OPERATION AND MAINTENANCE PLAN

[INSERT DAM NAME]

National Inventory of Dams (NID) No. [Insert NID No.]

[INSERT DAM LOCATION]

[Insert Date]

Prepared for:

[Insert Name]
[Insert Address]
[Insert Address]

Prepared by:

[Insert Name]
[Insert Address]
[Insert Address]

[Insert Date]

TABLE OF CONTENTS

TYPICAL LIST OF TABLES

TYPICAL LIST OF ATTACHMENTS

REVISION SHEET
Operation and Maintenance Manual

FOR
[Insert Dam Name]

No.	Description of Revision Made	By	Date
#	Click here to enter text.	by	Date
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DISTRIBUTION LIST
Operation and Maintenance Manual

FOR
[Insert Dam Name]

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1.0 INTRODUCTION

1.1 Operation and Maintenance Plan Purpose

An Operations and Maintenance (O&M) Plan (referred to in this document as the Plan) is the most important reference for management of the [insert dam name] [insert NID No.]. The Plan will describe the components and will outline the operation, inspection and maintenance activities necessary to maintain the dependability of the system. This manual is intended to cover normal operating conditions; for recommended actions during emergency conditions, please refer to the Emergency Action Plan.

1.2 Plan Organization

The Plan is intended to be used by O&M personnel as a guide for operating, maintaining and monitoring the dam. As such, it is presented in sections specific to each system component and/or necessary activity. The Plan is organized into the following sections:

1.0 Introduction – This section outlines the objectives and organization of the Plan.
2.0 Dam Facility Description – This section describes the [insert dam name] and its components and includes stakeholder contact information and pertinent dam data (Tables 1 and 2).
3.0 Operations – This section describes the operations of the general system components of the [insert dam name] (Table 3).
4.0 Instrumentation and Monitoring – This section describes the instruments and instruction for monitoring them.
5.0 Inspection – This section describes the inspection recommendation for the [insert dam name] (Tables 4, 5, and 6).
6.0 Maintenance – This section describes the routine maintenance activities and procedures for each system component (Table 7).

2.0 DAM FACILITY DESCRIPTION

Insert a description of the following:

- Dam location and access
- Dam ownership
- Maintenance responsibilities
- Physical features of the dam - Include embankment, spillway, outlet, inflow, instrumentation, operating mechanisms or components, and any other applicable system features or relevant information.

Include:

- A table summarizing all pertinent system data - Table 2 is an example of a pertinent data summary table and can be used as a guide for developing a summary of pertinent data.
- List of contacts - Table 1 is an example of a contact list and can be used to aid in developing a contact list.
- Site plan (Attachment 1) showing locations of facility components
- Typical cross section through the embankment - Attachment 2 is a typical cross section of an earth embankment with places to insert elevations of relevant project features and can be used to develop a site specific cross section.
- Photographs of each system component, if available.

3.0 OPERATIONS

Insert a description of the following:

- General reservoir operation, including the regulation of inflow and outlet ditches, the maximum allowable pool levels for different times of the year, maximum or minimum carry over storage, and maximum or minimum permissible outlet releases as applicable to the structure.
- Operation of the outlet to limit or prevent excessive spillway flow
- Method for periodic drainage of the reservoir to permit thorough outlet and upstream slope inspection.

Include:

- Complete, clear, step-by-step instructions for operating each mechanism or component described in Section 2.0.
- The correct method of opening and closing gates and valves. Emphasize proper sequences.
- Sketches, drawings, and photographs to identify specific handles, cranks, buttons, etc.
- A schematic diagram for hydraulic and electric gates, showing each component (including back-up equipment) and its place in the operating sequence.
- An Operations Schedule - Table 3 can be used as an aid to develop the schedule.
- An Operations Log that provides information that may be of importance to their specific structure. An example Operations Log is included as Attachment 3 and may be developed a site-specific Operations Log or the Operations Log may be in the form of an electronic record or database, as applicable to the structure.

