



Missouri Department of Natural Resources

Dam and Reservoir Safety

**MISSOURI DAM AND RESERVOIR SAFETY STAFF CHECKLIST
FOR EVALUATING REGISTRATION PERMIT APPLICATIONS ON EARTH DAMS**

II. SIGNED AND SEALED CERTIFICATION BY ENGINEER THAT:

- A. Dam and reservoir have been inspected in accordance with the law.
- B. Owner has complied with the engineer's recommendations to correct observed defects.

III. REPORT ON INSPECTION INCLUDING:

- A. Determination of an environmental class for each dam and reservoir
 - 1. For Class I (Go to Part III – B.)
 - 2. For Class II and III only
 - a. If a sufficient number of homes are located downstream of a dam, a breach analysis is required to justify a Class II or Class III downstream environmental zone. The following information should be submitted:
 - 1) Topographic map showing: (The most recent USGS Topographic map is minimum acceptable).
 - a) Location of dam and reservoir.
 - b) Location of stream cross sections used in breach analysis.
 - c) Flood plain as derived from breach analysis.
 - d) Verified locations of permanent dwellings, campgrounds or industrial buildings within the dam breach flood plain.
 - 2) Dam failure criteria:
 - a) Final breach configuration (bottom width, top width, side slopes).
 - b) Assumed time of failure.
 - c) Description of the methodology used and the computations

performed in the breach analysis.

3) Stream profile showing:

- a) Water surface elevation created by failure of the dam with the reservoir at the emergency spillway crest elevation.
- b) Stream cross section locations.

b. To show that a structure located in the dam breach flood plain is not inundated by the dam breach flood:

- 1) Replace cross-section data derived from topographic maps with field survey cross-sections
- 2) Compare surveyed first floor elevation of structure to the computed water surface elevation for the dam breach flood.

c. In a situation where a dam is in a very remote location where there are not enough buildings or other structures located downstream of the dam to justify a class I environmental zone, another environmental class may be used without having to perform a detailed dam breach analysis. Engineers are advised to obtain the approval of the Dam and Reservoir Safety staff before using this option.

B. Evaluation of Spillway Capacity

1. The following data must be included in the application report:

- a. Drainage area (square miles or acres) shown on an up-to-date USGS topo map.
- b. SCS Curve Number for watershed draining into lake.
- c. Time of concentration for runoff draining into reservoir.

Sufficient documentation should be provided to derive the value used.

- d. Storage (acre-feet) vs. elevation (feet) data for reservoir.

This information should be provided for elevations ranging from the bottom of the reservoir to the top of the dam. Surface area (acres) vs elevation data should also be submitted in support of this information.

- e. Minimum elevation of top of dam exclusive of the spillway(s).

If the top of dam is not level, a profile of the top of dam is required.

- f. Height of dam (measured in accordance with 10 CSR 22-1.020 (13)).
- g. Length of Dam.
- h. Discharge (cubic feet per second) vs. elevation (feet) data for spillway(s) with backup computations.
- i. The required critical design in-flow hydrograph to the reservoir as determined by taking the appropriate percentage of the PMP as shown in Table 5, 10 CSR 22-3.020.

The probable maximum precipitation values from Hydrometeorological Report No. 51, the duration of the rainfall, and the rainfall distribution pattern used to compute the hydrograph must also be submitted. Sufficient information should be submitted to derive the hydrograph.

- j. The required design storm out-flow hydrograph derived by reservoir routing the required design storm in-flow hydrograph through the spillway.
2. Other items that must be addressed:
- a. The possibility of submergence of the spillway control(s) by backwater conditions in the spillway discharge channel.
 - b. The ability of the spillway and discharge channel to withstand the exit velocity expected through them during the required design storm.
 - c. The alignment of the spillway discharge channel with respect to the dam and what effect, if any, erosion or overtopping of the discharge channel will have on the dam.

C. Description of dam and appurtenant structures: (at the time of application)

- 1. Appurtenant Structures
 - a. Description and location of principal and emergency spillways.
 - b. Description and location of water withdrawal works, drawdown works, and internal drain outlets.
 - c. Description and location of all discharge channels.
 - d. Description and location of all pipes through the dam other than what was described in b. above.
- 2. Dam and Foundation

- a. Description of the soils in the dam and foundation.
- b. Description of the layout of the dam, including the slopes and dimensions of the dam and the valley below the dam.
- c. Description and location of all seepage including quantity and quality.
- d. Description of modifications to the performance of the dam since the original construction was completed.

D. Slope Stability

1. Observation of Slope Stability

- a. Description and location of slides.
- b. Description and location of zones of softness and irregular settlement.
- d. Description and location of erosion features on the dam.
- e. Plot of cross-section of the dam, at the maximum section, showing soil zones and their respective properties.
- f. Location of piezometers and a description of data collected (if applicable).
- g. Description and location of cracks in the embankment and appurtenant works.

2. Judgement of Slope Stability

- a. The engineer needs to state that in his judgement the dam is performing adequately and there are no observable indications that the dam is unsafe.

IV. REPORT ON THE CORRECTION OF DEFECTS:*

A. Lists of Defects

B. Description of the corrections to the principal or emergency spillways and lake drain or water intakes.

C. Description of repairs to the dam and appurtenant structures other than spillways.

1. Embankment modifications

2. Seepage control measures.

3. Other actions

D. Description of the design and analysis upon which the repairs are based.

V. REPORT ON PROPOSED FUTURE OPERATION AND MAINTENCE

A. Description of maintenance program (required).

1. Erosion control on the embankment.

2. Vegetation control.

3. Spillway maintenance.

B. Monitoring or reservoir level and spillway operation during storm runoff.

C. Emergency Action Plans.

D. Monitoring of seepage observation devices (if any).

E. Monitoring of instruments used to observe the stability of the dam (if any).

F. Operation of the dam and reservoir.

1. Description of the procedure for withdrawing water from the reservoir.

2. Description of the use of controlled outlets to regulate the reservoir level.

3. Description of reservoir control structures such as dikes within the reservoir used to control the flow of water through the reservoir.

*The information requested in item IV should be submitted only if observed defects (as listed in 10 CSR 22-3.030 (1), (A), 1) are noted during the initial inspection for a registration permit.