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**IDAPA 37
TITLE 03
CHAPTER 06**

37.03.06 - SAFETY OF DAMS RULES

000. LEGAL AUTHORITY (RULE 0).

These rules are adopted pursuant to Chapter 17, Section 42-1714, Idaho Code, and implement the provisions of Sections 42-1709 through 42-1721, Idaho Code. (7-1-93)

001. TITLE AND SCOPE (RULE 1).

01. Title. (7-1-93)

02. Scope. (7-1-93)

a. The requirements that follow are intended as a guide to establish acceptable standards for construction and to provide guidelines for safety evaluation of new or existing dams. The rules apply to all new dams, to existing dams to be enlarged, altered or repaired, and maintenance of certain existing dams, as specifically provided in the rules. The Director will evaluate any deviation from the standards hereinafter stated as they pertain to the safety of any given dam. The standards are not intended to restrict the application of other sound engineering design principles. Engineers are encouraged to submit new ideas which will advance the state of the art and provide for the public safety. (7-1-93)

b. Under no circumstances shall these rules be construed to deprive or limit the Director of the Department of Water Resources of any exercise of powers, duties and jurisdiction conferred by law, nor to limit or restrict the amount or character of data, or information which may be required by the Director from any owner of a dam for the proper administration of the law. State sovereignty as expressed in Policy 1A of the adopted State Water Plan for independent review and approval of dam construction, operation and maintenance will not be waived due to any overlapping jurisdiction from federal agencies. (7-1-93)

002. WRITTEN INTERPRETATION (RULE 2).

003. ADMINISTRATIVE APPEALS (RULE 3).

Any owner who is aggrieved by a determination or order of the Director may request a hearing pursuant to the provisions of Section 42-1701A(3), Idaho Code, and the Department's adopted Rules of Procedure. (7-1-93)

004. -- 009. (RESERVED)

010. DEFINITIONS (RULE 10).

Unless the context otherwise requires, the following definitions govern these rules. (7-1-93)

01. Active Storage. The water volume in the reservoir stored for irrigation, water supply, power generation, flood control, or other purposes but does not include flood surcharge. Active storage is the total reservoir capacity in acre-feet, less the inactive and dead storage. (7-1-93)

02. Alterations, Repairs or Either of Them. Only such alterations or repairs as may directly affect the safety of the dam or reservoir, as determined by the Director. Alterations, repairs does not include routine maintenance items. (See Rule Subsections 055.02.a. and 055.02.b.) (7-1-93)

03. Appurtenant Structures. Ancillary features (e.g. outlets, tunnels, gates, valves, spillways, auxiliary barriers) used for operation of a dam, which are owned by the dam owner or the owner has responsible control. (7-1-93)

04. Board. The Idaho Water Resource Board. (7-1-93)

05. Certificate of Approval. A certificate issued by the Director for all dams listing restrictions imposed by the Director, and without which no new dams shall be allowed by the owner to impound water. A

certificate of approval is also required for existing dams before impoundment of water is authorized. (7-1-93)

06. Dam. Any artificial barrier together with appurtenant works, which is or will be ten (10) feet or more in height or has or will have an impounding capacity at maximum storage elevation of fifty (50) acre-feet or more. Height of a dam is defined as the vertical distance from the natural bed of the stream or watercourse at the downstream toe of the barrier, as determined by the Director, or from the lowest elevation of the outside limit of the barrier, if it is not across a stream channel or watercourse, to the maximum water storage elevation. (7-1-93)

07. Small Dams. Artificial barriers twenty (20) feet or less in height that are capable of storing less than one hundred (100) acre-feet of water. (7-1-93)

08. Intermediate Dams. Artificial barriers more than twenty (20) feet, but less than forty (40) feet in height, or are capable of storing one hundred (100) acre-feet or more, but less than four thousand (4,000) acre-feet of water. (7-1-93)

09. Large Dams. Artificial barriers forty (40) feet or more in height or are capable of storing four thousand (4,000) acre-feet or more of water. (7-1-93)

10. Department Jurisdiction. The following are not subject to department jurisdiction: (7-1-93)

a. Artificial barriers constructed in low risk areas as determined by the Director, which are six (6) feet or less in height, regardless of storage capacity. (7-1-93)

b. Artificial barriers constructed in low risk areas as determined by the Director, which impound ten (10) acre-feet or less at maximum water storage elevation, regardless of height. (7-1-93)

c. Artificial barriers in a canal used to raise or lower water therein or divert water therefrom. (7-1-93)

d. Fills or structures determined by the Director to be designed primarily for highway or railroad traffic. (7-1-93)

e. Fills, retaining dikes or structures, which are under jurisdiction of the Department of Environmental Quality, designed primarily for retention and treatment of municipal, livestock, or domestic wastes, or sediment and wastes from produce washing or food processing plants. (7-1-93)

f. Levees, that store water regardless of storage capacity. Levee means a retaining structure alongside a natural lake which has a length that is two hundred (200) times or more greater than its greatest height measured from the lowest elevation of the toe to the maximum crest elevation of the retaining structure. (7-1-93)

11. Days Used in Establishing Deadlines. Calendar days including Sundays and holidays. (7-1-93)

12. Dead Storage. The water volume in the bottom of the reservoir stored below the lowest outlet and generally is not withdrawn from storage. (7-1-93)

