Article 2 Applications for Construction, Enlargement, Repair, Alteration, or Removal of Dams or Reservoirs

Section 310. Applications for Construction or Enlargement

(a) This section shall apply to applications for the department's approval of plans and specifications for the construction or enlargement of dams and reservoirs.

(b) Applications for construction or enlargement of a dam and reservoir shall be made on printed forms provided by the department. The department shall also provide written instructions for completing the application.

(c) The amount of information required will depend on factors such as the size of the proposed dam and reservoir, potential hazards, hydrology of the watershed, complexity of the site and proximity to active faults.

(d) Plans, maps, specifications and other information required for an application shall be provided in sufficient clarity and detail to be readily interpreted and studied, and to permit an adequate evaluation of the safety of the proposed work.

(e) The department may require the filing of any information, in addition to that specified in this section which, in its opinion, it considers necessary to determine the safety of the dam and reservoir.

(f) In addition to the information required by Water Code Sections 6201-6206, and subsections (b)-(e), an application shall also include the following:

1. Evidence of water rights, as required by Section 303.

2. Information necessary to enable the department to comply with the requirements of the California Environmental Quality Act (Public Resources Code Sections 21000-21174). This information shall be either:
(A) a copy of the environmental impact report (EIR) or negative declaration prepared by a lead agency, or evidence that a lead agency is preparing or will prepare environmental documentation, or

(B) data and information necessary for the department to act as a lead agency to prepare environmental documentation, where it is required by law to do so.

(3) Where the department acts as a responsible agency, the lead agency’s EIR or negative declaration must be submitted to the State Clearinghouse.

(4) The fee as required by Water Code Section 6300, as made specific by Section 314 of this subchapter.

(5) For the construction or enlargement of dams that the department classifies as significant, high, or extremely high hazard potential, inundation maps and other requirements described in sections 335 to 335.20 for the dam and all critical appurtenant structures.

Authority: Sections 6078 and 6162, Water Code.
Reference: Sections 6075, 6200-6206, 6261, 6355, and 6357, Water Code; and Sections 21002.1(d) and 21083, Public Resources Code.

Article 6. Inundation Maps

Section 335. Scope and Applicability of Regulations

(a) Owners of state jurisdictional dams, except dams classified by DSOD as low hazard, shall prepare inundation maps for their dams and critical appurtenant structures. Dam owners are responsible for preparing and submitting these documents to DSOD as described in this article. Approved inundation maps are used to support emergency action plans that dam owners are required to prepare pursuant to section 6161 of the Water Code.

(b) The provisions of this article apply to all owners of state jurisdictional dams except dams classified by DSOD as low hazard, including those regulated pursuant to Title 18, Code of Federal Regulations, Part 12.

Note: Authority Cited: Water Code sections 6078 and 6162.
Section 335.2. Definitions

(a) Unless the context clearly requires otherwise, as used in this article, the terms below shall have the meanings noted:

(1) “Breach” refers to an opening through a dam or critical appurtenant structure.

(2) “Critical appurtenant structure” refers to a barrier or hydraulic control structure that impounds the same reservoir as the dam and is 25 feet or more in height, impounds a minimum of 5,000 acre-feet of water at the maximum possible storage elevation, or that DSOD determines poses a significant or higher downstream hazard potential per section 335.4(a). Typical critical appurtenant structures include emergency spillways, gated spillways, and saddle dams.

(A) A critical appurtenant structure may contain multiple water barriers, including but not limited to gates, flashboards, and concrete monoliths.

(B) The height of a critical appurtenant structure shall be measured from the upstream toe or downstream toe, whichever elevation is higher, to the maximum possible storage elevation, except for the following cases:

1. For a structure comprising gates constructed on a concrete control structure, such as a spillway with multiple radial gates, its height shall be measured from the upstream toe of the concrete control structure to the maximum possible storage elevation.

2. If gates are affixed to a concrete dam, the height shall be measured from the base of the gates to the maximum possible storage elevation.

(C) A penstock or low-level outlet shall be considered a critical appurtenant structure if DSOD determines it poses a significant or higher downstream hazard potential, as defined in section 335.4(a).

