Dam ID: H100062	Vulnerability Index: Extreme 1 High 2 Moderate 3 Low 4	Inspection No: _____ Date: _____

STATE OF HAWAII - DLNR
VISUAL DAM SAFETY INSPECTION SHEET

Inspection Type: Dam Safety Inspection – Twin Reservoir

Persons Present	Affiliation	Phone Number
Alan Silva (DOFAW) 3/20/06	Hiram Young (DLNR) 3/23/06	
Rick Britsman (COE) 3/20/06	Sherri Paul (DOFAW) 3/23/06	
Hiram Young (DLNR) 3/20/06	Stafford Soto (DOFAW) 3/23/06	
	Dwayne Lillard (COE) 3/23/06	
	Jerry Raychel (COE) 3/23/06	

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

Comments: _____

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

Dam/Res. Name Twin Reservoir
Owner see back
Owner Contact _____ Owner Ph. _____
Lessee _____ Lessee Ph. _____
O & M Contractor see back O & M Ph. _____
Nearest City _____ Latitude _____ ° (decimal)
County _____ Longitude _____ ° (decimal)
Tax Map Key(s) _____

Dam Status _____ Hazard Potential _____ Dam Size _____
Year Completed _____ Dam Length _____ ft. Dam Height _____ ft.
Normal Storage _____ ac.ft. Max. Storage _____ ac.ft. Max. Surface Area _____ ac.
Offsite Drainage Area _____ mi. Spillway Type _____ Max. Spillway Q _____ cfs

Owner owns land under dam facility: _____
Emergency Action Plan on file with the Department: _____
Reports on file with the Department:

(back)

Landowners

1. **George "Geo" Hoffberg is owner of the larger reservoir and crest of dam (blocked road).**
2. **Leonard Kaui-owns downstream slope from top of crest. Spillway(s) and outlet are located on his land. Mr. Kaui has no rights to water and is not "clear" what his responsibilities are. re: maintenance of the downslope.**
3. **East Kauai Irrigation – Les Milnes. EKI has rights to use, operate water system, controls water level of the Twin (2) reservoirs.**

References

1. **1997 Dam Safety Report of Twin Reservoir by DLNR.**
2. **September 1979 – by Army COE for DLNR**

All the recommendations from the inspections of 3/20/06 and 3/21/06 are similar to those contained in 1979 and 1997 reports.

2. Questions for Owner's Rep.:	Yes	No	Unknown	Comments
Construction Plans Available	☐	☐	☐	
Site / Facility Map	☐	☐	☐	
Operation & Maintenance Manual	☐	☐	☐	
Emergency Action Plan	☐	☐	☐	
Modifications / Improvements	☐	☐	☐	
Conduct Routine Inspections	☐	☐	☐	
Conduct Routine Maintenance	☐	☐	☐	
Vehicle access to site	x	☐	☐	☐ Not accessible x With Standard car ☐ Requires 4-Wheel Drive
Access during heavy rains	x	☐	☐	☐ Not accessible x With Standard car ☐ Requires 4-Wheel Drive
Access when spillway is flowing	x	☐	☐	☐ Not accessible ☐ With Standard car X Requires 4-Wheel Drive
Other Studies Conducted	x	☐	☐	☐ Phase I ☐ Phase II ☐ Hydraulics ☐ Stability ☐ Hazard ☐ Seismic ☐ Other: 1979 by COE and 1997 by DLNR
Incident History	☐	☐	☐	☐ Breached ☐ Overtop ☐ Slide ☐ Down stream Flooding ☐ Other:
Reservoir's Current Use	x	☐	☐	☐ Sediment X 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.
- x h. The dam did not appear to be maintained on a regular basis.
- x 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:

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

3. Reservoir:

Level during inspection 5-6 ft per _____ (**gage** / other)

Normal Operating Level/Range _____ ft per _____ (gage / other)

Description: _____

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

☐ Other: _____

Sinkhole in Res.: ☐ # Observed: _____ Size: _____ by _____ in. Deep x Not Visible ☐ None Observed

Description: _____

Staff Gage: Description: wood gage

Findings:

x a. The reservoir was not inspected.

