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CHAPTER 20
DAM SAFETY STANDARDS

Authority

N.J.S.A. 58:4-1 et seq. and 13:1D-1 et seq.

Source and Effective Date

R.1995 d.266, effective April 28, 1995.
See: 27 N.J.R. 795(a), 27 N.J.R. 2210(a).

Executive Order No. 66(1978) Expiration Date

Chapter 20, Dam Safety Standards, expires on April 28, 2000.

Chapter Historical Note

Chapter 20, Bureau of Water Control, was filed and became effective prior to September 1, 1969. Revisions were filed and became effective April 23, 1975 as R.1975 d.104. See: 7 N.J.R. 100(a), 7 N.J.R. 207(a). Further revisions were filed and became effective July 21, 1976 as R.1976 d.233. See: 8 N.J.R. 176(b), 8 N.J.R. 379(d). Subchapter 3 was deleted in its entirety effective December 16, 1977 as R.1977 d.477. See: 9 N.J.R. 461(a), 10 N.J.R. 10(c). This chapter was repealed and a new chapter, Dam Safety Standards, was adopted as R.1985 d.214, effective May 6, 1985. See: 16 N.J.R. 790(a), 17 N.J.R. 1081(a). Pursuant to Executive Order No. 66(1978), Chapter 20 was readopted as R.1990 d.276, effective May 2, 1990. See: 22 N.J.R. 279(a), 22 N.J.R. 1760. Chapter 20 was readopted as R.1995 d.266, effective April 28, 1995. See: Source and Effective Date.

See section annotations for specific rulemaking activity.

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Cross References

Flood control, dams, engineering review, see N.J.A.C. § 7:13-2.12.

SUBCHAPTER 1. APPLICATION PROCEDURE;
DESIGN CRITERIA FOR DAM
CONSTRUCTION; DAM INSPECTION
PROCEDURE

7:20-1.1 Scope and applicability

(a) The rules in this subchapter were adopted pursuant to the authority of N.J.S.A. 58:4-1 et seq., as amended by the Safe Dam Act of 1981, and N.J.S.A. 13:1D-1 et seq.

1. These rules set forth procedures for application to construct, repair or modify a dam, as defined in N.J.A.C. 7:20-1.2, and set standards for design and maintenance of dams. These rules also establish a dam inspection procedure.

2. Any dam which raises the waters of a stream five feet or less above its usual, mean, low water height falls under the jurisdiction of the Flood Hazard Area Control Act, N.J.S.A. 58:16A-50 et seq.

3. The requirements in this subchapter shall not affect or relate to a dam or reservoir in the pinelands area, as designated by subsection a. of section 10 of P.L. 1979, c.111 (C. 13:18A-11), which will raise the waters of any river or stream less than eight feet above the surface of the ground where the drainage area above the same is less than one square mile in extent and where the water surface created by the dam or reservoir is less than 100 acres in extent except that the commissioner may investigate and take appropriate action regarding any dam or reservoir about which he has a security or safety concern. With respect to dams and reservoirs located on lands utilized for agricultural or horticultural purposes within the pinelands area, the commissioner's actions shall be undertaken after consultation with the Secretary of Agriculture. See N.J.S.A. 58:4-1, P.L. 1985, c. 33, § 1 and 2.

Amended by R.1990 d.276, effective June 4, 1990.
See: 22 N.J.R. 279(a), 22 N.J.R. 1760(a).
Added authority N.J.S.A. 13:1D-1 et seq.

7:20-1.2 Definitions

The following words and terms, as used in this chapter, shall have the following meanings, unless the context clearly indicates otherwise.

“Applicant” means any person making application for a dam permit.

“Auxiliary spillway” means the second used spillway during flood flows which is not the emergency spillway.

“Dam” means any artificial dike, levee or other barrier, together with appurtenant works, which is constructed for the purpose of impounding water, on a permanent or temporary basis, that raises the water level five feet or more above the usual, mean, low water height when measured from the downstream toe-of-dam to the emergency spillway crest or, in the absence of an emergency spillway, the top-of-dam.