(3) “Critical facilities” refers to law enforcement facilities, fire stations, schools, hospitals, prisons, and major roads.

(4) “Dam” has the same meaning as provided in section 6002 of the Water Code.
(5) “Dam system” refers to a dam and all critical appurtenant structures that impound the same reservoir.

(6) “DSOD” refers to the Division of Safety of Dams within the Department of Water Resources, which regulates dam safety pursuant to Water Code, Division 3, Part 1.

(7) “Dynamic routing” refers to hydraulic flow routing based on the shallow water equations to compute changes in discharge, velocity, and stage with respect to time at various locations along a watercourse.

(8) “EAP” refers to an emergency action plan as described in section 8589.5 of the Government Code.

(9) “Failure scenario” refers to the modeled simulation of a breach of a dam or critical appurtenant structure that results in an unintended release of the impoundment.


(11) “Flood wave arrival time” refers to the elapsed time from the initiation of the failure scenario until the arrival of the leading edge of the flood wave.

(12) “Geospatial file” refers to a digital file containing data that is geographically referenced, typically in vector or raster format.

(13) “Hydraulic model” refers to a computer model used to simulate the spatial and temporal changes of water depth and velocity conveyed through a watercourse.

(14) “Hydrograph” refers to a graphical representation of flow as a function of time.

(15) “Inundation area” refers to the area downstream of the dam or critical appurtenant structure that would experience a rise in water surface elevation as the result of a failure scenario.

(16) “Inundation boundary” refers to the perimeter of the inundation area.
(17) “Inundation map” refers to a map showing the impacts of a failure scenario, such as where and when flooding would occur, and may contain multiple sheets.

(18) “Inundation map sheet” refers to a page in an inundation map.

(19) “Maximum possible storage elevation” refers to the maximum reservoir elevation to which water can be physically impounded without spilling, not including any flood surcharge.

(20) “NAVD88” refers to the North American Vertical Datum of 1988 computed by the National Geodetic Survey.

(21) “Owner” has the same meaning as provided in section 6005 of the Water Code.

(22) “PDF” refers to a portable document format file.

(23) “Projection” refers to a method by which the curved surface of the Earth is portrayed onto a flat surface.

(24) “Raster” refers to a data format that represents geographic information as a grid of cells, where each cell contains a value.

(25) “Storm-induced loading condition” refers to the meteorological conditions before and during the modeled breach of the dam or critical appurtenant structure when the reservoir is at or above the maximum possible storage elevation and the inundation boundary is greater than that of a sunny-day loading condition due to a rain or flood event.

(26) “Sunny-day loading condition” refers to the meteorological conditions before and during the modeled breach of the dam or critical appurtenant structure at the maximum possible storage elevation with non-flood season inflow.

(27) “Toe” refers to the junction of the slope of a dam or critical appurtenant structure with the natural ground surface.

(28) “Two-dimensional hydraulic model” refers to a hydraulic model in which variables such as velocity and depth vary in two horizontal directions along a watercourse.
“Vector” refers to a data format that represents geographic information as point, line, or polygon features.

Note: Authority Cited: Water Code sections 6078 and 6162.

Section 335.4. Downstream Hazard Potential Classification

(a) DSOD classifies the downstream hazard potential of all state jurisdictional dams based on a sunny-day loading condition as follows:

(1) Low Hazard Potential. No probable loss of human life and low economic and environmental losses. Losses are expected to be principally limited to the owner’s property.

(2) Significant Hazard Potential. No probable loss of human life but can cause economic loss, environmental damage, impacts to critical facilities, or other significant impacts.

(3) High Hazard Potential. Expected to cause loss of at least one human life.

(4) Extremely High Hazard Potential. Expected to cause considerable loss of human life or would result in an inundation area with a population of 1,000 persons or more.

(b) If a dam owner contends that their dam should be assigned a different hazard potential classification, the dam owner may request a re-evaluation by providing a justification and supporting documentation to DSOD for its re-evaluation. The dam owner shall comply with this article during the re-evaluation of the hazard potential classification.