4.0 INSTRUMENTATION AND MONITORING

Insert a description of the following:

- All instruments used to monitor the dam with locations shown on the site plan (Attachment 1) or other maps, as appropriate.
- A discussion of the purpose of each instrument
- Clear step-by-step instructions on how to use each instrument and how to take measurements at each monitoring point
- Instructions on how to document each measurement.
- Discussion of results and recommendations for data reduction and subsequent calculations, and comparison to existing data.

Include:

- Recommended instrument monitoring frequencies on the Operation Schedule. Table 3 can be used as an aid to develop the schedule.
- Information on what is considered a normal or abnormal reading
- Relevant threshold values
- Procedures to be followed when abnormal readings are recorded or threshold values are exceeded.
- Instrument Monitoring Data forms applicable to the structure for recording instrument monitoring data. Example Instrument Monitoring Data forms are included as Attachment 4 and may be used as an aid in developing site-specific forms or electronic data recording procedures may be developed, as applicable to the structure.

5.0 INSPECTIONS

Insert a description of the following:

- Inspection requirements, including the types and frequency of recommended inspections
- An Inspection Schedule. An example Inspection Schedule is included as Table 4 and can be used to develop the schedule for the structure.

Include:

- Specific inspection procedures
- Clear, step-by-step set of instructions for conducting routine/informal inspections, annual inspections and special inspections of the dam and its surroundings.
- A list or table of what to look for during an inspection for each of the physical features of the system described in Section 2.0. Tables 4, 5, and 6 are examples of the types of things to look for during an inspection, presented by system component. These tables can be used as an aid in developing specific inspection instructions for the structure.
- Dam Safety Inspection Forms. Attachment 5 is an example form that can be used to develop site specific inspection forms.

6.0 MAINTENANCE

Insert a description of the following:

- General maintenance requirements for the dam
- Specific maintenance requirements for each operational component and all monitoring instruments described in Section 2.0
- A schedule for general and specific maintenance activities. An example Maintenance Schedule is included as Table 5 and can be used to develop the schedule for the structure.

Include:

- Clear and detailed instructions for performing maintenance so that new personnel can understand the tasks required and experienced personnel can verify that they have completed the work properly.
- A list or table of recommended maintenance activities for each of the physical features of the system described in Section 2.0. Table 7 is an example summary of the types of maintenance activities common for earth embankments and can be used as an aid in developing specific maintenance procedures for the structure.

Table 1. Example Contact List – [Insert dam name]

Role	Organization	Office Address	Representative and Phone Number
Owner			
Owner			
Operator			
Maintenance			
Regulator			
Emergency Contact			
Emergency Contact			
State Dam Safety			
County Emergency			
Emergency Services			
Others as Needed			

Table 2. Example Summary of Pertinent Data – [Insert dam name]

Item	Description
General	
State/National ID & Name	
Latitude/Longitude	
County/Island/Nearest Town	
Size Classification	
Drainage Area	
Inflow	
Type/Size/Configuration	
Control device(s)	
Bypass(s)	
Reservoir family	
Outlet	
Type/Size/Configuration	
Control location	
Conduit type	
Conduit size	
Conduit invert	
Intake/Control	
Embankment	
Type of dam	
Minimum crest width	
Upstream slope	
Upstream slope protection	
Downstream slope	
Downstream slope protection	
Height	
Length	
Spillway	
Type	
Length	
Crest Elevation	
Normal Pool Elevation	
Available Freeboard	
Maximum Discharge	
Reservoir	
Normal Storage	
Maximum Storage	
Surface Area	
Access	
Access Surface	
Access Method	
Access Description	

Table 3. Example Operations Schedule – [Insert dam name]

ACTIVITY		Quarterly		Annually	Occasional Occurrence	Required Forms (2)
Operations	Dam Visit	✓				Operations Log
	Transmit Log & Forms			✓		
	Flood Operations				✓	
Instrumentation	Reservoir Staff Gauges	✓				Reservoir Staff Gauge Monitoring Data Form
	Survey Points				✓	Survey Point Monitoring Data Form

Table 4. Example Inspection Schedule – [Insert dam name]