“Department” means the New Jersey Department of Environmental Protection.

“Design freeboard” means the minimum freeboard which would exist during passage of the design flood.

“Division” means the Division of Engineering and Construction in the Department of Environmental Protection.

“Emergency spillway” means the spillway capable of passing the spillway design storm with the principal and/or auxiliary spillway blocked.

“Environmental impact statement” means a report which describes the real and potential impacts which will or may result from the construction and operation of a proposed dam project, the adverse environmental impacts which cannot be avoided, the steps to be taken to minimize adverse impacts and the alternatives to the project with reasons for the acceptability or unacceptability.

1. The report shall address real or potential impacts upon ecology, natural resources, historical and archeological resources, recreational resources, aesthetic resources, endangered and non-game species, fisheries and any other identifiable impacts; and

2. The report shall include a listing of qualifications of those preparing the report and a reference list of pertinent published information relating to the project, the project site and the surrounding region.

“Formal inspection” means the inspection by a New Jersey licensed professional engineer to reevaluate the safety and integrity of the dam and appurtenant structures to determine if the structure meets current design criteria, including a field inspection and a review of the records on project design, construction and performance.

“Freeboard” means the vertical dimension between the crest of the embankment of a dam (without camber) and the reservoir water surface at the spillway design flood stage.

“Height-of-dam” means the vertical dimension from the lowest point in the stream bed or ground surface at the downstream toe of the dam to the elevation of the top of dam (without camber).

“Independent Review Board” means one or more independent professional engineers who are qualified in the design, construction and rehabilitation of dams to perform a review of the project design and construction.

“Informal inspection” means the visual inspection of the dam by the dam owner or operator to detect apparent signs of deterioration or other deficiencies of the dam structure or function.

“Levee” or “dike” means any artificial barrier together with appurtenant works that will divert or restrain the flow of a stream or river.

“One-hundred-year storm” means the storm which is estimated to have a one percent chance, or one chance in 100, of being equalled or exceeded in any one year.

“Outlet” means an opening through which water can be freely discharged from a reservoir for a particular purpose.

“Owner and/or operator” means any person who owns, controls, operates, maintains, manages or proposes to construct a dam.

“Permit” or “dam permit” means all approvals required under N.J.S.A. 58:4-1 et seq. for the construction and operation of a dam.

“Person” means any individual, proprietorship, partnership, association, corporation, municipality, county or public agency.

“Pipe conduit” means any hollow tube which conveys water through a dam from a reservoir, either as a spillway or as a drain.

“Principal spillway” means the primary or first used spillway during normal inflow and flood flows.

“Probable maximum precipitation” or “(PMP)” means the theoretically greatest depth of precipitation for a given duration that is physically possible, over a given size storm area, at a particular geographic location, at a certain time of year.

“Regular inspection” means the visual inspection of a dam by a New Jersey licensed professional engineer to detect any signs of deterioration in material, developing weaknesses or unsafe hydraulic or structural behavior.

“Reservoir” means any impoundment or any potential impoundment that will be created by a dam, dike or levee.

“Spillway” means a structure other than low flow outlets, over or through which flood flows are discharged.

“Spillway design storm” means the storm upon which the hydraulic capacity of the spillway structure is designed.

“Toe-of-dam” means the junction of the downstream face of a dam with the ground surface or the invert of the outlet pipe, whichever is the lowest point.

Amended by R.1990 d.276, effective June 4, 1990.

See: 22 N.J.R. 279(a), 22 N.J.R. 1760(a).

Added “Emergency spillway”, “Independent Review Board”, and “Toe-of-dam”. Revised “Division” and “Height-of-dam”.

Amended by R.1995 d.266, effective June 5, 1995.

See: 27 N.J.R. 795(a), 27 N.J.R. 2210(a).

7:20-1.3 Permit-by-rule

(a) All dams must be designed, constructed, operated, maintained or removed in compliance with the rules in this subchapter except as set forth below:

1. A general description of the dam and all appurtenances thereto, and the proposed dam classification, pursuant to N.J.A.C. 7:20-1.8. The description shall include the following:

- i. A statement of the purpose for which the dam and appurtenances are to be used; and
 - ii. A description of the potential effects of project construction and operation upon the environment.
2. Maps of the area within one-half mile of the dam and impoundment boundary, showing the following:
- i. The location of the proposed dam and all appurtenances, thereto;
 - ii. The location of all structures;
 - iii. The county and township;
 - iv. The boundary of the reservoir;
 - v. The location of all streets and roads;
 - vi. The location of all major utilities, i.e. pipe lines and transmission, telegraph, and telephone lines; all minor utilities shall be identified in the immediate vicinity of the dam and impoundment area;
 - vii. The topography and scale; and
 - viii. All other structures or facilities affected by the proposed dam, including the area downstream from the dam (State, county, and U.S.G.S. maps and aerial photographs may be used for this purpose).
3. A written report of the surficial conditions (i.e. geology, topography, and culture), based upon a field reconnaissance by the applicant's engineer;
4. Typical cross-sections of the dam, and any dike(s) and levee(s), showing proposed elevations, pool levels and top and bottom widths;
5. Preliminary design data, tentative conclusions and references. The design data shall address hydrologic features such as drainage area and rainfall data, the basis for proposed dam location, the basis for the type of structure and spillway proposed, the soils and geologic engineering criteria and the basis for design and construction;
6. The hydrologic design procedure and the storm durations which are used in the design;
7. All documentation and information related to determining hazard classification; and
8. Other information required by the Department.

(b) Upon review of the pre-application, the Department will notify the applicant of what design criteria will apply.

(c) Applicants for a permit to repair an existing dam are not required to submit a preliminary report unless the Department determines it to be necessary.

Amended by R.1990 d.276, effective June 4, 1990.
See: 22 N.J.R. 279(a), 22 N.J.R. 1760(a).
Added (c).

7:20-1.7 Application stage

(a) The application shall be on forms specified and supplied by the Department and must be accompanied by two copies of the final design report and construction specifications and five sets of all plans, drawings, designs and specifications. Upon the written request of the applicant, the Department may waive certain requirements for documentation in the application stage set forth at (b) to (g) below for a permit to modify or repair an existing dam.

(b) The application shall include a Final Design Report, which must contain the following:

1. A report of the field and laboratory investigation(s) of the foundation soils and/or bedrock, a location map to identify borings and the materials that will comprise the dam and any dikes or levees. Stability and settlement analyses and seepage and underseepage studies are required, unless the applicant can demonstrate to the satisfaction of the Department that these analyses are not necessary.

2. The bases, references, calculations and conclusions relative to hydrologic studies and design of spillway.

3. Structural and hydraulic design studies and calculations. Structural, hydraulic and hydrologic design procedures should be used, as established by one of the following: the U.S. Army Corps of Engineers, the U.S. Bureau of Reclamation, the U.S. Soil Conservation Service and other procedures universally accepted as sound engineering practice.

(c) The application must include all drawings necessary to fully describe the proposal. Drawings must be prepared in accordance with the following:

1. All drawings must be prepared by a New Jersey licensed professional engineer or land surveyor, as appropriate. Each drawing shall have a title block which meets the requirements of the State Board of Professional Engineers and Land Surveyors.

2. Drawings must clearly show the datum to which elevations shown are referred. The National Geodetic Vertical Datum of 1929 (N.G.V.D.), formerly known as the U.S. Coast & Geodetic Survey Datum, should be used wherever possible. If the N.G.V.D. datum is not used, an appropriate conversion equation must be indicated on the drawings.