Note: Authority Cited: Water Code sections 6078 and 6162.
Section 335.6. Modeling Requirements

The breach of the dam and critical appurtenant structures and the subsequent downstream routing of the resulting breach hydrograph shall be modeled in accordance with the requirements of this section. Failure scenarios shall be applied separately to the dam and each critical appurtenant structure. The results of the inundation model shall be used to prepare an inundation map.

(a) Modeling Assumptions for each Failure Scenario. A sunny-day loading condition is required for the modeled breach of each dam and critical appurtenant structure. A storm-induced loading condition is not required, but may be submitted in lieu of a sunny-day loading condition.

(1) Each failure scenario shall assume the following:

(A) The reservoir is at the maximum possible storage elevation.
(B) A breach of the full height of the dam or critical appurtenant structure. The height of the dam is defined in Water Code section 6002 and the height of the critical appurtenant structure is defined in section 335.2(a)(2)(B).
(C) The impoundment associated with the full height shall consist entirely of water.
(D) If a dam owner chooses to include the effects of sediment, the owner may also submit a second failure scenario depicting the effects of sediment release along with supporting documentation to DSOD for consideration. However, modeling sediment release is not required.

(2) Failure scenarios for dams shall comply with the following:

(A) The dam owner shall select one of the following methods that are applicable to the dam for estimating breach parameters, except breach height, prescribed in section 335.6(a)(1)(B):
   1. Table 9-3 of FEMA P-946, incorporated here by reference.
   3. A sensitivity analysis using equations appropriate for the dam in Table 2 of U.S. Department of the Interior’s *DSO-98-004 Prediction of Embankment Dam Breach Parameters* (July
1998), incorporated here by reference, that produces the largest peak outflow.

4. Upon pre-approval by DSOD, alternative breach parameters that fulfill the purpose of section 335.6(a)(2)(A).

(B) If the release from a failure scenario could impact separate watercourses based on the assumed failure locations, the dam sections located upstream of each respective watercourse shall be failed independently as separate failure scenarios.

(3) Failure scenarios for critical appurtenant structures shall comply with the following, as applicable:

(A) For saddle dams, failure scenarios shall be modeled as described in section 335.6(a)(2).

(B) For gated critical appurtenant structures, all gates shall be breached simultaneously together with the control structure.

(C) Multiple gates affixed to concrete dams shall be failed collectively but separately from the dam.

(D) All critical appurtenant structures, except for saddle dams, shall assume a nearly instantaneous and complete failure.

(E) For any type of critical appurtenant structure and upon pre-approval by DSOD, the dam owner may assume an alternative failure mode that produces the largest peak outflow, as substantiated by a sensitivity analysis.

(4) If a failure scenario is expected to cause the failure of any downstream dams or critical appurtenant structures, the failure of those downstream dams and critical appurtenant structures shall be included in the model and map.

(b) Inundation Modeling Assumptions. The inundation model shall satisfy the following requirements:

(1) The elevation data shall be appropriate for the downstream development and terrain that would potentially be impacted by the failure scenario. The horizontal resolution of the data shall be ten meters or finer.

(2) The following describes the modeling software requirements used to simulate the inundation.

(A) An unsteady hydraulic model appropriate for the downstream development and terrain shall be used. The model must be capable of performing dynamic routing to approximate the temporal and spatial
changes in inundation magnitude and extent. In areas of lateral spreading, a two-dimensional hydraulic model is generally appropriate.

(B) Upon pre-approval by DSOD, the dam owner may submit an alternative model for review that produces the inundation extent and timing described in section 335.6(b)(2)(A).

Note: Authority Cited: Water Code sections 6078 and 6162.

Section 335.8. Technical Memorandum

(a) A technical memorandum shall be prepared for each dam system to document the modeling used to develop inundation maps. The technical memorandum shall include the following:

(1) Name and location of the dam and critical appurtenant structures.

(2) Description of the dam, including the materials and methods of construction and a description of each critical appurtenant structure. Identify elevations of the crest, upstream, and downstream toes. Provide a description of the outlet(s), including capacity. Provide justification for appurtenances that are not considered critical appurtenant structures by the dam owner.

(3) Reservoir storage capacity curve that shows the relationship between reservoir elevation and volume from the base of the reservoir to the dam crest. Elevation shall be specified as feet above NAVD88.

(4) Brief summary of the following:
   (A) Modeled failure scenario(s) for the dam system, including the scenario described in section 335.6(a)(4), if applicable. For each failure scenario, include the breach hydrograph immediately downstream of the dam or critical appurtenant structure in tabular and graphical formats.
   (B) Modeling software:
1. Name
2. Reasons for its use
3. Version
4. Release date
(C) Modeling assumptions.
(D) Breach parameters for each failure scenario submitted in tabular format. Provide an explanation for breach parameter selection.
(E) Type of terrain data used, including any modifications made to the terrain.
(F) Any sensitivity analyses of the model, including the model’s response to changes made to the roughness or other friction coefficients.
(G) Modifications made to stabilize the model or accelerate its computational runtime, if applicable, and the effects such modifications have on the modeled inundation results.
(H) Determination of the inundation boundary per section 335.10(c).

(5) The signature, seal, and license number of the California-licensed professional civil engineer responsible for preparing the technical memorandum.

Note: Authority Cited: Water Code sections 6078 and 6162.

Section 335.10. Inundation Maps

(a) An inundation map shall be prepared for each failure scenario as described in section 335.6. Inundation maps must contain the following model outputs as rasters, contours, points, or cross-sections at appropriate time and space intervals displayed over current aerial imagery:

(1) Inundation boundary.
(2) Flood wave arrival time.
(3) Maximum depth, and
(4) Maximum velocity.
(b) If using a raster for items in section 335.10(a), the opacity shall be adjusted to display the underlying aerial imagery.

(c) The inundation boundary shall be displayed as a one-foot maximum depth, except where the flood wave would be confined to a channel or canyon or where the flood wave no longer poses a threat to life or critical facilities.

(d) General information. Each inundation map sheet shall contain the following information:

1. The name of the dam, DSOD’s dam number, the national dam ID number, and the county in which the dam is located.

2. The meteorological loading condition. Identify whether a sunny-day or storm-induced loading condition is depicted. If a storm-induced loading condition is depicted, note the return period of the storm or the term “Probable Maximum Flood,” as applicable.

3. Sediment. If the failure scenario depicts the effects of sediment release, note “Includes reservoir sediment release.”

4. Label identifying the dam.

5. Symbols and a corresponding legend that identifies all critical facilities in the inundation area and within the mapped extent.

6. Labels identifying the downstream channels and flood control features within the inundation area, such as dams, levees, canals, rivers, streams, bypasses, weirs, pumps, and control structures.

7. Boundary delineations identifying the city, county, or other governmental agency jurisdictional boundaries affected by the inundation area.

8. An arrow indicating north.

9. An appropriate scale bar and the stated map scale.

10. Vertical elevation datum specified as NAVD88.

11. If applicable, an index showing the relationship of the map sheet to the other map sheets.
(12) The preparation date of the map.

(13) The simulation date of the model.

(14) The signature, seal, and license number of the California-licensed professional civil engineer responsible for preparing the map.

(15) A statement that the information shown is approximate and should be used as a guideline for emergency preparation and response.

(16) For flood waves that are confined within a channel but not shown within the inundation boundary as allowed by section 335.10(c), a statement indicating high flows may continue beyond the inundation boundary.

(17) Labels identifying low-lying areas where the flood recession is expected to be slow and affect lives or critical facilities.

(e) Map Layout. All inundation maps shall be prepared at a scale and quality that enables a person familiar with the area to clearly comprehend an aerial view of the extent of flooding. A map scale such as that described in Section 11.3.3 of FEMA P-946 may be applied.


Section 335.12. Reporting Standards

All submittals under section 335.14 shall utilize the following standards and conventions, unless otherwise specifically indicated in this article:

(a) Reservoir storage and other water volumes shall be reported in acre-feet.

(b) Water discharge shall be reported in cubic feet per second.

(c) Depth shall be reported in feet.

(d) Time shall be reported in minutes, hours, or both.
(e) Elevation shall be reported in feet above NAVD88.