☐ b. The reservoir appeared to be in satisfactory condition, no corrective actions are required at this time. For "Geo" side

☐ 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 _____

☐ Intake Culvert / Pipe

Size: _____ 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:

x 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. _____

5. Upstream Slope: **(Typical Slope ± STEEP : __)**

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

☐ Defect in Protection: Description: _____

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

Description: _____

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

Description: _____

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

Description: _____

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

Description: clearing of large trees underway for "Geo" side

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.

x 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.

x 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. For both reservoirs

☐ k. _____

6. Crest: Approximate Crest Width: **Varies from 20 ft – 24 ft.**

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

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

Description: _____

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

Description: _____

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

Description: _____

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

Description: Paved

Findings:

☐ a. The dam crest was not inspected.

x 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:

x 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. _____

7. Downstream Slope: **(Typical Slope ± Steep : ____)**

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

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

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

Description: _____

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

Description: _____

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

Description: _____

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

Description: heavy vegetation

Seepage: Seep Spot Number 1

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

x Flowing, Description: see COE & DLNR reports for area in Kaui property

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

Description: no other seepage observed. Seepage seen flowing from roots of downed tree.

Seep Spot Number 2

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

☐ Flowing, Description: Entire toe of southeast embankment is wet/muddy.

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.

x c. The downstream slope appeared to be in fair to poor condition and requires corrective action.

☐ 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.

x j. 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.

x k. 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.

☐ l. 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.

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

☐ n. _____

8. Abutments/Toe:

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

Description: _____

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

Description: _____

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

Description: _____

Seepage: Seep Spot Number 1

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

X Flowing, Description: see COE & DLNR reports

Water Clarity: X 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.

x 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.

x 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.

x 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.

x 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. **On Kaui property**

☐ 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. _____

9. Outlet Works:

Culvert / Pipe

Type / Size: Unlined tunnel @ exit. Reported lined upstream, but could not verify due to flow.

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

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

Control Type: x Gate ☐ Valve ☐ Other _____

Location: x 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.

x 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.

x i. 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.

X j. note 1979 picture of outlet and compare to 1997 picture, In the 3/20 inspection, the opening at outlet is approximately 30' wide. Erosion at exit is increasing in size. Extend conduit lining

X k. Catwalk to outlet tunnel should be evaluated by structural engineer. Since spillways are unusable, dam safety depends on reservoir control.

10. Spillway:

Type: ☐ None x Culvert/Pipe ☐ Channel

Description: see 1979 & 1997 reports for additional pictures

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.

X 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:_____

X e. The spillway approach was blocked. Clear approach.

X f. Severe scour erosion was observed which requires maintenance and/or repair.
Description:_____

X g. A headcut was observed downstream of the spillway. Corrective / mitigative action is required to prevent this problem from moving upstream.

X h. Trees are unacceptable in the spillway channel and approach. Take corrective action to address the woody vegetation problem and repair the damaged area.

x 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: _____

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

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

Description: _____

Findings:

x 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. _____

Additional Comments:

1. Upstream and downstream slopes are very steep.

2. U/S and D/S slopes are heavily vegetated, downstream slope has large trees..

3. Dam has three spillway tunnels.

- one is partially concrete lined, partially unlined

- one is unlined and collapsed

- both of the above have headcutting and scour at outlet

- both of the above have wire fencing at outlet

- the third spillway tunnel was not found or inspected

4. Downstream toe of southeast embankment has seepage or wet muddy conditions along entire toe.

5. Outlet control is accessed by a catwalk. Requires structural evaluation since spillways are not usable and this is the only control for this structure.

6. Previous inspection reports in 1979 and 1997 found similar deficiencies which have not been addressed.

7. Imperative that reservoir level be controlled

8. Outlet works and tunnel should have immediate detailed inspection/evaluation. The unlined portion and the erosion at the exit are of special concern.

RECOMMENDATIONS

- 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. Seepage should be monitored to be sure that piping (i.e. internal erosion) does not develop.

-Inspection reports written in 1979 and 1997 have made recommendations that have not been implemented to date. These reports should be reviewed by the owners and recommendations implemented.