ACTIVITY		Quarterly	Semi-Annually	Annually	Occasional Occurrence	Required Forms
Inspection	Routine/Informal Inspection	✓				Operations Log
	Annual Inspection			✓		Dam Safety Inspection Form
Unusual or Emergency Event	Special Inspection				✓	Dam Safety Inspection Form
	Emergency Action				✓	Operations Log

Table 5. Example Maintenance Schedule – [Insert dam name]

ACTIVITY		Quarterly	Semi-Annually	Annually	Occasional Occurrence	Required Forms (2)
Maintenance	Mow Grass	✓(1)				
	Maintain, Valves, Gates & Operators	Per Manufacturer's Recommendations				
	Control Vegetation		✓(1)			
	General Maintenance		✓			

(1) At least twice during growing seasons.

Table 4. Example summary of routine/informal inspection activities – [Insert dam name]

Component	What to Look For	What to Record
Safety	▪ Take safety seriously.	▪ Personnel on-site ▪ Weather conditions ▪ Reservoir water level
Reporting	▪ Operations Log	▪ File completed Operations Log in project O&M Plan
Access	▪ Condition of gates and locks ▪ Condition of signage ▪ Evidence of vandalism	▪ Location ▪ Description
Inflow structure	▪ Obvious problems and/or damage (erosion, cracks or spalling, deterioration, etc.).	▪ Location ▪ Description
Inflow control device	▪ Obvious problems and/or damage (erosion, cracks or spalling, deterioration, etc.).	▪ Location ▪ Description
Outlet	▪ Obvious problems and/or damage (cracks and spalling, deterioration, blocked trashracks etc.).	▪ Location ▪ Description
Embankment (crest, slopes, toes)	▪ Obvious problems and/or damage (erosion, excessive vegetation, sinkholes, etc.).	▪ Location (station and offset) ▪ Description ▪ Limits (length, width, depth, height)
Spillway	▪ Obvious problems and/or damage (erosion, damage, riprap displacement, etc.).	▪ Location ▪ Description ▪ Limits (length, width, depth, height)
Staff Gauges	▪ Obvious problems and/or damage	▪ Location ▪ Description
Survey Monuments	▪ Obvious problems and/or damage	▪ Location ▪ Description
Reservoir	▪ Obvious problems (debris buildup, upstream development, etc.).	▪ Location ▪ Description

Table 5. Example summary of annual inspection activities – [Insert dam name]

Component	What to Look For	What to Record
Safety	▪ Take safety seriously.	▪ Personnel on-site ▪ Weather conditions ▪ Reservoir water level
Reporting	▪ Dam Safety Inspection Form	▪ File completed Dam Safety Inspection Form in project O&M Plan
Access	▪ Condition of gates and locks ▪ Condition of signage ▪ Evidence of vandalism ▪ Condition of crest road	▪ Location ▪ Description
Inflow structure	▪ Obstructions or blockage hampering flow ▪ Structural integrity of concrete ▪ Damage, deterioration or malfunction of valve	▪ Location ▪ Description
Inflow control device	▪ Obstructions, blockage, leakage or significant structural cracks ▪ Deterioration and structural integrity of concrete ▪ Evidence of any abnormal settlements, heaving, deflections or lateral movements in the concrete channel ▪ Erosion or sedimentation in inlet channel and energy dissipater	▪ Location (station and offset) ▪ Description ▪ Limits (length, width, depth, height) ▪ Flow rate in channel (if applicable)
Outlet	▪ Obstructions or blockage hampering flow ▪ Structural integrity of concrete	▪ Location ▪ Description
Embankment	▪ Settlement, depressions, sinkholes, cracking, slides, sloughing, erosion, crest and downstream alignment seepage ▪ Piping, boils, low spots on crest ▪ Unauthorized activity (construction, excavation, etc.) on or adjacent to the dam ▪ Excessive vegetation ▪ Rodent activity	▪ Location (station and offset) ▪ Description ▪ Limits (length, width, depth, height) ▪ Flow rate (if applicable)
Spillway	▪ Erosion or lining damage (loss, disturbance, weathering or abrasion of lining material) ▪ Sloughing or cracking on side slopes ▪ Displacement of riprap ▪ Erosion or scour of upstream or downstream ends ▪ Rodent activity ▪ Excessive vegetation growth.	▪ Location ▪ Description ▪ Limits (length, width, depth, height)
Staff Gauges	▪ Damage or deterioration	▪ Location ▪ Description
Survey Monuments	▪ Damage or deterioration	▪ Location ▪ Description