(f) Geospatial files shall be submitted in NAD 1983 Teale (California) Albers projection, with the units specified in feet.

(g) Geospatial files shall be labeled with the loading condition.

(h) Dates shall be reported as month, day, and year.

Note: Authority Cited: Water Code sections 6078 and 6162.

Section 335.14. Submittals to DSOD

(a) The dam owner shall submit the following digital files for each failure scenario:

(1) A color PDF of each inundation map.

(2) Geospatial files for the inundation boundary, flood wave arrival time, maximum depth, and maximum velocity. For inundation maps developed using a two-dimensional hydraulic model, the file format of the flood wave arrival time, maximum depth, and maximum velocity shall be raster files.

(b) The dam owner shall submit one hard copy and one PDF copy of the technical memorandum.

(c) Upon the request of DSOD, the dam owner shall submit a digital copy of the model and other information DSOD needs to complete its review of the inundation map and supporting documentation.

Note: Authority Cited: Water Code sections 6078 and 6162

Section 335.16. Updates to Inundation Maps and Supporting Documentation

(a) The dam owner shall update all inundation map(s) at least every 10 years from the map preparation date of the dam, and sooner under conditions that include, but are not limited to, the following:
(1) Anytime there is a significant change to the dam or critical appurtenant structure, and

(2) Anytime there is a significant change to downstream development or terrain.

(b) When an inundation map is being updated for its 10-year cycle, a new model simulation may not be required.

(1) If all the following conditions are met, a new model simulation is not required:

(A) No significant change to the dam or critical appurtenant structures,

(B) No significant change to downstream development or terrain,

(C) No significant changes to model assumptions, and

(D) No significant changes to inundation modeling state-of-practice.

(2) If a new model simulation is not performed for a 10-year map update, the dam owner shall submit the following:

(A) Updated map(s) with updated aerial imagery, critical facilities, map preparation date, the California-licensed professional civil engineer’s seal, along with all map requirements in section 335.10.

(B) A written explanation of why a new model simulation is not required, as described in section 335.16(b)(1), and all changes made to update the inundation map(s).

(c) A new model simulation must be performed if there is a significant change to the dam, critical appurtenant structures, downstream development or terrain, model assumptions, or inundation modeling state-of-practice. In this case, the dam owner shall submit the map(s), geospatial files, and technical memorandum per section 335.14. The technical memorandum must include a description of all changes to the model and map(s).

Note: Authority Cited: Water Code sections 6078 and 6162.
Section 335.18. DSOD Review and Approval

Upon receipt of a complete submittal pursuant to section 335.14, DSOD shall evaluate it for consistency with the requirements of this article. DSOD shall provide comments to the dam owner and an opportunity to correct deficiencies and provide further explanation. DSOD may approve inundation maps upon a demonstration of compliance with Water Code sections 6160 and 6161 and substantial compliance with this article. Substantial compliance means that the submittals were made in a good faith attempt to conform to requirements in this article and other applicable law, and DSOD determines that the submittal is sufficient in view of the particular circumstances to fulfill the purpose of the requirements. Upon approval of the inundation maps, DSOD will provide written notification to the dam owner.

Note: Authority Cited: Water Code sections 6078 and 6162
Reference: Government Code section 8589.5; Water Code sections 6161 and 6431.

Section 335.20. Inundation Map and EAP Requirements for New and Enlarged Dams

The following shall apply to new or enlarged dams and their critical appurtenant structures that DSOD classifies as significant, high, or extremely high hazard potential:

(a) Inundation maps and the submittals required by section 335.14 shall be submitted before DSOD approval of any construction or enlargement application, pursuant to section 310.

(b) A Certificate of Approval authorizing storage to the elevation requested in the application shall not be issued until the inundation map(s) are approved by DSOD pursuant to section 335.18 and the dam owner has submitted an EAP pursuant to Government Code section 8589.5.

Note: Authority Cited: Water Code sections 6078 and 6162.
Reference: Water Code sections 6075, 6160, 6161, 6202(d), 6205(d), 6206, 6261, 6355, and 6357. Government Code section 8589.5.