3. The applicant must submit drawings showing the following information:

- i. A general plan of the dam, drawn to an appropriate scale, which must show accurately the position of all essential details, such as the spillway and its point of discharge into the stream, pipes through the dam,

inlets, outlets, screen chambers, gate or valve houses, head-races, the canal mill or power plant, tailraces and downstream bridges which might cause backwater on the dam;

ii. A longitudinal section of the dam and cross-section of the valley at the site of the dam, showing the elevation of the crest of the dam, the elevation of the normal and design storm flow line of the lake or reservoir, the original surface of the ground, the nature and depth of the underlying strata, the probable depth of the excavation for the foundation of the dam and for the cutoff, foundation treatment, elevation of the restored surface of the ground, the location and elevation of all pipes or conduits passing through the dam, the core wall, if any, and the spillway structure;

iii. Typical cross sections, including a maximum section of the dam and of a spillway section which shall meet the following requirements:

(1) Cross sections must show the original surface of the ground, subsurface conditions as disclosed by test pits or borings, the probable depth of excavations for the foundation and for cutoff, the elevations of the top of the dam, the crest of the spillway and the normal flow line or water surface in the reservoir;

(2) For earth dams, the depth of stripping must be shown, as well as the position, material and dimensions of the cutoff or core wall, the width of the crest, the slopes and the nature and dimensions of the slope protection, the position and dimensions of the outlet pipes or conduits and the cutoff to prevent seepage along such structures, the disposition of different classes of embankment material if of varying composition, toe drains and clay blankets;

(3) For concrete or other composite dams, the cross sections shall show all dimensions and shall indicate the position and kinds of material to be included in the structure.

iv. If not clearly indicated on one or more of the drawings listed above, the following details shall be shown on additional detail sheets:

(1) Detail of spillway or overflow, showing the length and depth of opening, together with the width and shape of the crest, grade and shape of the approach and discharge channels, if any, methods of protecting the toe of the dam or end of the discharge channel from erosion and the dimensions of all walls, floors and paving;

(2) Details of the intake and outlet works, showing the location and dimensions of all valves or sluice gates, intakes, screen chambers, racks, outlet towers and gate houses and appurtenances;

(3) For reinforced concrete dams, detailed drawings must also be submitted, showing the size, spacing and arrangement of all reinforcing steel and expansion joints; and

(4) Special drawings shall be submitted showing any special construction features not otherwise shown, such as piling, fishways, aprons, materials used in the core wall, movable dams, tainter gates and mechanical devices, drains and instrumentation.

(d) The application must include specifications, containing the following:

1. General provisions, specifying the rights, duties and responsibilities of the owner, applicant, applicant's engineer and the builder;

2. The estimated project schedule and sequence of work; and

3. Technical provisions, describing carefully and in detail the approved work methods and procedures, standards for equipment and testing, materials to be used and the results to be obtained.

(e) The application shall complete all investigations, including the following, prior to submission of the final design report which shall meet the following requirements:

1. The scope and the degree of precision of investigations required for a specific project shall be based on the complexities of the site, the importance of the proposed structure and the hazard created by the proposed structure.

2. The foundation investigation shall consist of borings, test pits, seismic investigations or other subsurface explorations and must be performed so as to accurately define the soil and rock stratigraphy and the ground water conditions to the satisfaction of the Department.

3. Laboratory testing of undisturbed and remolded soil specimens and rock samples may be required by the Department.

4. The applicant must determine the nature and extent of materials which are proposed for use in the structure (e.g. borrow material, concrete aggregate, riprap stone, filter materials) and their structural properties when incorporated into the proposed structure.

5. Stability analysis and calculations for the proposed structure to ensure safety against failure due to overturning, sliding or overstressing must be submitted and approved by the Department.

6. Topographic surveys must be performed with sufficient accuracy to locate the proposed construction and to define the volume of the storage in the reservoir and the flowage limits. The upstream and downstream area must be investigated in order to delineate the area of potential damage in case of failure or flooding. Locations of baselines, centerlines and other horizontal and vertical control points must be shown on the topographic map of the site.