Reservoir	▪ Changes to the surface of the drainage basin (changed agriculture practices, railroad or highway construction or real estate developments) ▪ Evidence of any abnormal settlements, heaving, deflections or lateral movements in the culvert	▪ Location (station and offset) ▪ Description ▪ Limits (length, width, depth, height) ▪ Flow rate in culvert (if applicable)

Table 6. Example Special inspections – [Insert dam name]

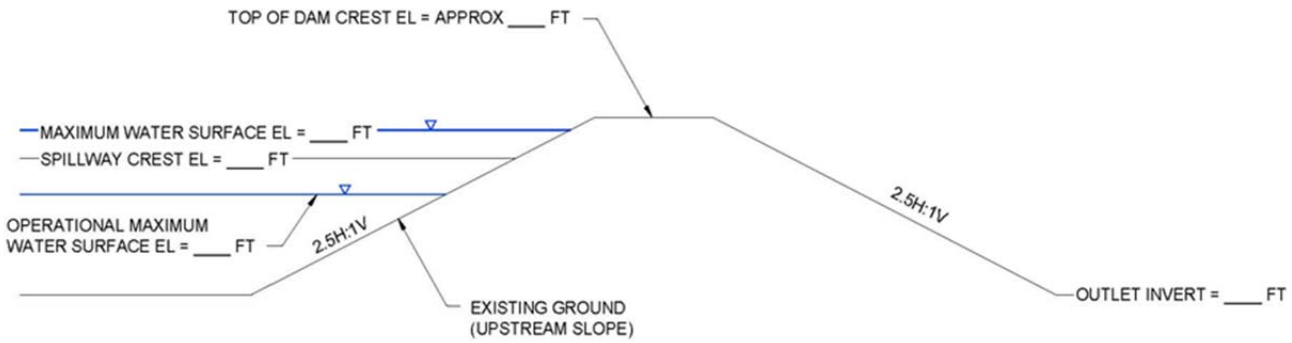
Type of inspections	Inspection items	Operational duties
High water conditions	▪ Conduct during floods and high water events ▪ Monitor performance of flood control works ▪ Monitor landside slope and toe for excessive seepage and piping problems	▪ Initiate and take corrective actions, as required.
Post flood	▪ Conduct after a flood event	▪ Inspect and assess condition of flood control works.
Post earthquake	▪ Conduct immediately after an earthquake in accordance with Hawaii Dam Safety guidelines. Conduct a follow-up inspection after a period of several days to two weeks, depending on site-specific considerations.	▪ Conduct a rapid overall assessment of the remaining level of protection ▪ Identify immediate danger of secondary damage

Table 7 – Example summary of required maintenance activities – [Insert dam name]