13. Department. The Idaho Department of Water Resources. (7-1-93)

14. Design Evaluation. The engineering analysis required to evaluate the performance of a dam relative to earthquakes, floods or other site specific conditions that are anticipated to affect the safety of a dam or operation of appurtenant facilities. (7-1-93)

15. Director. The Director of the Idaho Department of Water Resources. (7-1-93)

16. Engineer. A registered professional engineer, licensed as such by the state of Idaho. (7-1-93)

17. Enlargement. Any change in or addition to an existing dam or reservoir, which raises or may raise the water storage elevation of the water impounded by the dam. (7-1-93)

- 18. Factor of Safety.** A ratio of available shear strength to shear stress, required for stability. (7-1-93)
- 19. Flood Surcharge.** A variable volume of water temporarily detained in the upper part of a reservoir, in the space (or part thereof) that is filled by excess runoff or flood water, above the maximum storage elevation. Flood surcharge cannot be retained either because of physical or administrative factors but is passed through the reservoir and discharged by the spillway(s) until the reservoir level has been drawn down to the maximum storage elevation. (7-1-93)
- 20. Inflow Design Flood (IDF).** The flood specified for designing the dam and appurtenant facilities. (7-1-93)
- 21. Maximum Credible Earthquake.** The largest earthquake that reasonably appears capable of occurring under the conditions of the presently known geological environment. (7-1-93)
- 22. Operation Plan.** A specific plan that will assure the project is safely managed for its intended purpose and which provides reservoir operating rule curves or specific limits and procedures for controlling inflow, storage, and/or release of water, diverted into, passed through or impounded by a dam. (7-1-93)
- 23. Owner.** Includes any of the following who own, control, operate, maintain, manage, hold the right to store and use water from the reservoir or propose to construct a dam or reservoir. (7-1-93)
- a.** The state of Idaho and any of its departments, agencies, institutions and political subdivisions; (7-1-93)
- b.** The United States of America and any of its departments, bureaus, agencies and institutions; provided that the United States of America shall not be required to pay any of the fees required by Section 42-1713, Idaho Code, and shall submit plans, drawings and specifications as required by Section 42-1712, Idaho Code, for information purposes only; (7-1-93)
- c.** Every municipal or quasi-municipal corporation. (7-1-93)
- d.** Every public utility; (7-1-93)
- e.** Every person, firm, association, organization, partnership, business trust, corporation or company; (7-1-93)
- f.** The duly authorized agents, lessees, or trustees of any of the foregoing; (7-1-93)
- g.** Receivers or trustees appointed by any court for any of the foregoing. (7-1-93)
- 24. Reservoir.** Any basin which contains or will contain the water impounded by a dam. (7-1-93)
- 25. Storage Capacity.** The total storage in acre-feet at the maximum storage elevation. (7-1-93)
- 26. Water Storage Elevation.** The maximum elevation of the water surface which can be obtained by the dam or reservoir. It is further defined as the storage level attained when the reservoir is filled to capacity (i.e. to the spillway crest) or an authorized storage level attained by installing flashboards to increase the reservoir capacity, or a specified upper storage limit, which is attained by operation of moveable gates that raises the reservoir to a controlled operating level. The maximum storage elevation is an equivalent term of water storage elevation. (7-1-93)
- 27. Release Capability.** The ability of a dam to pass excess water through the spillway(s) and outlet works and otherwise discharge. (7-1-93)
- 011. -- 024. (RESERVED)**
- 025. DAM SIZE CLASSIFICATION AND RISK CATEGORY (RULE 25).**

01. Size Classification. The following table defines the height and storage capacity limits used by the Department to classify dams:

| Size Classification | Height (ft) | | Storage Capacity |
|---------------------|---------------------------------------|-----|-------------------------------------------------|
| Small | 20 ft. or less | and | Less than 100 acre-ft. |
| Intermediate | More than 20 ft. but less than 40 ft. | or | 100 Acre-ft or more, but less than 4000 acre ft |
| Large | 40 ft. or more | or | 4000 acre-ft., or more |

(7-1-93)

02. Risk Category. The following table describes categories of risk used by the Department to classify losses and damages anticipated in down-stream areas, that could be attributable to failure of a dam during typical flow conditions.

| Risk Category | Dwellings | Economic Losses |
|---------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Low | No permanent structures for human habitation. | Minor damage to land, crops, agricultural, commercial or industrial facilities, transportation, utilities or other public facilities or values. |
| Significant | No concentrated urban development, 1 or more permanent structures for human habitation which are potentially inundated with flood water at a depth of 2 ft. or less or at a velocity of 2 ft. per second or less. | Significant damage to land, crops, agricultural, commercial or industrial facilities, loss of use and/or damage to transportation, utilities or other public facilities or values. |
| High | Urban development, or any permanent structure for human habitation which are potentially inundated with flood water at a depth of more than 2 ft. or at a velocity of more than 2 ft. per second. | Major damage to land, crops, agricultural, commercial or industrial facilities, loss of use and/or damage to transportation, utilities or other public facilities or values. |

(7-1-93)

03. Determination of Size and Risk Category. The Director shall determine the size and risk category of a new or existing dam. (7-1-93)

026. -- 029. (RESERVED)

030. AUTHORITY OF REPRESENTATIVE (RULE 30).

When plans, drawings and specifications are filed by another person on behalf of an owner, written evidence of authority to represent the owner shall be filed with the plans, drawings and specifications. (7-1-93)

031. -- 034. (RESERVED)