-A V-notch weir, was installed near the downstream toe of the dam to collect & monitor/measure the rate or volume of seepage with respect to changes (i.e. increase & decrease) in reservoir (pool) elevation. It appears to be in disrepair and the operator was unaware of ts existence. It should be refurbished and used.

- The slopes should be clear and visible for inspection. The existing trees have been allowed to grow so large in some cases that there is concern that seepage and piping (i.e. internal erosion) along root systems may develop. There is additional concern that cutting and killing the trees will lead to rotten roots and greater potential for such seepage and piping . A more in depth evaluation of the condition should be performed to determine how best to remediate the condition.

-. A path or roadway along the groins, the toe and to the outlet discharge point should be cleared and maintained to facilitate periodic inspection, maintenance, monitoring of seepage conditions, and remediation, if required,

- The spillways are in disrepair as described above. The operator has been holding the pool below the spillway but requires immediate guidance until spillway capacity is restored and verified as adequate. It is imperative that the owners retain professional hydrologic personnel to provide operating guidance and spillway analysis and repair guidance.

The previous inspection reports mentioned in this report have recommended extending the outlet conduit beyond the downstream slope. This has not been done and the erosion damage has increased. These recommendations should be implemented.

The structure leading to the outlet control should be evaluated and repaired as needed to assure that access is maintained.

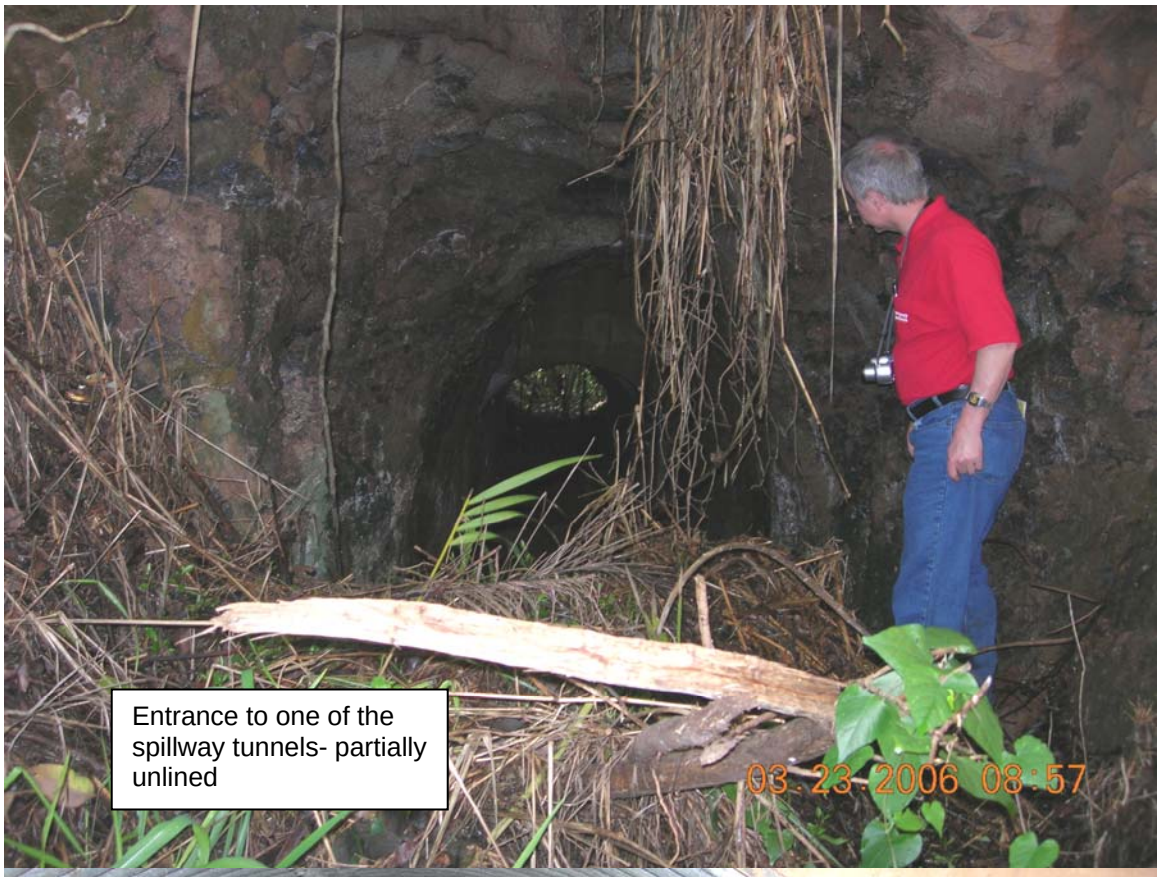
- The stability of the slopes should be further evaluated. If flattening of the slopes is required incorporation of measures to resolve clearing, and potential seepage issues on the downstream slopes may be possible.