Component	Maintenance activity	Responsibility	
		Person 1	Person 2
Inlet structure	▪ Promptly repair or replace damaged lining and components.		
	▪ Remove sediment that has accumulated to maintain capacity of the channel.		
	▪ Vegetation shall be maintained and trees and brush controlled by chemical or mechanical means. Control noxious weeds.		
	▪ Keep machinery away from steep side slopes. Keep equipment operators informed of all potential hazards.		
Inlet control device	▪ Promptly repair or replace damaged components.		
	▪ Exercise gate valve regularly.		
	▪ Lubricate in accordance with manufacturer's recommendations.		
	▪ Repair deteriorated concrete as soon as possible.		
Outlet	▪ Exercise regularly.		
	▪ Lubricate in accordance with manufacturer's recommendations.		
	▪ Promptly repair or replace damaged components.		
Embankment	▪ Fill rills and gullies that occur on the embankment slopes and in the vegetated spillway and reseed the filled areas.		
	▪ When animal burrows are found, remove the burrowing animals, replace embankment materials and reseed.		
	▪ Maintain a vigorous sod in the emergency spillway and on embankment by regular mowing and fertilization. Remove excess growth. Do not burn or overgraze.		
	▪ Prevent trees and brush from growing on embankment slopes, crest, or toe. Control tree and bush growth by hand cutting, mowing, or chemicals. Avoid damaging grass with herbicide sprays.		
	▪ Maintain a fencing to keep livestock of embankment, where applicable.		
	▪ Operate mowing and other equipment on slopes in accordance with machinery operation manual.		
Spillway	▪ Fill rills and gullies that occur in the vegetated spillway and reseed the filled areas.		
	▪ Maintain a vigorous sod in the spillway by regular mowing and fertilization. Remove excess growth. Do not burn or overgraze.		
	▪ Do not graze livestock during establishment of vegetation and when soil conditions are wet.		
	▪ Protect spillway from damage by farm equipment and vehicles. Do not use spillway as a road and practice care when crossing to prevent tillage marks or wheel tracks.		
	▪ Prevent trees and brush from growing in the spillway. Control tree and bush growth by hand cutting, mowing, or chemicals. Avoid damaging grass with herbicide sprays.		
	▪ Reestablish vegetative cover immediately where scour erosion has removed established seeding.		
	▪ Where there is rock lining, replace any dislodged rock and fill back to grade if displacement or settlement occurs.		
Staff gauges	▪ Promptly repair or replace damaged components		
Survey Monuments	▪ Promptly repair or replace damaged components		

ATTACHMENT 1
SITE PLAN
[Insert Site Plan]

ATTACHMENT 2
TYPICAL SECTION THROUGH EMBANKMENT
[See Example Below]



ATTACHMENT 3
EXAMPLE OPERATIONS LOG

[See Example on Next Page]

State of Hawaii Inventory Number: _____	OPERATIONS LOG	Date: _____ Page __ of __

Weather: _____
Reservoir Water Surface Elevation: _____
Spillway Discharge (cfs): _____
Diversion Structure Discharge (cfs): _____
Attendance: _____

Operations: _____

Maintenance: _____

Observations: _____

Other Items: _____

ATTACHMENT 4
EXAMPLE INSTRUMENT MONITORING DATA FORMS
[See Examples on Following Pages]

DRAIN OUTFALL/WEIR MONITORING TABLE

DRAIN OUTFALL/WEIR NO. _____

Date	Time	Read By	Height of water above weir (feet)	Discharge (cfs)	Comments
					Turbidity

Notes:

Use the following equation to compute flow in gallons per minute (gpm): $Q = 461.558\ (H)^{5/2}$

Where H = height (in feet, measured to nearest hundredth) of water flowing over the weir.

PIEZOMETER MONITORING DATA

PIEZOMETER NO. _____

Date	Reservoir Water Surface Elevation (feet)	Top of PVC Pipe Elevation (feet msl)	Depth to Water (feet)	Water Elevation (feet)

Notes:

Water elevation = Top of PVC pipe elevation - depth to water

RESERVOIR STAFF GAGE MONITORING DATA

Date	Staff Gage Reading (feet)	Reservoir Water Surface Elevation (feet)	Comments

Notes:

Where applicable, use real time data available from USGS http://waterdata.usgs.gov/nwis

SURVEY POINT MONITORING DATA

				STRUCTURAL SURVEY CONTROL POINTS							
Date	Reservoir Elevation (ft)	Surveyor	Survey Data	Original	Current	Original	Current	Original	Current	Original	Current
06/20/12	6.25	mf	Northing								
			Easting								
			Elevation								
			Northing								
			Easting								
			Elevation								
			Northing								
			Easting								
			Elevation								
			Northing								
			Easting								
			Elevation								
			Northing								
			Easting								
			Elevation								
			Northing								
			Easting								
			Elevation								

Notes:

All points will be surveyed by a licensed surveyor to measure northings, easting, and elevations to the nearest 0.01 foot.

