil from the embankment. Conduct further investigation to determine the underlining cause and take corrective action. Monitor the area.

☐ j. The slope was very steep, around a 1 to 1 slope, further study is required to verify slope stability.

☐ k. _____

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8. Abutments/Toe:

Erosion: ☐ Loose soil w/ little vegetation ☐ Rut (<6") ☐ Gully (>6" deep) ☐ Not Visible ☒ None Observed

Description: _____

Cracks: ☐ Parallel with crest ☐ Perpendicular to crest ☐ Slide visible ☐ Not Visible ☒ None Observed

Description: _____

Vegetation: ☐ None ☒ Low Ground Cover ☐ Bushes or Tall Grass ☐ Trees #_____ ☐ <6" ☐ >6" & <20" ☐ >20"

Description: _____

Seepage: Seep Spot Number 1

☐ Green Vegetation ☐ Wet or Muddy Ground ☐ Ponding Water ☐ Not Visible ☒ None Observed

☐ Flowing, Description: _____

Water Clarity: ☐ Clear ☐ Some particles ☐ Muddy ☐ Other: _____

Description: _____

Seep Spot Number 2

☐ Green Vegetation ☐ Wet or Muddy Ground ☐ Ponding Water ☐ Not Visible ☒ None Observed

☐ Flowing, Description: _____

Water Clarity: ☐ Clear ☐ Some particles ☐ Muddy ☐ Other: _____

Description: _____

Findings:

☐ a. The abutments/toe were not inspected.

☒ b. The abutments/toe appeared to be in satisfactory condition, no corrective actions are required at this time.

☐ c. The abutments/toe appeared to be in fair to poor condition and requires corrective action.

☐ d. The abutments/toe appeared to be in unsatisfactory condition and not expected to fulfill its intended function. Urgent corrective action is required.

Corrective Actions:

☐ e. Slope protection needs maintenance or repair. Description: _____

☐ f. Rut and/or Gully erosion was observed, which requires maintenance and/or repair. Description: _____

☐ g. A crack was observed along the abutments/near the toe, which requires further investigation to determine the underlining cause. Monitor the area and/or repair as required.

☐ h. The abutment/toe area was not visible due to high grass and bush vegetation. Clear high vegetation and maintain low to enable easy visual inspection.

☐ i. Tree(s) were observed along the abutment/toe. Trees have been identified as the probably cause of piping failures, and can possibly cause sever damage to the embankment if they are uprooted during a high winds. Corrective action is required to remove the tree hazards from the dam. Acceptable remedies include removal of the tree and its root structure down to a 2" diameter and reconstructing the damaged embankment section. All repair work shall be accomplished as per the requirements of licensed geotechnical or structural engineer. Routinely monitor the damaged area for signs of settlement and seepage.

☐ j. Seepage/Ponding water was observed. Monitor and conduct further investigation to locate the source of water and extent of any possible hazardous or developing condition.

☐ k. Seepage was observed flowing and particles were observed to be removed by the flow. Take immediate action to stop the loss of soil from the embankment. Conduct further investigation to determine the underlining cause and take corrective action. Monitor the area.

☐ l. _____

Dam ID: MA-0133 PUKALANI RESERVOIR	Inspection No: _____ Date: 4/7/06

9. Outlet Works:

Culvert / Pipe

Type / Size: 8" PVC

Culvert: ☐ Concrete ☐ Masonry ☐ unlined earth ☐ Other _____

Pipe: ☐ DIP ☐ Corrugated Metal ☒ PVC ☐ HDPE ☐ Concrete ☐ Other _____

Control Type: ☐ Gate ☒ Valve ☐ Other _____

Location: ☐ Control on Upstream side ☒ Control on Downstream side

Seepage: ☐ Green Vegetation ☐ Wet or Muddy Ground ☐ Ponding Water ☐ Not Visible ☒ None Observed

☐ Flowing, Description: _____

Water Clarity: ☐ Clear ☐ Some particles ☐ Muddy ☐ Other: _____

Description: _____

Findings:

☐ a. The outlet works were not inspected.

☒ b. The outlet works were not tested.

☒ c. The outlet works appeared to be in satisfactory condition, no corrective actions are required at this time.

☐ d. The outlet works appeared to be in fair to poor condition and requires corrective action.

☐ e. The outlet works appeared to be in unsatisfactory condition and not expected to fulfill its intended function. Urgent corrective action is required.

Corrective Actions:

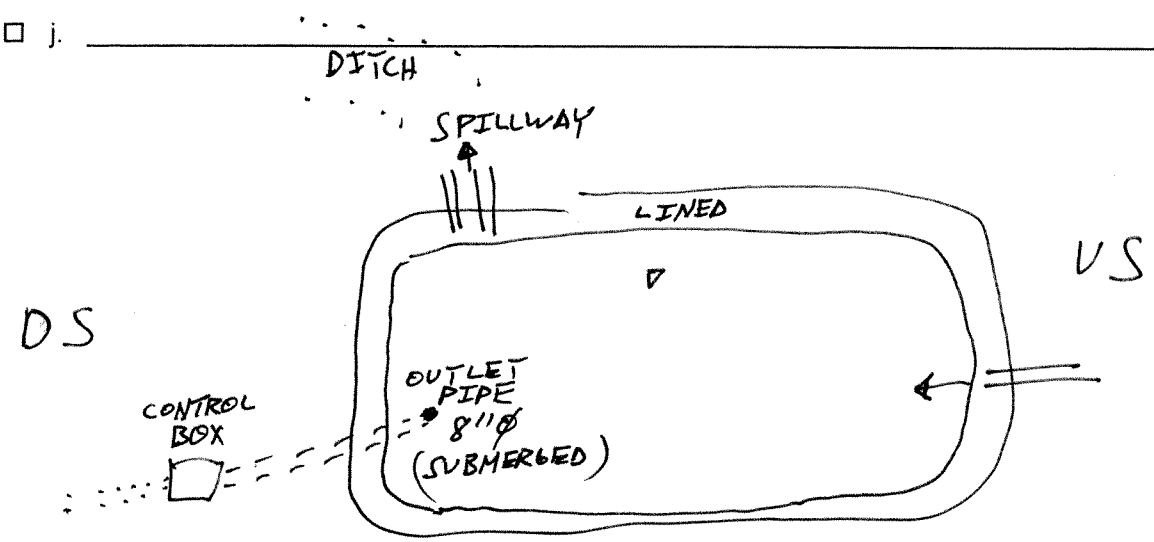
☐ f. Seepage/Ponding water was observed. Conduct further investigation to locate the source of water and extent of any possible hazardous or developing condition.

☐ g. Seepage was observed flowing and particles were observed to be removed by the flow. Take immediate action to stop the loss of soil. Conduct further investigation to determine the underlining cause and take corrective action. Monitor the area. Failures caused by seepage/piping along the outlet conduit are very common and are considered to be a dangerous situation.

☐ h. Were not visible due to high grass and bush vegetation. Clear high vegetation and maintain low to enable easy visual inspection.

☐ i. _____

☐ j. _____



Dam ID: MA-0133
PUKALANI RESERVOIR

Inspection No: _____
Date: 4/7/06

10. Spillway:

Type: ☐ None ☒ Culvert/Pipe ☐ Channel
Description: TWO 8" PVC PIPES

Dimension: _____ ft. Invert elevation: _____ ft. per staff gage

Slope Protection: ☒ None ☐ Grass ☐ Dumped Rock ☐ Fitted Rip Rap ☐ Grouted Rip Rap ☐ Concrete
☐ Defect in Protection: Description: _____

Approach: ☒ Clear ☐ High Veg. ☐ Trees ☐ Other: _____

Erosion: ☐ Scour ☐ Gully ☐ Headcut ☒ Not Observed ☐ Other: _____
Description: _____

Vegetation: ☒ None ☐ Low Ground Cover ☐ Bushes or Tall Grass ☐ Trees #_____ ☐ <6" ☐ >6" & <20" ☐ >20"
Description: _____

Findings:

☒ a. The Spillway appeared to be in satisfactory condition, no corrective actions are required at this time.
☐ b. The Spillway appeared to be in fair to poor condition and requires corrective action.
☐ c. The Spillway appeared to be in unsatisfactory condition and not expected to fulfill its intended function. Urgent corrective action is required.

Corrective Actions:

☐ d. Slope protection needs maintenance or repair. Description: _____
☐ e. The spillway approach was blocked. Clear approach.
☐ f. Severe scour erosion was observed which requires maintenance and/or repair.
Description: _____
☐ g. A headcut (vertical drop in channel due to erosion) was observed downstream of the spillway. Corrective action is required to prevent this problem from moving upstream.
☐ h. Trees are unacceptable in the spillway channel and approach. Take corrective action to address the woody vegetation problem and repair the damaged area.
☐ i. Unclear if spillway is adequately sized. Spillway should pass the probable maximum flood. Verify spillway capacity and take corrective action as required.
☐ j. _____

11. Down Stream Channel:

Name: DITCH

Downstream: ☐ Sump ☐ Open Area ☒ Un-Defined Drainage-way ☐ Defined Drainage-way ☐ Other _____

Items along Stream Bank: ☒ None ☐ Road ☐ Houses ☐ Town ☐ Not Inspected

Description: _____

Findings:

☒ a. The downstream channel was not inspected.
☐ b. The downstream channel appeared to be in satisfactory condition, no corrective actions are required at this time.
☐ c. The downstream channel appeared to be in fair to poor condition and requires corrective action.
☐ d. The downstream channel appeared to be in unsatisfactory condition and not expected to fulfill its intended function. Urgent corrective action is required.

Corrective Actions:

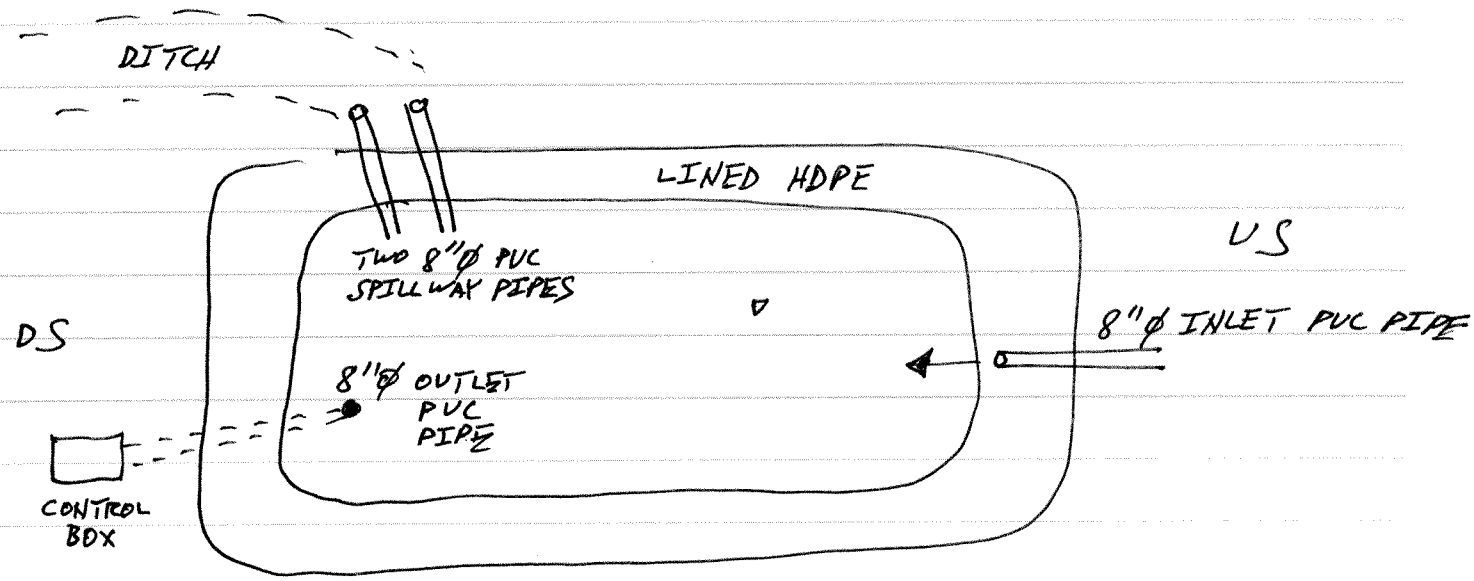
☐ e. _____

Dam ID: MA-0133 PUKALANI RESERVOIR	Inspection No: _____ Date: 4/7/06

Additional Comments:

On the date of this limited visual inspection, there appeared to be no immediate threat to the safety of the dam. No assurance can be made regarding the dam's condition after this date. Subsequent adverse weather and other factors may affect the dam's condition.

1) BASED ON VISUAL OBSERVATIONS AND DISCUSSIONS OF OPERATIONAL PROCEDURES OF THE DAM, THERE IS NO IMMEDIATE THREAT TO THE SAFETY OF THE DAM AT THIS TIME.



Limitations and Intent of this Dam Safety Inspection:

This Dam Safety Inspection was conducted to assess the general overall condition of the reservoir/dam, identify visible deficiencies, and recommend areas of for monitoring, additional investigative studies and corrective actions. The inspection is based only on visible features/areas of the dam on the day of inspection. This inspection is not a formal phase I or phase II dam safety inspection and does not include a review or evaluation from each specialist of an inspection team, such as a geologists, civil, geotechnical, structural, or hydraulics engineer. The owner should verify the findings of this report and take corrective actions. The owner may submit to the State alternative corrective actions that are certified by a licensed professional engineer in the State of Hawaii experienced in the design and construction of dams. This inspection does not relieve the owner/operator from their responsibility to conduct routine inspections, maintenance, repairs, modifications, monitoring, documentation, and/or investigative studies. The inspection was conducted under the authority of the Hawaii Revised Statures Chapter 179D, and Hawaii Administrative Rules, Title 13, Chapter 190, titled "Dams and Reservoirs". Questions regarding this inspection should be forwarded to the Hawaii State Dam Safety Program; PO Box 373; Honolulu, Hawaii 96809; Ph. (808) 587-0236.

Revised: Dec. 1, 2003