Limitations and Intent of this Dam Safety Inspection:

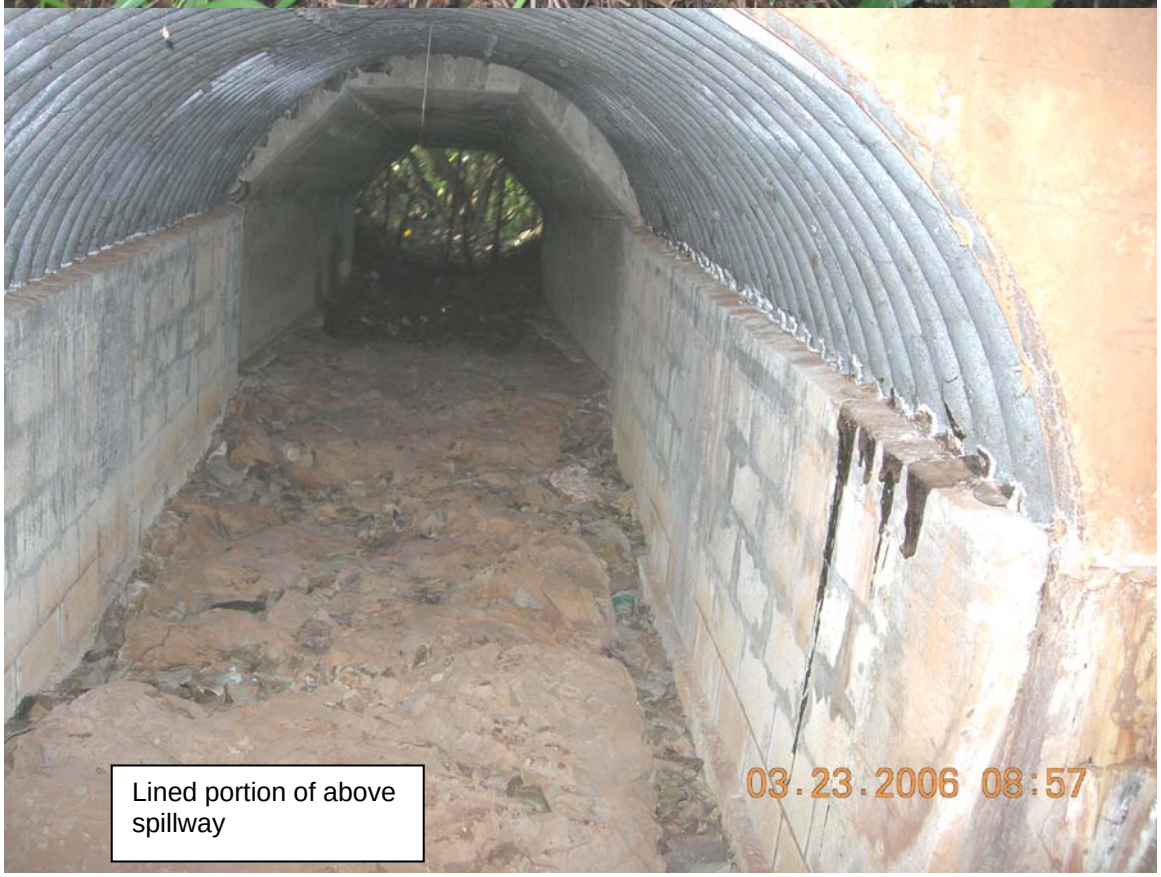
This Dam Safety Inspection was conducted to assess the general overall condition of the reservoir/dam, identify visible deficiencies, and recommend areas of for monitoring, additional investigative studies and corrective actions. The inspection is based only on visible features/areas of the dam on the 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.

Catwalk to outlet control

Upstream slope

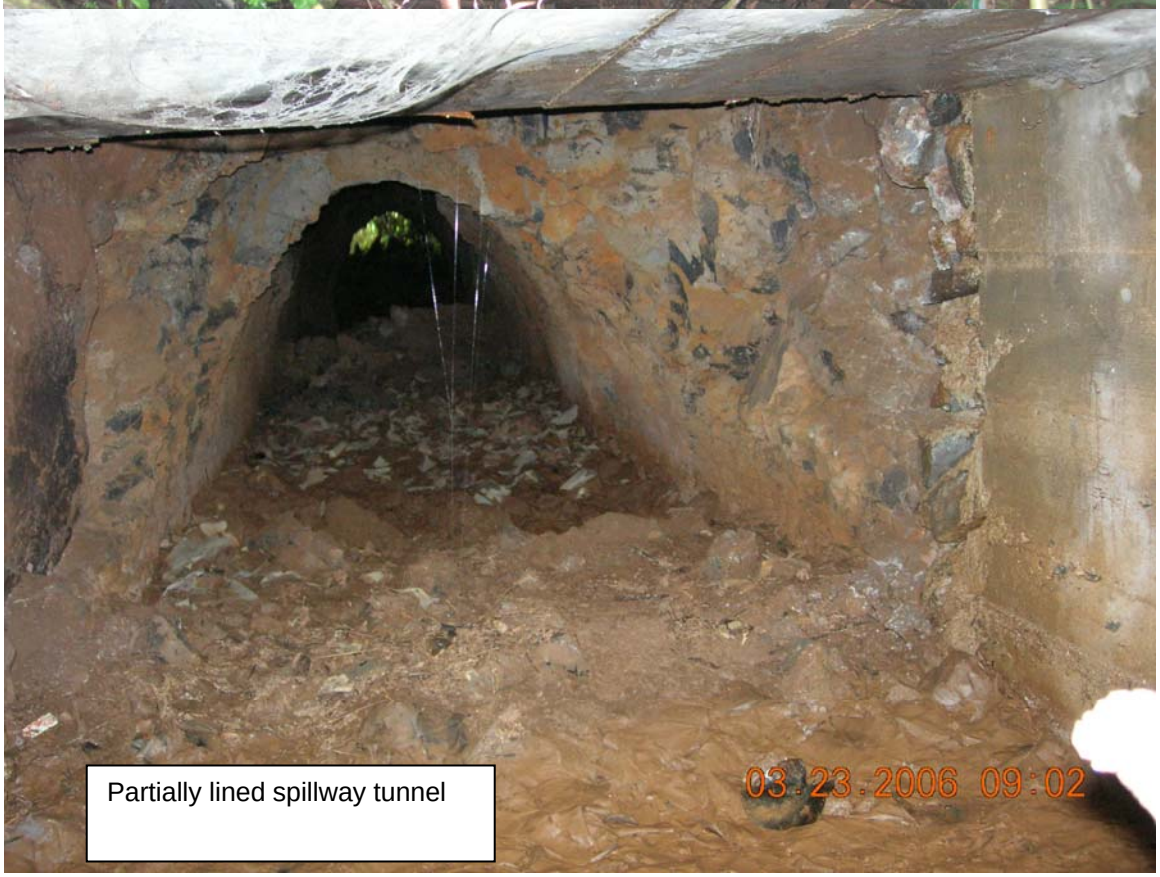


Entrance to one of the spillway tunnels- partially unlined



Lined portion of above spillway

Fenced at outlet of collapsed spillway tunnel



Partially lined spillway tunnel

Damaged V-notched seepage measurement weir

Unlined portion of outlet conduit

Seepage emerging from beneath fallen tree

Dam crest, note trees on slopes

View of southeast embankment to the left, taken from causeway separating reservoirs

Catwalk to outlet control

Cavity beneath Spillway outlet on D/S

Collapsed spillway tunnel inlet

Seepage at base of tree