Composite Monitoring Data Form Example

Dam Name, Dam #

Date	Water Level	Gate Opening	Piezometer Reading	Drain Measurement	Operations, Maintenance and Observation	Operator

ATTACHMENT 5
DAM SAFETY INSPECTION FORM

Dam ID: HI-####
Hawaii Reservoir

DAM SAFETY INSPECTION SHEET

Inspection No: _____
Date: Month Day, Year

Inspection Type: Visual Dam Safety Inspection

Persons Present	Affiliation	Phone Number

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

Comments: _____

---

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

Dam/Res. Name _____
Owner _____
Owner Contact _____ Owner Ph. _____
Lessee _____ Lessee Ph. _____
O & M Contractor _____ 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 _____ sq 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:

Dam ID: HI-####
Hawaii Reservoir

Inspection No: _____
Date: Month Day, Year

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	☐	☐	☐	☐ 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
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 and Significant 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 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. Submit narrative and additional information detailing the improvements, modifications, and/or alterations at the dam site, unless covered by approved dam permit.
- ☐ h. Routine inspection logs were not inspected.
- ☐ i. Dam owners shall provide for routine inspection of the dam.
- ☐ j. The dam did not appear to be maintained on a regular basis.
- ☐ k. Access to site appears to be satisfactory.
- ☐ l. There is no vehicular access to the dam site. Operational and emergency plans need to reflect this deficiency or access provided.
- ☐ m. 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.
- ☐ n. 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
- ☐ o. _____

Additional Requirements:

The following investigative study(s) are:

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

Dam ID: HI-#### **Inspection No:** _____

Hawaii Reservoir **Date:** Month Day, Year

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

3. Reservoir:

Level during inspection _____ ft per _____ (gage / other)

Normal Operating Level/Range _____ ft per _____ (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: _____

Findings:

☐ a. The reservoir was not inspected.
☐ b. Satisfactory – Expected to fulfill intended function – no corrective action required.
☐ c. Fair - Expected to fulfill intended function, but maintenance or other actions are recommended.
☐ d. Poor – May not fulfill intended function; maintenance, repairs, or other actions are necessary.
☐ e. Unsatisfactory – Is not expected to fulfill intended function; repair, replacement, or modification is necessary.
☐ f. Unknown – Not visible, not accessible, not inspected, or unable to determine based on the observation taken.

Corrective Actions:

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

4. Inflow Works Description:

☐ Number of Inflows _____

☐ Inflow 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 _____

☐ Inflow 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 inflow works were not inspected.
☐ b. Satisfactory – Expected to fulfill intended function – no corrective action required.
☐ c. Fair - Expected to fulfill intended function, but maintenance or other actions are recommended.
☐ d. Poor – May not fulfill intended function; maintenance, repairs, or other actions are necessary.
☐ e. Unsatisfactory – Is not expected to fulfill intended function; repair, replacement, or modification is necessary.
☐ f. Unknown – Not visible, not accessible, not inspected, or unable to determine based on the observation taken.

Corrective Actions:

☐ g. The inflow works needs maintenance and/or repair. Description: _____
☐ h. _____

Dam ID: HI-####
Hawaii Reservoir

Inspection No: _____
Date: Month Day, Year

5. Upstream Slope: **(Typical Slope ± _____ : ____)**

Slope Protection: ☐ None ☐ Dumped Rock ☐ Fitted Rip Rap ☐ Grouted Rip Rap ☐ Liner _____ ☐ 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. Satisfactory – Expected to fulfill intended function – no corrective action required.
☐ c. Fair - Expected to fulfill intended function, but maintenance or other actions are recommended.
☐ d. Poor – May not fulfill intended function; maintenance, repairs, or other actions are necessary.
☐ e. Unsatisfactory – Is not expected to fulfill intended function; repair, replacement, or modification is necessary.
☐ f. Unknown – Not visible, not accessible, not inspected, or unable to determine based on the observation taken.