7. The drainage area must be accurately determined. Both present and projected future land use must be considered in determining the runoff characteristics of the drainage area. The most severe of these two conditions must be used in the design. The hydrologic assumptions and design calculations used in spillway designs shall be specified and shall include:

- i. Drainage area size;
- ii. Rainfall and runoff data;
- iii. Reservoir inflow hydrographs;
- iv. Reservoir area-capacity-elevation data;
- v. Spillway elevation-discharge data; and
- vi. Reservoir flood routings, except as otherwise provided in this subchapter.

(f) All applicants must submit an Operation and Maintenance Manual in accordance with N.J.A.C. 7:20-1.11 and applicants for Class I and II dams (see N.J.A.C. 7:20-1.8) shall prepare and submit an Emergency Action Plan which shall at least include a Dam Breach Analysis, Inundation Maps and Emergency Notification and Evacuation Plans.

(g) The Department may require the submission of an Environmental Impact Statement, as defined in N.J.A.C. 7:20-1.2, by any applicant for a dam permit.

(h) The application to remove or breach a dam shall include the following:

1. Design report, and plans and computations to effect the breach including size of breach, shape of breach, disposal of spoil material;
2. Plans and computations for stabilization of the lake bed including the channel upstream of the breach, and for the control of sediment within the lake downstream of the breach during and after the breach has been effected;
3. Computations for design of the method and timing for dewatering the lake;
4. Computations detailing the effects of the breach on the downstream channel and demonstrating that the project will not adversely affect flooding conditions downstream during the 10, 50 and 100 year storms;
5. Specifications containing the technical provisions which describe in detail the proposed work methods and equipment and, in addition, a work schedule for the entire project;
6. A plan of the existing dam and lake along with surrounding property lines;
7. Evidence that all adjoining property owners of the impoundment and the municipality where the reservoir or dam is located have received notification that an application has been submitted to the Department to remove or breach a dam and proof of publication of notice of the

proposed removal application in at least one newspaper of general circulation in the municipality where the reservoir or dam is located;

8. A description of the potential effects of the dam removal or breach upon the environment; and

9. A description of the potential effects of the dam removal or breach upon life and property downstream of the dam.

Amended by R.1990 d.276, effective June 4, 1990.
See: 22 N.J.R. 279(a), 22 N.J.R. 1760(a).

In (a), added provision regarding waiver of certain documentation requirements. Added (h).

Amended by R.1995 d.266, effective June 5, 1995.
See: 27 N.J.R. 795(a), 27 N.J.R. 2210(a).

In (f) added the requirement that applicants submit an Operation and Maintenance Manual; and in (h)4 added the proviso that computations be made involving 10, 50, and 100 year storms.

7:20-1.8 Dam classification

(a) The Department will use the following guidelines to classify dams according to hazard. Probable future development of the area downstream from the dam which might be affected by its failure will be considered in determining the hazard classification. The Department may, in its discretion, change the hazard class of any proposed or existing dam.

1. Class I—High Hazard Potential: This classification includes those dams, the failure of which may cause the probable loss of life or extensive property damage.

i. The existence of normally occupied homes in the area that are susceptible to significant damage in the event of a dam failure will be assumed to mean “probable loss of life”.

ii. Extensive property damage means the destructive loss of industrial or commercial facilities, essential public utilities, main highways, railroads or bridges. A dam may be classified as having a high hazard potential based solely on high projected economic loss.

iii. Recreational facilities below a dam, such as a campground or recreation area, may be sufficient reason to classify a dam as having a high hazard potential.

2. Class II—Significant Hazard Potential: This classification includes those dams, the failure of which may cause significant damage to property and project operation, but loss of human life is not envisioned. This classification applies to predominantly rural, agricultural areas, where dam failure may damage isolated homes, major highways or railroads or cause interruption of service of relatively important public utilities.

3. Class III—Low Hazard Potential: This classification includes those dams, the failure of which would cause loss of the dam itself but little or no additional damage to other property. This classification applies to rural or agricultural areas where failure may damage farm build-

ings other than residences, agricultural lands or non-major roads.

4. Class IV—Small Dams: This classification includes any project which impounds less than 15 acres/feet of water to the top of the dam, has less than 15 feet height-of-dam and which has a drainage area above the dam of 150 acres or less in extent. No dam may be included in Class IV if it meets the criteria for Class I or II. Any applicant may request consideration as a Class III dam upon submission of a positive report and demonstration proving low hazard.

Amended by R.1990 d.276, effective June 4, 1990.
See: 22 N.J.R. 279(a), 22 N.J.R. 1760(a).

In (a), text clarified regarding DEP's authority to change a hazard class. In (a)4, 15 feet height-of-dam was 10 feet.

7:20-1.9 Design criteria

(a) The minimum design storm used to calculate required spillway capacity must be determined according to the following table:

Hazard	Spillway Design Storm (SDS)
Class I	PMP
Class II	One-half PMP
Class III	24 hour 100 year frequency, Type III storm ¹
Class IV	24 hour 100 year frequency, Type III storm plus 50% ¹

¹ Any later technology adopted by the U.S. Department of Agriculture, Soil Conservation Service may be substituted for the use of the Type III storm.

(b) For existing dams, it is recognized that the relationships between valley slope and width, total reservoir storage, drainage area, and other hydrologic factors have a critical bearing on determining the safe spillway design flood. When appropriate, based on the design of the dam, rational selection of a safe, reduced spillway design for specific site conditions based on quantitative and relative impact analysis is acceptable. The spillway should be sized so that the increased downstream damage resulting from overtopping failure of a dam would not be significant as compared with the damage caused by the flood in the absence of a dam overtopping failure. The minimum design storm for the dam shall be the 100 year storm.

(c) All Class II and III dams shall, where practicable, incorporate in the proposed design, the ability to make modifications necessary to increase the spillway capacity of the facility or other alternative measures if the downstream hazard potential increases.

(d) All dams shall have adequate storage for the design storm or have a spillway system which will safely pass the design storm without endangering the safety of the dam.

(e) Each spillway shall include a satisfactory means of dissipating the energy of flow at its outlet without endangering the safety of the dam.

(f) The capacity of the spillway system shall be equal to the peak inflow of the design flood unless the applicant demonstrates by flood routing procedures that the spillway system has the capacity to safely pass the resulting water flow.

(g) Pipe conduits may be used for the primary (principal) spillway. When so used, the following requirements shall be met:

1. Pipe conduits shall be of such design as to safely support the total external loads in addition to the total internal hydraulic pressure without leakage. The type of construction material used shall be consistent with the anticipated life of the structure. Corrugated metal pipe shall not be used in the construction of new dams.

i. For Class I and II dams, the minimum allowable inside dimension of the pipe conduit is 30 inches.

ii. For Class III dams, the minimum allowable inside diameter of the pipe conduit is 18 inches.

iii. For Class IV dams, the minimum allowable inside diameter of the pipe conduit is 12 inches.

2. All pipe conduits shall convey water at the maximum design velocity without damage to the interior surface;

3. The pipe conduits shall be designed so that negative pressure will not occur at any point along the primary (principal) spillway system;

4. Anti-seep collars or other methods approved in writing by the Department shall be installed to control seepage along the conduit;

5. Adequate allowances shall be incorporated in the design to compensate for differential settlement and possible elongation of the pipe conduit;

6. An anti-vortex device shall be included in the design unless the applicant has demonstrated to satisfaction of the Department that one is not necessary;

7. A trash rack, approved by the Department, shall be installed at the intake to prevent clogging of the pipe conduit;

8. An emergency spillway shall be provided; and

9. Cathodic protection is required for all metal pipes.

(h) Should a vegetated or unlined auxiliary spillway, approved by the Department, be installed, it must be able to pass the design storm without jeopardizing the safety of the structure and that has a predicted average frequency of use less than:

1. Once in 100 years for Class I dams;

2. Once in 50 years for Class II dams; or

3. Once in 25 years for Class III and IV dams.