035. FORMS (RULE 35).

Forms required by these rules are available from the Department to interested parties upon request. Construction of a small dam requires the filing of Form 1710 and construction of an intermediate or large dam requires the filing of Form 1712. (7-1-93)

036. -- 039. (RESERVED)

040. CONSTRUCTION PLANS, DRAWINGS AND SPECIFICATIONS (RULE 40).

The following provisions shall apply in submitting plans, drawings and specifications. (7-1-93)

01. Submission of Duplicate Plans, Drawings and Specifications. Any owner who shall desire to construct, enlarge, alter or repair any intermediate or large dam, shall submit duplicate plans, drawings and specifications prepared by an engineer for the proposed work to the Director with required fees. The Director may, however, require the submittal of plans, drawings and specifications prior to the construction of any dam. (7-1-93)

02. Applying for and Obtaining Written Approval. Construction of a new dam or enlargement, alteration or repairs on existing dams shall not be commenced until the owner has applied for and obtained written approval of the plans, drawings and specifications. Alteration or repairs do not include routine maintenance for which prior approval is not required. (See Rule Subsections 055.02.a and 055.02.b) (7-1-93)

03. Plans Shall Be Prepared on a Good Quality Vellum or Mylar. Transparent copies reproducible by standard duplicating processes, if accurate, legible and permanent, will be accepted. Plans may initially be submitted in the form of nonreproducible paper prints. After reviewing the plans, the Director will notify the owner of any required changes. (7-1-93)

04. Preparation and Submission of Plans. Plans and drawings shall be of a sufficient scale with an adequate number of views showing proper dimensions, so that the plans and drawings may be readily interpreted and so that the structure and appurtenances can be built in conformance with the plans and drawings. (7-1-93)

05. Information Included with Plans. Plans for new dams shall include the following information and plans for enlargement, alteration or repair of an existing dam shall include as much of the following information as required by the Director to adequately describe the enlargement, alteration or repair and the affect on the existing dam or its appurtenant facilities: (7-1-93)

a. A topographic map of the dam site showing the location of the proposed dam by section, township and range, and location of spillway, outlet works, and all borings, test pits, borrow pits; (7-1-93)

b. A profile along the dam axis showing the locations, elevations, and depths of borings or test pits, including logs of bore holes and/or test pits; (7-1-93)

c. A maximum cross-section of the dam showing elevation and width of crest, slopes of upstream and downstream faces, thickness of riprap, zoning of earth embankment, location of cutoff and bonding trenches, elevations, size and type of outlet conduit, valves, operating mechanism and dimensions of all other essential structural elements such as cutoff walls, filters, embankment zones, etc.; (7-1-93)

d. Detailed drawings showing plans, cross and longitudinal sections of the outlet conduits, valves and controls for operating the same, and trash racks; (7-1-93)

e. A curve or table showing the capacity of the reservoir in acre-feet vs gauge height (referenced to a common project datum) of the reservoir storage level, and the computations used in making such determinations. (7-1-93)

f. A curve or table showing the outlet discharge capacity in cubic feet per second vs gauge height of reservoir storage level, and the equation used in making such determination; (7-1-93)

g. A curve showing the spillway discharge capacity in cubic feet per second vs gauge height of the reservoir or flood surcharge level above the spillway crest and the equation used in making such determinations; (7-1-93)

h. Detailed drawings of spillway structure(s), cross-sections of the channel heading to and from the spillway and a spillway profile; (7-1-93)

i. Plans for flow measuring devices capable of providing an accurate determination of the flow of the stream above and below the reservoir, and a permanent reservoir or staff gauge near the outlet of the reservoir plainly

marked in feet and tenths of a foot referenced to a common project datum; (7-1-93)

j. Plans or drawings of instruments, recommended by the owner's engineer to monitor performance of intermediate or large dams to assure safe operation, or as may be required by the Director to monitor any dam regardless of size, that is situated upstream of a high risk area. (7-1-93)

06. Specifications. Specifications shall include provisions acceptable to the Director for adequate observation, inspection and control of the work by a registered professional engineer, during the period of construction. (7-1-93)

07. Changes to Specifications. The specifications shall not be materially changed without prior written consent of the Director. Significant design changes, while construction is underway, shall be submitted for the Director's review and approval. (7-1-93)

08. Inspections. The owner shall provide for and allow inspections by the Department to assure the dam and appurtenant structures are constructed in conformance with the approved plans and specifications, or as may be revised by the engineer and approved by the Director if there are unforeseen conditions discovered during site excavation or construction of the dam which potentially jeopardize the future integrity and safety of the dam. Certain stages of construction shall not proceed without inspection and approval by the Director, including the following: (7-1-93)

a. After clearing and excavation of the foundation area and cutoff trench and prior to placing any fill material. (7-1-93)

b. After installation of the outlet conduit and collars and before placing any backfill material around the conduit; (7-1-93)

c. After construction is completed and before any water is stored in the reservoir. (7-1-93)

d. At such other times as determined necessary by the Director. The Director will, upon seven (7) days notice, inspect and if satisfactory, approve the completed stage of construction. The Director may conduct inspections upon shorter notice upon good reason being shown or upon a schedule jointly agreed upon by the Director and the owner. (7-1-93)

09. Inspection, Examination and Testing of Materials. All materials and workmanship shall be subject to inspection, examination and testing by the Director at any and all times. (7-1-93)

10. Rejection of Defective Material. The Director shall have the right to require the owner or engineer to reject defective material and workmanship or require its removal or correction respectively. Rejected workmanship shall be corrected and rejected material shall be replaced with proper material. (7-1-93)

11. Suspension of Work. The Director may order the engineer to suspend any work that may be subject to damage by inclement weather conditions. (7-1-93)

12. Responsibility of Engineer. These provisions shall not relieve the engineer of his responsibility to assure that construction is accomplished in accordance with the approved plans and specifications or to suspend work on his own motion. (7-1-93)

13. Detailing Provisions of Specifications. The specifications shall state in sufficient detail, all provisions necessary to insure that construction is accomplished in an acceptable manner and provide needed control of construction to insure that a safe structure is constructed. (7-1-93)

14. Design Report. Owners proposing to construct, enlarge, alter or repair an intermediate or large dam shall submit an engineering or design evaluation report with the plans and specifications. The engineering report shall include as much of the following information as necessary to present the technical basis for the design and to describe the analyses used to evaluate performance of the structure and appurtenances. (7-1-93)

- a. All technical reference(s); equations and assumptions used in the design; (7-1-93)
- b. Hydrologic data used in determining runoff from the drainage areas; reservoir flood routing(s); and hydraulic evaluations of the outlet(s) and the spillway(s). (7-1-93)
- c. Engineering properties of the foundation area and of each type of material to be used in the embankment. (7-1-93)
- d. A stability analysis, including an evaluation of overturning, sliding, slope and foundation stability and a seepage analysis; (7-1-93)
 - i. Seismic design loads shall be evaluated and applied at all large dams to be located in significant or high risk areas, in Seismic Zone 3, which for purposes of these rules is the area in Idaho east of Range 22 East, Boise Meridian. The evaluation required of large dams, that are classified significant or high risk, shall use the maximum ground motion/ acceleration generated by the maximum credible earthquake, which could affect the dam site. (7-1-93)
 - ii. Seismic analysis may be required as determined by the Director for large dams located above high risk areas in Seismic Zone 2, which for purposes of these rules is the area in Idaho west of Range 22 East, Boise Meridian. (7-1-93)

15. Additional Information/Waiver. The Director may require the filing of such additional information which in his opinion is necessary or waive any requirement herein cited if in his opinion it is unnecessary. (7-1-93)

16. Alternate Plans. The Director may accept plans and specifications or portions thereof prepared for other agencies which are determined to meet the requirements of Rule 40. (7-1-93)

041. -- 044. (RESERVED)

045. OPERATION PLAN (RULE 45).

An operation plan is required as described in the following rules and shall provide procedures for emergency operations and include guidelines and procedures for inspection, operation and maintenance of the dam and appurtenances, including any instruments required to monitor performance of the dam during normal operating cycles, critical filling or flood periods, or as may be required to monitor new or existing dams subject to earthquake effects. (7-1-93)

01. New, Reconstructed or Enlarged Dams. Prior to the initial filling of the reservoir or refilling the reservoir for a reconstructed or enlarged dam in the following categories, the owner shall file with the Director an operation plan for review and approval: (7-1-93)

- a. Small, high risk. (7-1-93)
- b. Intermediate, significant risk. (7-1-93)
- c. Intermediate, high risk. (7-1-93)
- d. Large, any risk category. (7-1-93)

02. Existing Dams. Unless exempted by the Director, owners of the following categories of dams shall file an operation plan with the Director on or before July 1, 1992 for review and approval: (7-1-93)

- a. Intermediate, high risk. (7-1-93)
- b. Large, significant risk. (7-1-93)
- c. Large, high risk. (7-1-93)

03. Alternate Plans. The Director may accept existing studies or plans in lieu of an operation plan if the Director determines the information provided fulfills the requirements of Rule 45. (7-1-93)

046. -- 049. (RESERVED)

050. NEW INTERMEDIATE OR LARGE DAMS (RULE 50).

The following minimum criteria shall be used to evaluate the design of intermediate or large earthfill dams in Idaho. These standards are intended to serve as guidelines for a broad range of circumstances, and engineers should not consider them as a restriction to the use of other sound engineering design principles. Exclusion from this established criteria will be considered by the Director on a case-by-case basis in approving plans and specifications and evaluating dams. Dams constructed of other materials shall comply with these criteria as found appropriate by the Director and with other engineering criteria approved by the Director. (7-1-93)

01. Embankment Stability. Slope stability analyses shall determine the appropriate upstream and downstream slopes. Unless slope stability analysis determines otherwise, the embankment slopes shall be:

| | |
|------------------|----------------|
| Upstream slope | 3:1 or flatter |
| Downstream slope | 2:1 or flatter |

(7-1-93)

a. For large high and significant hazard dams and intermediate high hazard dams the embankment shall be designed, constructed and maintained to assure stability under static loads and prevent instability due to seepage or uplift forces, or drawdown conditions. Transmission of seepage through the embankment, abutments and foundation shall be controlled to prevent internal removal of material and instability where seepage erodes or emerges. (7-1-93)

b. The design analysis shall consider the need for installing filters, filter fabric and/or toe drains to stabilize the fill and protect against piping of the embankment fill material. (7-1-93)

c. The minimum factor of safety for a dam under steady state condition shall be 1.5. During rapid drawdown of the reservoir, the minimum factor of safety for the embankment shall be 1.2. For dams constructed in Seismic Zone 3, the minimum factor of safety under seismic load shall be 1.0. (7-1-93)

d. The stability of an embankment subjected to earthquake ground motions can be analyzed by dynamic response or pseudo-static analyses. Pseudo-static analyses are acceptable for embankment dams constructed of soils that will not build-up excess pore pressures due to shaking, nor sustain more than fifteen percent (15%) strength loss during earthquake events, otherwise the stability of an embankment dam shall be analyzed by a dynamic response method. A pseudo-static analysis simplifies the structural analysis (i.e. the resultant force of the seismic occurrence is represented by a static horizontal force applied to the critical section to derive the factor of safety against sliding along an assumed shear surface). The value of the horizontal force used in the pseudo-static analysis, is the product of the seismic coefficient and the weight of the assumed sliding mass. (7-1-93)

e. Slope deformation analyses are required for dams located in Seismic Zone 3, that are constructed of cohesionless soils and/or on foundations which are subject to liquefaction, when the peak acceleration at the site is anticipated to exceed 0.15g. (7-1-93)

f. The design analyses for new dams located in high risk areas (in Seismic Zone 2 or 3) shall include geologic and seismic reports, location of faults and history of seismicity. (7-1-93)

g. Where in the opinion of the Director, embankment design or conditions warrant, instrumentation of the embankment and/or foundation will be required. (7-1-93)

h. The design analyses for new large dams located in high risk areas (in Seismic Zone 3) shall include an evaluation of potential landslides in the vicinity of the dam or immediate area of the reservoir, which could cause

damage to the dam or appurtenant structures, obstruct the spillway or suddenly displace water in the reservoir causing the dam to overtop. If potential landslides pose such a threat, they shall be stabilized against sliding, with a minimum factor of safety of 1.5. (7-1-93)

02. Top Width. The crest width shall be sufficient to provide a safe percolation gradient through the embankment at the level of the maximum storage elevation. The minimum crest width (top of embankment) shall be determined by:

$$W = H / 5 + 10$$

W = Width, in feet
H = Structural Height, in feet

The minimum top width for any dam is twelve (12) feet. (7-1-93)

03. Cutoff Trenches or Walls. Cutoff trenches shall be excavated through relatively pervious foundation material to an impervious stratum or zone. The trench shall be backfilled with suitable material, compacted to the specified density. The cutoff trench shall extend up the abutments to the maximum storage elevation. (7-1-93)

a. Cutoff trenches shall be wide enough to allow the free movement of excavation and compaction equipment. Side slopes shall be no steeper than one to one (1:1) for depths up to twelve (12) feet, and no steeper than one and one half to one (1 1/2:1) for greater depths to provide for proper compaction. Flatter slopes may be required for safety and stability. (7-1-93)

b. Concrete cutoff walls may be used to bond fills to smooth rock surfaces in a similar manner as cutoff trenches and shall be entrenched in the rock to a depth approximately one-half the thickness of the cutoff wall. Concrete cutoff walls shall be doweled into the rock a minimum of eight (8) inches with a maximum spacing of eighteen (18) inches for three-fourths (3/4) inch steel dowels. Concrete walls shall have a minimum projection of three (3) feet perpendicular to the rock surface and shall have a minimum thickness of twelve (12) inches. (7-1-93)

04. Impervious Core Material. The approved earth materials (silt soils are seldom acceptable) shall be zoned as shown in the plans and placed in the embankment in continuous, approximately level layers, having a thickness of not more than six (6) inches before compaction. Compaction shall be based on ASTM D-698. A minimum compaction of ninety-five percent (95%) is required. (7-1-93)

a. An acceptable working range of moisture content for the core material shall be established and maintained. (7-1-93)

b. The material shall be compacted by means of a loaded sheep's foot or pneumatic roller to the required density. (7-1-93)

c. No rock shall be left in the core material which has a maximum dimension of more than four (4) inches. The core material shall be free of organic and extraneous material. (7-1-93)

d. The core material shall be carried up simultaneously the full width and length of the dam, and the top of the core material shall be kept substantially level at all times, or slope slightly toward the reservoir. (7-1-93)

e. No frozen or cloddy material shall be used, and no material shall be placed upon frozen, muddy or unscarified surfaces. (7-1-93)

f. All materials used in the dam shall meet the stability and seepage requirements as shown by a design analysis of the structure and shall be properly installed to meet these requirements. (7-1-93)

05. Drains. Toe or chimney drains or free draining downstream material shall be installed where necessary to maintain the phreatic line within the downstream toe. (7-1-93)

a. Filter design for chimney drains, filter blankets and toe drains in clay and silt soils shall be selected using the following design criteria, unless deviations are substantiated by laboratory tests. All tests are subject to

review and approval by the Director.

D15 filter/D15 base > 5 but < 20

D15 filter/D85 base < 5

D50 filter/D50 base < 25

D85 filter > 2 times diameter of pipe perforations, or 1.2 times width of pipe slots. (7-1-93)

b. Filter material requirements are determined by comparing the particle size distribution of the filter to the particle size distribution of the materials to be protected;

e.g. D50 filter
D50 material to be protected

Where D is the particle size passing a mechanical (sieve) analysis expressed as a percentage by weight. (7-1-93)

c. The base material should be analyzed considering the portion of the material passing the No. 4 sieve, for designing filters for base materials that contain gravel size particles. To assure internal stability and prevent segregation of the filter material, the coefficient of uniformity (D60/D10) shall not be greater than 20. (7-1-93)

d. The minimum thickness of filter blankets and chimney drains shall be twelve (12) inches, with the maximum size particle passing the one (1) inch sieve. The maximum particle size may be increased with increasing thickness of the filter, by the rate of one (1) inch per foot of filter. However, the maximum particle shall not exceed three (3) inches. Zoned filters and chimney drains must not be less than twelve (12) inches thick per each zone. The width of granular filters shall not be less than the width of the installation equipment unless the plans and specifications include construction procedures adequate to insure the integrity of a narrower width. (7-1-93)

e. Perforated drain pipes must have a minimum of six (6) inches of drain material around the pipe. The maximum particle size shall not exceed one-half (1/2) inch unless the layer thickness is increased at the rate of one (1) inch per foot of filter. Underdrains and collection pipes must be constructed of noncorrosive material. (7-1-93)

06. Freeboard. The elevation of the top of the embankment shall be constructed and maintained above the flood surcharge level to prevent the dam from overtopping during passage of the inflow design flood and to provide freeboard for wind generated waves. Camber shall be included in the design and incorporated in the construction of the top of the embankment, unless waived by the Director. Camber may be estimated by multiplying the structural height of the dam by five percent (5%). (7-1-93)

a. The height of wind generated waves (H) moving across a surcharged reservoir can be estimated by the following equation:

$H = 1.95 (F/2)$ where F = fetch, the distance in miles across the reservoir, measured perpendicular to the major axis of the dam. (7-1-93)

b. For large, high risk dams the minimum freeboard shall be two (2) feet plus wave height during passage of the one percent (1%) flood or equal to the surcharge elevation of the reservoir during passage of the inflow design flood whichever is greater. (7-1-93)

c. Estimation of the height of the wind generated wave using the empirical equation in Rule 050.06.a. shall not preclude a more conservative design including consideration of fill materials, embankment zoning, slope surface protection, drainage or other safety factors. (7-1-93)

07. Riprap. All dams which are subject to erosion shall be protected from wave action. The design engineer, with approval of the Director, shall determine whether or not rock riprap or other protection is necessary. (7-1-93)

a. Where rock riprap is used, it shall be placed on a granular bedding material, and extend up the slope, from three (3) feet below the normal minimum operating level to the top of the dam. (7-1-93)

b. Where riprap is required by Rule Subsection 055.07, pipes, cables, brush, tree growth, dead growth, logs, or floating debris are not acceptable substitutes for rock riprap and granular bedding material. (7-1-93)

08. Outlet Conduits. All reservoirs shall be provided with an outlet conduit of sufficient capacity to prevent interference with natural streamflow through the reservoir to the injury of downstream appropriators unless waived by the Director. In addition to any natural flow releases, the outlet conduit should be of sufficient capacity to pass at the same time, the maximum water requirement of the owner. A larger outlet conduit may be required to provide adequate release capability as determined by the Director. (7-1-93)

a. Outlet conduits shall be laid on a firm, stable foundation and normally not be placed on fills which can consolidate, allow differential settlement, and cause separation or misalignment of the pipe. Unless otherwise required, the outlet shall have a minimum inside diameter of twelve (12) inches. The conduits shall be of reinforced concrete or of metal pipe encased in concrete, poured with a continuous seal between the concrete and the trench except as otherwise approved by the Director. Void spaces and uncompacted areas shall not be covered over when the outlet trench is backfilled. Outlets shall be properly aligned on an established grade and may be supported on a concrete cradle, or otherwise supported and kept aligned when the outlet is covered. (7-1-93)

b. Asphalt dipped or other metal pipe is not acceptable unless it is encased in concrete. Exceptions may be made only where conditions warrant, but in no case shall the reasonable life expectancy of the pipe be less than the design life of the dam. (7-1-93)

c. All outlet conduits shall have a seepage path through the impervious zone at least equivalent in length to the maximum head above the downstream end of the system. Only one-third (1/3) the horizontal distance through the impervious zone will be utilized when calculating the length of the seepage path. Collars may be used to satisfy this requirement but all collars shall extend a minimum of two (2) feet outside the conduit for dams up to thirty (30) feet in height and a minimum of three (3) feet for dams above that height. Collars shall be spaced at intervals of at least seven (7) times their height and no collar may be closer to the outer surface of the impervious zone than the distance it extends out from the conduit. (7-1-93)

d. The use of multiple conduits is allowed only upon the written approval of the Director. (7-1-93)

09. Gates. All conduits shall be gated on the upstream end, unless otherwise approved by the Director, with either a vertical or an inclined gate. All conduits shall be vented directly behind the gate unless otherwise determined by the Director. Reservoirs storing water during the winter and subject to severe ice conditions shall have inclined gate controls enclosed in a protective sleeve which is buried. All gate stem pedestals shall be made of concrete. All trash racks shall slope toward the reservoir. At least one (1) of the sides of the inlet structure shall be open to allow water to flow into the outlet conduit and shall be covered with a trash rack. Trash racks should be designed with bars primarily in one (1) direction so they can be cleaned. If fish screens are used, they shall be placed over the trash rack and shall be removable for cleaning, or of the self-cleaning type. (7-1-93)

10. Outlet Controls. Outlet controls shall be installed at a stable location, on the crest or on an elevated platform, or within an enclosure when required, which is readily accessible, but secured to prevent unauthorized operation. (7-1-93)

11. Release Capability. Based on the size of the dam and on the risk category assigned by the Director, the release capability of a dam shall equal or exceed the inflow design flood in the following table:

| Downstream Risk Category | Size Classification | Inflow Design Flood |
|--------------------------|---------------------|---------------------|
| Low | Small | Q50 |
| | Intermediate | Q100 |

| Downstream Risk Category | Size Classification | Inflow Design Flood |
|--------------------------|---------------------|---------------------|
| | Large | Q500 |
| Significant | Small | Q100 |
| | Intermediate | Q500 |
| | Large | 0.5 PMF |
| High | Small | Q100 |
| | Intermediate | 0.5 PMF |
| | Large | PMF |

NOTE: The inflow design flood(s) indicated in the table include specific frequency floods (2%/50yr, 1%/100 yr.) expressed in terms of exceedance with a probability the flood will be equaled or exceeded in any given year (a fifty (50) year flood has a two percent (2%) chance of occurring in any given year and a one hundred (100) year flood has a one percent (1%) chance of occurring in any given year); or PMF - probable maximum flood, which may be expected from the most severe combination of meteorologic and hydrologic conditions that are reasonably possible in the region. The PMF is derived from the probable maximum precipitation (PMP) which is the greatest theoretical depth of precipitation for a given duration that is physically possible over a particular drainage area at a certain time of year. (7-1-93)

a. All spillways shall be stabilized for the discharge of flow by the use of concrete, masonry, riprap or sod, if not constructed in resistant rock. (7-1-93)

b. Where site conditions allow, the spillway shall be constructed independent of embankment dams. The spillway(s) shall guide the discharge of water away from the dam embankment so as not to erode or endanger the structure. (7-1-93)

c. The minimum base width of an open-channel spillway shall be ten (10) feet. Conduits or siphon pipes other than glory hole spillways are not acceptable substitutes for an open-channel spillway. (7-1-93)

d. The effectiveness of spillways shall be undiminished by bridges, fences, pipelines or other structures. (7-1-93)

e. Unless expressly authorized in writing by the Director, or approved as an integral part of an operation plan, stop logs or flashboards shall not be installed in spillways. (7-1-93)

12. Reservoir Site. The dam site shall be cleared of all trees, brush, large rocks, and debris unless otherwise waived by the Director. The reservoir site shall be cleared of all woody material, growth or debris that is large enough to lodge in the spillway, or outlet works, except as otherwise approved by the Director. (7-1-93)

13. Inspection and Completion Reports. As construction proceeds, it is the responsibility of the engineer to submit test reports (e.g. soil material analyses, density tests, concrete strength tests) along with periodic inspection and progress reports to the Director. (7-1-93)

a. Upon completion of construction the owner or his engineer shall provide the Director a short, written narrative account of all items of work. Record drawings and revised specifications shall be submitted to the Director if the completed project has been substantially changed from the plans and construction specifications originally approved. (7-1-93)

b. The engineer representing the owner shall certify that construction, reconstruction, enlargement, replacement or repair of the dam and appurtenances was completed in accordance with the record drawings and specifications, or as revised. (7-1-93)

051. -- 054. (RESERVED)

055. EXISTING INTERMEDIATE OR LARGE DAMS (RULE 55).

All dams regulated by the department shall be operated and maintained to retain the embankment dimensions and the hydraulic capacity of the outlet works and spillway(s) as designed and constructed, or as otherwise required by these rules. (7-1-93)

01. Analyses Required. The analyses required by Rule 40 are not applicable to existing dams except as required in Rule Subsections 055.01.a. and 055.01.e. unless for good cause, the Director specifically requires the analyses. Dams constructed of other than earth material shall comply with these criteria, as determined by the Director, or with other engineering criteria approved by the Director. (7-1-93)

a. For large, significant or high risk dams, the release capability required by Rule Subsection 050.11 shall be evaluated and applied to the structure. Dams of other size and risk are required to provide the release capability of Rule Subsection 050.11 but are not required to conduct the analyses. (7-1-93)

b. Every dam, unless exempted by the Director shall have a spillway with a capacity to pass a flood of one percent (1%) (two percent (2%) for small low hazard dams) occurring with the reservoir full to the spillway crest at the beginning of the flood while maintaining the freeboard required by Rule Subsection 050.06. (7-1-93)

c. The Director may waive the spillway requirement for dams proposing off stream storage or upon a showing acceptable to the Director. (7-1-93)

d. The release capability can include the capacity of spillway(s) and outlet(s), diversion facilities, or other appurtenant structures, and any approved operating procedures which utilize upstream storage, diversion and flood routing storage to pass flood events. The remainder of the required release capacity, if any, may be met by the following: (7-1-93)

i. Reconstruction, enlargement or addition of spillway(s), outlet(s), diversion facilities or other appurtenant structures. (7-1-93)

ii. A showing acceptable to the Director that failure of the dam during a flood of the specified magnitude described in Rule Subsection 050.11 would not substantially increase downstream damages over and above the losses and damages that would result from any natural flood up to that magnitude. (7-1-93)

iii. A showing acceptable to the Director that the release capability of the dam together with other emergency release modes such as a controlled failure or overtopping of the dam would not result in a larger rate of discharge than the rate of inflow to the reservoir. (7-1-93)

iv. A showing acceptable to the Director that limiting physical factors unique to the dam site exist that prevent construction of a spillway or other release capability mechanisms during a flood of the specified magnitude described in Rule Subsection 050.11 provided the owner implements storage operational procedures and/or provides for emergency warning to protect life and property. (7-1-93)

e. For large, high risk dams, the seismic design loads shall be evaluated and applied to dams located east of Range 22E, B.M. The evaluation shall use the maximum ground motion/acceleration generated by the maximum credible earthquake. (7-1-93)

f. The Director may accept existing studies relative to requirements of Rule Subsections 055.01.a. and 055.01.e., if the Director determines the information provided fulfills the requirements of Rule Subsections 055.01.a. and 055.01.e. (7-1-93)

g. The Director may allow until July 1, 1992 for completion of the analyses required in Rule Subsections 055.01.a. and 055.01.g. and may allow the owner of an existing dam a compliance period of up to ten years for completing the studies, to complete structural modifications or implement other improvements necessary to provide the release capability determined to be required (Rule Subsection 055.01.a.) or complete structural

modifications necessary to assure the dam and appurtenant facilities will safely function under earthquake loads (Rule Subsection 055.01.g.). (7-1-93)

h. Within thirty (30) days after completing the analyses required in Rule Subsection 055.01.a. or 055.01.g., the owner of an existing dam that is deficient in either case (Rule Subsection 055.01.a. or 055.01.g.) shall file with the Director a schedule outlining the dates work or construction items will be completed. (7-1-93)

02. Other Requirements. (7-1-93)

a. Routine maintenance items include the following: (7-1-93)

i. Eradication of rodents and filling animal burrows. (7-1-93)

ii. Removal of vegetation and debris from the dam. (7-1-93)

iii. Restoring original dimensions of the dam by the addition of fill material. (7-1-93)

iv. Addition of bedding or riprap material which will not increase the height or storage capacity. (7-1-93)

v. Repair or replacement of gates, gate stems, seals, valves, lift mechanisms or vent pipes with similar equipment. (7-1-93)

vi. Repair or replacement of wingwalls, headwalls or aprons including spalling concrete. (7-1-93)

b. The following are not routine maintenance items: (7-1-93)

i. Reconstruction of embankment slopes. (7-1-93)

ii. Replacement, reconstruction or extension of outlets. (7-1-93)

iii. Foundation stabilization. (7-1-93)

iv. Filter or drain construction or replacement. (7-1-93)

v. Spillway size alteration or modification. (7-1-93)

vi. Installation of instrumentation or piezometers. (7-1-93)

vii. Release capability modification. (7-1-93)

c. Items not specifically described in Rule Subsections 055.02.a. and 055.02.b. will be determined by the Director to be included in one rule or the other upon receipt of a written request from the owner or his representative seeking such a determination. (7-1-93)

d. Where riprap is required to prevent erosion and to maintain a stable embankment, pipes, cables, brush, tree growth, logs, or floating debris are not acceptable substitutes for rock riprap and granular bedding material. Dams or portions thereof which are stable without riprap, are not required to have riprap. (7-1-93)

e. Upon completion of reconstruction of a dam or feature of a dam included in Rule Subsection 055.02.b., the owner or his engineer shall provide the Director a short written narrative account of all items of work. Record drawings and revised specifications shall be submitted to the Director if the completed project has been substantially changed from the plans and construction specifications originally approved. (7-1-93)

f. Upon request, the owner of every dam shall provide his name and address to the Director and shall advise the Director of future changes in ownership. If the owner does not reside in Idaho, the owner shall provide the name and address of the person residing in Idaho who is responsible for the operation, maintenance and repair of the

dam. (7-1-93)

056. -- 061. (RESERVED)

060. SMALL DAM DESIGN CRITERIA (RULE 60).

The following provisions apply to small dams. (7-1-93)

01. Design and Construction of Small Dams. Design and construction of small dams located in high risk areas as determined by the Director require submittal of fees, plans and specifications prepared by an engineer and shall follow the same general criteria established under Rules 40, 45, 50, and 55. Other small dams not determined to be in a high risk area shall follow the same general criteria established under Rules 50 and 55 or larger dams, except that submittal of plans, specifications and test results is not required. (7-1-93)

02. Notification Prior to Construction. The owner shall notify the Director in writing ten (10) calendar days prior to commencing construction. (7-1-93)

03. Approval Required. The owner shall not proceed with the following stages of construction without approval from the Director. (7-1-93)

a. After clearing and excavation of the foundation area and cutoff trench, and prior to placing any fill material; (7-1-93)

b. After installation of the outlet conduit, and before placing any backfill material around the conduit; (7-1-93)

c. After construction is completed, and before any water is stored in the reservoir; (7-1-93)

d. At such other times as determined necessary by the Director. The Director, will, upon seven (7) day notice, inspect and, if satisfactory, approve the completed stage of construction. (7-1-93)

04. Notification upon Completion of Construction. The owner shall in writing notify the Director upon completion of construction. (7-1-93)

061. -- 064. (RESERVED)

065. DAMS STORING TAILINGS AND WATER (RULE 65).

01. Construction of Dams Storing Fifty Acre-Feet or More. Construction of dams intended to store or likely to store fifty (50) acre-feet or more of water in excess of the water contained in the tailings material shall meet the requirements specified in Rules 40, 45, 50 and 55 of these rules. The Director may waive any or all of these requirements if, in the opinion of the Director, sound engineering design provided by the owner indicates such requirements are not applicable. (7-1-93)

02. Abandonment Plan. An abandonment plan which provides a stable, maintenance-free condition at any time tailings are not being actively placed for an extended period of time, as determined by the Director, shall be submitted to the Director by the owner of a dam storing tailings and water. This rule may be waived by the Director if determined not to be applicable. (7-1-93)

066. -- 999. (RESERVED)

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