Corrective Actions:

☐ g. Slope protection needs maintenance or repair. Description: _____
☐ h. Rut and/or Gully erosion was observed on the slope, which requires maintenance and/or repair. Description: _____
☐ i. A crack was observed on the slope, which requires further investigation to determine the underlining cause. Monitor the area and/or repair as required.
☐ j. A sinkhole was observed on the slope, which requires further investigation to determine the underlining cause. Repair and monitor the area.
☐ k. The upstream slope was not visible due to high grass and bush vegetation. Clear high vegetation and maintain low to enable easy visual inspection.
☐ l. Tree(s) were observed on the dam embankment. Trees have been identified as the probable cause of piping failures, and can possibly cause severe damage to the embankment if they are uprooted during a high winds. Corrective action is required to remove the tree hazards from the dam. All repair work shall be accomplished as per the requirements of licensed geotechnical or civil engineer. Routinely monitor the damaged area for signs of settlement and seepage.
☐ m. _____

Dam ID: HI-####	Inspection No:
Hawaii Reservoir	Date: Month Day, Year

6. Crest: Approximate Crest Width: _____

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: _____

Findings:

- ☐ a. The crest was not inspected.
- ☐ b. Satisfactory – Expected to fulfill intended function – no corrective action required.
- ☐ c. Fair - Expected to fulfill intended function, but maintenance or other actions are recommended.
- ☐ d. Poor – May not fulfill intended function; maintenance, repairs, or other actions are necessary.
- ☐ e. Unsatisfactory – Is not expected to fulfill intended function; repair, replacement, or modification is necessary.
- ☐ f. Unknown – Not visible, not accessible, not inspected, or unable to determine based on the observation taken.

Corrective Actions:

- ☐ g. Access along the crest was satisfactory.
- ☐ h. Access along the crest was not possible. Description: _____
- ☐ i. Rut and/or Gully erosion was observed on the crest, which requires maintenance and/or repair. Description: _____
- ☐ j. A crack was observed on the crest, which requires further investigation to determine the underlining cause. Monitor the area and/or repair as required.
- ☐ k. A sinkhole was observed on the crest, which requires further investigation to determine the underlining cause. Repair and monitor the area.
- ☐ l. 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.
- ☐ m. Tree(s) were observed on the dam embankment. Trees have been identified as the probable cause of piping failures, and can possibly cause severe damage to the embankment if they are uprooted during a high winds. Corrective action is required to remove the tree hazards from the dam. All repair work shall be accomplished as per the requirements of licensed geotechnical or civil engineer. Routinely monitor the damaged area for signs of settlement and seepage.
- ☐ n. _____

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

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. Satisfactory – Expected to fulfill intended function – no corrective action required.
☐ c. Fair - Expected to fulfill intended function, but maintenance or other actions are recommended.
☐ d. Poor – May not fulfill intended function; maintenance, repairs, or other actions are necessary.
☐ e. Unsatisfactory – Is not expected to fulfill intended function; repair, replacement, or modification is necessary.
☐ f. Unknown – Not visible, not accessible, not inspected, or unable to determine based on the observation taken.

Corrective Actions:

☐ g. Slope protection needs maintenance or repair. Description: _____
☐ h. Rut and/or Gully erosion was observed on the slope, which requires maintenance and/or repair. Description**:** _____
☐ i. A crack was observed on the slope, which requires further investigation to determine the underlining cause. Monitor the area and/or repair as required.
☐ j. A sinkhole was observed on the slope, which requires further investigation to determine the underlining cause. Repair and monitor the area.
☐ k. 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.
☐ l. Tree(s) were observed on the dam embankment. Trees have been identified as the probable cause of piping failures, and can possibly cause severe damage to the embankment if they are uprooted during a high winds. Corrective action is required to remove the tree hazards from the dam. All repair work shall be accomplished as per the requirements of licensed geotechnical or civil engineer. Routinely monitor the damaged area for signs of settlement and seepage.
☐ m. 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.
☐ n. 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.
☐ o. The slope was very steep, around a 1 to 1 slope, further study is required to verify slope stability.
☐ p. _____

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8. Abutments:

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 were not inspected.
- ☐ b. Satisfactory – Expected to fulfill intended function – no corrective action required.
- ☐ c. Fair - Expected to fulfill intended function, but maintenance or other actions are recommended.
- ☐ d. Poor – May not fulfill intended function; maintenance, repairs, or other actions are necessary.
- ☐ e. Unsatisfactory – Is not expected to fulfill intended function; repair, replacement, or modification is necessary.
- ☐ f. Unknown – Not visible, not accessible, not inspected, or unable to determine based on the observation taken.

Corrective Actions:

- ☐ g. Slope protection needs maintenance or repair. Description: _____
- ☐ h. Rut and/or Gully erosion was observed, which requires maintenance and/or repair. Description: _____
- ☐ i. A crack was observed along the abutments, which requires further investigation to determine the underlining cause. Monitor the area and/or repair as required.
- ☐ j. The abutment area was 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 on the dam embankment. Trees have been identified as the probable cause of piping failures, and can possibly cause severe damage to the embankment if they are uprooted during a high winds. Corrective action is required to remove the tree hazards from the dam. All repair work shall be accomplished as per the requirements of licensed geotechnical or civil engineer. Routinely monitor the damaged area for signs of settlement and seepage.
- ☐ l. 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.
- ☐ m. 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.
- ☐ n. _____

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9. 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 toe was not inspected.
- ☐ b. Satisfactory – Expected to fulfill intended function – no corrective action required.
- ☐ c. Fair - Expected to fulfill intended function, but maintenance or other actions are recommended.
- ☐ d. Poor – May not fulfill intended function; maintenance, repairs, or other actions are necessary.
- ☐ e. Unsatisfactory – Is not expected to fulfill intended function; repair, replacement, or modification is necessary.
- ☐ f. Unknown – Not visible, not accessible, not inspected, or unable to determine based on the observation taken.

Corrective Actions:

- ☐ g. Slope protection needs maintenance or repair. Description: _____
- ☐ h. Rut and/or Gully erosion was observed, which requires maintenance and/or repair. Description: _____
- ☐ i. A crack was observed along the near the toe, which requires further investigation to determine the underlining cause. Monitor the area and/or repair as required.
- ☐ j. The toe area was 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 on the dam embankment. Trees have been identified as the probable cause of piping failures, and can possibly cause severe damage to the embankment if they are uprooted during a high winds. Corrective action is required to remove the tree hazards from the dam. All repair work shall be accomplished as per the requirements of licensed geotechnical or civil engineer. Routinely monitor the damaged area for signs of settlement and seepage.
- ☐ l. 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.
- ☐ m. 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.
- ☐ n. _____

10. Outlet Works:

Culvert / Pipe

Type / Size: _____

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 tested

. ☐ b. The outlet works were not inspected

☐ c. Satisfactory – Expected to fulfill intended function – no corrective action required.

☐ d. Fair - Expected to fulfill intended function, but maintenance or other actions are recommended.

☐ e. Poor – May not fulfill intended function; maintenance, repairs, or other actions are necessary.

☐ f. Unsatisfactory – Is not expected to fulfill intended function; repair, replacement, or modification is necessary.

☐ g. Unknown – Not visible, not accessible, not inspected, or unable to determine based on the observation taken.

Corrective Actions:

☐ h. Seepage/Ponding water was observed. 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. 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.

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

☐ k. _____

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11. Spillway:

Type: ☐ None ☐ Culvert/Pipe ☐ Channel
Description: _____

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 was not inspected.
☐ b. Satisfactory – Expected to fulfill intended function – no corrective action required.
☐ c. Fair - Expected to fulfill intended function, but maintenance or other actions are recommended.
☐ d. Poor – May not fulfill intended function; maintenance, repairs, or other actions are necessary.
☐ e. Unsatisfactory – Is not expected to fulfill intended function; repair, replacement, or modification is necessary.
☐ f. Unknown – Not visible, not accessible, not inspected, or unable to determine based on the observation taken.

Corrective Actions:

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

12. Downstream Channel:

Name: _____

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. Satisfactory – Expected to fulfill intended function – no corrective action required.
☐ c. Fair - Expected to fulfill intended function, but maintenance or other actions are recommended.
☐ d. Poor – May not fulfill intended function; maintenance, repairs, or other actions are necessary.
☐ e. Unsatisfactory – Is not expected to fulfill intended function; repair, replacement, or modification is necessary.
☐ f. Unknown – Not visible, not accessible, not inspected, or unable to determine based on the observation taken.

Corrective Actions:

☐ g. _____

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Additional Comments: