



PERMANENT ADMINISTRATIVE ORDER

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CHAPTER 690
WATER RESOURCES DEPARTMENT

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FILING CAPTION: Safety of Dams including Design, Construction, Maintenance, Corrective Action, Removal, and Emergencies

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RULES:

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AMEND: 690-020-0000

RULE TITLE: Purpose and Applicability

NOTICE FILED DATE: 04/29/2020

RULE SUMMARY: Amends existing rule to clarify the Water Resources Department's general responsibilities for Dam safety and for coordination with Dam owner, agencies, and others. Maintains exclusion from regulation for Dams that are not at least ten feet high and storing at least 3 million gallons of Water.

RULE TEXT:

(1) The purpose of these rules is to implement ORS 540.443 through 540.491 and ORS 540.995, as well as applicable sections of ORS 536.050 and ORS 537.400, through actions that are intended to ensure the safety of the Dams, insofar as Dams may affect possible loss of life or property, and damage to public infrastructure. Prioritization of Dam safety actions and requirements are based on the Hazard Rating of the Dam. These rules outline processes to:

- (a) Review design and specifications to Construct a Dam;
- (b) Review plans for Removal of Significant Hazard and High Hazard Dams;
- (c) Conduct routine inspections and notify Dam owners of outcomes;
- (d) Cooperate with Dam owners over Dam safety issues;
- (e) Prescribe Maintenance Actions, corrective actions, or any other actions necessary to protect life, property, or public infrastructure consistent with the Department's authorities and with law, and to pursue formal enforcement as necessary;
- (f) Communicate, coordinate, and collaborate with Persons, Tribes, or other government entities regarding Dam safety;

and

(g) Plan for and respond to emergencies as necessary and as consistent with law.

(2) These rules do not apply to:

(a) Dams that are less than ten feet in Height or that impound less than three million gallons (9.2 Acre-feet) of Water;

(b) Water storage Tanks or various types of Tanks that are part of Water treatment facilities; and

(c) Dams regulated under a federal Dam safety program, except as provided in ORS 540.446 and OAR 690-020-0024.

(3) Compliance with ORS 540.443 through 540.491 and these OAR Chapter 690, Division 20 rules does not relieve the owner or operator of a Dam or an individual in immediate charge of a Dam from any duty, obligation, or liability regarding the ownership, maintenance, or operation of the Dam.

STATUTORY/OTHER AUTHORITY: ORS 536.027, 540.488

STATUTES/OTHER IMPLEMENTED: ORS 536.050, 537.400, 540.446, 540.488, 540.491

AMEND: 690-020-0022

RULE TITLE: Definitions

NOTICE FILED DATE: 04/29/2020

RULE SUMMARY: Amends existing rule to reference definitions used in 2019 Oregon Laws, Chapter 390 (ORS 540.443). Maintains existing definition of essential Dam and Dam safety terminology used in Division 20, with references to the statutory language for definitions defined in statute. Defines terms used in Division 20 rules.

RULE TEXT:

Unless the context requires otherwise, the following definitions apply in OAR Chapter 690, Division 20:

- (1) "Abutment" means a natural valley or canyon side against which the Dam is built;
- (2) "Acre-feet" means the unit of volume equal to one acre covered with one foot of Water (325,851 gallons);
- (3) "Annual Exceedance Probability Flood" means the likelihood of a specific flood flow being equaled to or exceeded in any given year at that specific location, expressed as a percentage;
- (4) "As-built Drawing" means an engineering drawing of a Dam as it was actually constructed, noting all differences between original design and actual constructed condition;
- (5) "Conduit" means a closed conveyance used to release Water through a Dam;
- (6) "Core" means a soil of low permeability within an Embankment Dam;
- (7) "Construct" has the meaning given to the term in ORS 540.443;
- (8) "Constructing" has the same meaning as "Construct";
- (9) "Crest" means the top of the Dam;
- (10) "Cutoff Trench" means a trench excavated beneath the Dam Foundation and backfilled with low permeability material to retard Water seepage;
- (11) "Dam" has the meaning given to the term in ORS 540.443;
- (12) "Dam Failure" has the meaning given to the term in ORS 540.443;
- (13) "Department" means the Oregon Water Resources Department;
- (14) "Director" means the Director of the Oregon Water Resources Department;
- (15) "Embankment" means an engineered earth fill;
- (16) "Emergency Action Plan" or "EAP" has the meaning given to the term in ORS 540.443;
- (17) "Engineer" means an individual who is registered in this state and holds a valid certificate to practice engineering in this state as provided under ORS 672.002 to 672.325;
- (18) "Engineer of Record" means a professional engineer registered in Oregon retained by a Dam owner to analyze, plan, and design a Dam to current safety standards, to oversee safe construction of a Dam, to supervise Modification or Removal of a Dam, or to oversee corrective actions identified by the Department, or to otherwise administer activities for a Dam;
- (19) "Foundation" means the ground surface upon which a Dam is constructed;
- (20) "Freeboard" means the vertical distance between the high-water level in the reservoir and the low spot on the Crest;
- (21) "Gate" or "Valve" means a permanent device for regulating Water flow through the Dam;
- (22) "Hazard Rating" means the categorization of a Dam established by the Department based on the potential damage to life, property, or public infrastructure downstream of a Dam in the event of a Dam Failure;
- (23) "Height" means the maximum height of the Dam above natural ground as measured at the maximum section along the Dam's longitudinal axis;
- (24) "High Hazard Rating" or "High Hazard" has the meaning given to the term in ORS 540.443;
- (25) "Inflow Design Flood" or "IDF" means the peak flood flow that the Engineer of Record will design to safely pass over or through the Spillway;
- (26) "Low Hazard Rating" or "Low Hazard" means that if a Dam were to fail, loss of life would be unlikely, and damage to property or public infrastructure would not be extensive;

- (27) "Maintenance Action" has the meaning given to the term in ORS 540.443;
- (28) "Modification" means changes to a Dam that have a potential impact on the safe functioning of the dam, are to an extent that the modified dam structures no longer conform to the original design, and do not include modifying Dam Height, performing Maintenance Actions, or Removal of a Dam;
- (29) "Person" has the meaning given to the term in ORS 536.007;
- (30) "Potentially Unsafe" has the meaning given to the term in ORS 540.443;
- (31) "Pressurized Conduit" means any pipe that penetrates into a Dam so that there is hydrostatic pressure due to the location of a Gate, Valve, or pipe connection;
- (32) "Probable Maximum Flood" or "PMF" means the largest flood that could occur at a specific location, determined by the most severe set of atmospheric, soil moisture, and snowpack conditions that are reasonably possible at that location;
- (33) "Removal" means demolishing all, or a portion of, the Dam structure permanently preventing storage of Water and allowing safe and natural passage of flood flows downstream;
- (34) "Significant Hazard Rating" or "Significant Hazard" has the meaning given to the term in ORS 540.443;
- (35) "Soil Filter" means soil with a gradation designed to inhibit movement of adjacent, finer grained soils;
- (36) "Spillway" means any structure constructed to bypass Water, including flood waters, to prevent Water overtopping the Crest;
- (37) "State Engineer" means an Engineer employed by the Department that is either the director or a principal assistant working for the director as described in ORS 536.032;
- (38) "Tank" means a fully-enclosed (bottom and sides) hydraulic structure made from metal, reinforced concrete, rigid fiberglass, or plastic that provides its own Water-sealing and structural stability;
- (39) "Toe Drain" is a drainage structure designed to collect and remove seepage Water from the toe of the Dam and to discharge this Water in a manner where it can be measured;
- (40) "Unsafe" has the meaning given to the term in ORS 540.443;
- (41) "Water" means water or wastewater;
- (42) "Zoned Embankment" means an Embankment Dam with a Core of low permeability materials, Soil Filter materials, drainage, and other materials placed to improve performance and safety of the Dam.

STATUTORY/OTHER AUTHORITY: ORS 536.027, 540.488

STATUTES/OTHER IMPLEMENTED: ORS 540.443

REPEAL: 690-020-0023

RULE TITLE: Dam Safety Process Requirements for Construction of Dams

NOTICE FILED DATE: 04/29/2020

RULE SUMMARY: Rule repealed to conform with changes to statute made in 2019, updates made to other sections of rules, and for clarity.

RULE TEXT:

- (1) Dam safety requirements shall be based on the hazard rating of the dam, in order to efficiently protect life and property.
- (2) Any person, corporation, association, firm, partnership, limited liability company, joint stock company, unit of local government as defined in ORS 190.003, or State agency must, before beginning any construction on a dam, secure the services of a qualified engineer to design the dam and also to provide information on the dam as it was actually constructed. This engineer shall be deemed the engineer of record for the purposes of these rules.
- (3) The engineer of record shall design the dam and develop plans and specifications consistent with these rules.
- (4) Prior to beginning construction on any dam subject to these rules, written approval of dam designs, drawings and specifications must be obtained from the State Engineer as described in OAR 690-020-0080.
- (5) The engineer of record must oversee construction of the dam consistent with rules governing administration of dam construction in OAR 690-020-0065 to evaluate whether the dam is constructed consistently with approved plans and specifications. Any essential design changes must be described and justified in a letter sent to the State Engineer with the "as-built" drawings.

STATUTORY/OTHER AUTHORITY: ORS 540.350 - 540.400

STATUTES/OTHER IMPLEMENTED: ORS 183, 536, 543

ADOPT: 690-020-0024

RULE TITLE: General Department Authorities and Intergovernmental Coordination

NOTICE FILED DATE: 04/29/2020

RULE SUMMARY: This new rule describes Department statutory authorities for regulation, intergovernmental coordination, accepting monies, limited actions on federal dams, and accepting reports.

RULE TEXT:

In addition to any other powers of the Department, in carrying out its duties, functions, and powers, under these rules and ORS 540.443 through 540.491 and 540.995, the Department may:

- (1) Enter into contracts, memorandums of understanding and intergovernmental agreements for the inspection, evaluation or study of Dams, or the response to Dam Failure or potential Dam Failure.
- (2) Accept moneys from any public or private source for the administration and enforcement of ORS 540.443 through 540.491 and these Division 20 rules for enhancing the safety of Dams or the protection of life, property, or public infrastructure in areas below Dams.
- (3) Coordinate with federal, Tribal, state, local, and private entities to enhance the safety of Dams or the protection of life, property, or public infrastructure in areas below Dams.
- (4) Waive or reduce fees for Dams inspected by another state agency under a memorandum of understanding with the Department.
- (5) Aid in the inspection of a Dam and provide advice and assistance to prevent, mitigate, or respond to a potential or actual Dam Failure if there is a potential or actual risk of Dam Failure at a Dam regulated under a federal Dam safety program.
- (6) Accept the reports of consulting Engineers, engineering geologists or other specialists employed by the Dam owner.
- (7) Employ consulting Engineers, engineering geologists, or other specialists to make special examinations and inspections, and to prepare reports for the Department if the Department concludes that existing reports are insufficient. The cost of such special examinations, inspections, and reports shall be paid by the Department, or upon mutual agreement, may be divided between the Department and the Dam owner.

STATUTORY/OTHER AUTHORITY: ORS 536.027, 540.488

STATUTES/OTHER IMPLEMENTED: ORS 540.446, 540.464, 540.488

REPEAL: 690-020-0025

RULE TITLE: General Requirements

NOTICE FILED DATE: 04/29/2020

RULE SUMMARY: Repeals existing rule that is no longer needed due to updates to other rules and to conform with 2019 Oregon Laws, Chapter 390.

RULE TEXT:

- (1) The Director may require additional information or data beyond that specified in these rules to determine the safety of a proposed dam.
- (2) The Director may include, as part of any permit to construct a dam, limitations and conditions that pertain to construction, operation, maintenance, and the protection of lives and property. These limitations and conditions become, by reference, part of the water right certificate and remain in effect throughout the life of the water right.
- (3) Approved plans and specifications for construction are, by reference, considered limitations and conditions placed on the water right permit and water right certificate. The Director retains the authority to place additional limitations and conditions on the water right relative to operation and maintenance.
- (4) Dams constructed or operated in violation of limitations and conditions included in the water right permit or certificate are subject to restricted use. The certificate affirms the applicant's right to store water subject to the limitations and conditions therein.
- (5) For new dams on stream channels, an outlet conduit must be installed to permit drainage of all or most of the reservoir and for passage of flow to downstream, instream and out of stream water right holders or instream minimum releases unless the engineer of record provides another alternative and demonstrates the safety and efficacy of this alternative to the State Engineer.
- (6) The Department shall determine water impoundment volumes in acre-feet as follows:
 - (a) For dams impounding water for an authorized beneficial use, the impoundment volume indicated in the area-capacity curve as measured from the bottom of the reservoir to the spillway crest. For dams with multiple spillways, 'spillway crest' is referring to the crest of the lower elevation spillway.
 - (b) For wastewater treatment lagoons, the impoundment volume is that indicated in the wastewater lagoon plans and specifications.
 - (c) For diversion or flood control dams, the impoundment volume is that calculated at full reservoir at the dam highest elevation spillway crest level.
- (7) The State Engineer may approve final designs, drawings and specifications for water storage reservoirs after a water storage application and a draft final order for that application have been issued by the Department.
- (8) Any person, firm or private or municipal corporation must provide to the State Engineer an evaluation of whether the dam includes measures that make it readily adaptable to power generation for any new dam over 25 feet high on a stream with average annual flow over 2 cubic feet per second, unless exempted from this requirement as provided in ORS 540.350(3).
- (9) For any dam rated high hazard, the Department must review and approve an Emergency Action Plan prior to filling the reservoir.
- (10) For any dam rated high or significant hazard, the Department must review and approve an operations and maintenance manual prior to construction on the dam.

STATUTORY/OTHER AUTHORITY: ORS 540.350 - 540.400

STATUTES/OTHER IMPLEMENTED: ORS 183, 536, 543

ADOPT: 690-020-0026

RULE TITLE: Fees

NOTICE FILED DATE: 04/29/2020

RULE SUMMARY: Describes administration of newly authorized fees for review of Dam construction documents. Describes annual Dam safety program fees.

RULE TEXT:

(1) The Department may charge a fee for examination of the site, plans and specifications, features, and other supporting information regarding construction of a new Dam or construction to modify Dam Height. The fee, as provided in ORS 540.449, must be paid prior to final design approval and may not exceed the lesser of the costs of providing the examination or the amounts provided in ORS 540.449(3).

(2) Dam owners subject to the Department's laws governing Dam safety shall submit to the Department an annual fee based upon the Dam's Hazard Rating as provided in ORS 536.050(2) to support the Dam Safety Program and administration expenses.

(a) Dam owners who fail to pay the annual fee on or before six months after the billing date may be required to pay a late fee as provided in ORS 536.050(2).

(b) If a Dam owner fails to pay the annual fee or late fee charged by the Department, the Department may, after giving the Dam owner notice by certified mail, place a lien on the real property where the Dam is located for the fees owed by the Dam owner.

(c) Multiple Dams directly adjacent to each other and connected together and separated only by Embankments or other manmade materials will be considered as one Dam for the purpose of determining annual fees.

STATUTORY/OTHER AUTHORITY: ORS 536.027, 540.488

STATUTES/OTHER IMPLEMENTED: ORS 536.050, 540.449

ADOPT: 690-020-0028

RULE TITLE: Preliminary Plans and Specifications for Construction of New Dams or to Increase Dam Height

NOTICE FILED DATE: 04/29/2020

RULE SUMMARY: This rule describes initial submittal information for dams, where this is required and where it is advised.

RULE TEXT:

(1) If a Dam requires a Water right, preliminary plans and specifications must be submitted to the Department at the time an application to appropriate Water is submitted to the Department pursuant to ORS 537. Preliminary plans and specifications are recommended for Dams that do not require a Water right.

(2) Preliminary plans and specifications must include the following at a minimum:

(a) A contour map of the reservoir site showing the proposed location of the Dam. The map should be no smaller than 11" X 17". The map must show the proposed location of the Spillway(s) and the Conduit inlet and outlet;

(b) Written description of the proposed Dam location both as Latitude/Longitude and Township/Range/Section;

(c) A cross section of the proposed Dam at the maximum section indicating the proposed Height;

(d) The proposed storage of the reservoir in Acre-feet; and

(e) A brief description of geologic conditions of the proposed site. Any geologic features that could impact the safety of the Dam should be clearly described.

(3) The preliminary plans and specifications must be submitted by an Engineer, or a certified engineering geologist that is registered in the State of Oregon and is also a Certified Water Rights Examiner.

STATUTORY/OTHER AUTHORITY: ORS 536.027, 540.488

STATUTES/OTHER IMPLEMENTED: ORS 537.400

REPEAL: 690-020-0029

RULE TITLE: Recommendations for Dams Under 10 Feet High or Storing less than 9.2 Acre-feet

NOTICE FILED DATE: 04/29/2020

RULE SUMMARY: Rule repealed to conform with changes to statute made in 2019, updates made to other sections of rules, and for clarity.

RULE TEXT:

(1) Persons constructing or designing dams under ten feet high or storing less than 9.2 acre feet may be subject to requirements for use of registered engineers as specified in ORS 672.002 through 672.091.

(2) The Department is authorized to provide guidance for the construction of dams requiring a water right permit but not requiring State Engineer review and approval of designs, plans and specifications.

(3) Potential dam owners are advised that even small dams, should they fail, may cause injury to people and property. Dam owners should consider designs and inundation analysis methods described in OAR 690-020-0035 through 690-020-0065, 690-020-0100, and 690-020-0120.

(4) Persons proposing to build a dam under 10 feet high or storing less than 9.2 acre-feet must comply with all the requirements for a storage permit in ORS 537.409 and in OAR 690-310.

STATUTORY/OTHER AUTHORITY: ORS 183, 540

STATUTES/OTHER IMPLEMENTED: ORS 183, 540

AMEND: 690-020-0035

RULE TITLE: Minimum Engineering Requirements for Final Design of New Dams or to Increase Dam Height

NOTICE FILED DATE: 04/29/2020

RULE SUMMARY: Describes design submittal requirements for engineers' submission of plans, specifications, and other documents for new construction and to increase height of existing dams.

RULE TEXT:

(1) Final documents must be submitted by the Engineer of Record prior to construction to build a new Dam or increase Dam Height as required in OAR 690-020-0080. Design reports may be completed by Engineers other than the Engineer of Record. If multiple reports are submitted, each must be stamped by the Engineer who prepared the report.

(2) Final documents shall include:

- (a) A plan for construction administration as provided in OAR 690-020-0065;
- (b) An operations and maintenance plan if required by OAR 690-020-0350;
- (c) An Emergency Action Plan for Dams rated High Hazard as provided in OAR 690-020-0400;
- (d) Final design drawings as provided in OAR 690-020-0055; and
- (e) Final design reports.

(3) The final design report(s) must include the following elements:

- (a) Site suitability evaluation as provided in OAR 690-020-0036;
- (b) Hydrology and Inflow Design Flood as provided in OAR 690-020-0037;
- (c) Dam structure design as applicable and as provided in OAR 690-020-0038–690-020-0041;
- (d) Spillway design as provided in OAR 690-020-0042;
- (e) Design for penetrating Conduit(s) as provided in OAR 690-020-0043;
- (f) Monitoring and instrumentation for determining whether a Dam is operating properly based on the Hazard Rating of the Dam as provided in OAR 690-020-0044; and
- (g) A Dam Breach Inundation Analysis as provided in OAR 690-020-0120.

STATUTORY/OTHER AUTHORITY: ORS 536.027, 540.488

STATUTES/OTHER IMPLEMENTED: ORS 540.449, 540.488

AMEND: 690-020-0036

RULE TITLE: Design Requirements for New Dams or to Increase Dam Height: Site Suitability and Geotechnical Evaluation

NOTICE FILED DATE: 04/29/2020

RULE SUMMARY: This is an existing rule with minor changes to existing rule language for clarity. Provides minimum technical standards for investigation and design of geotechnical and geologic issues for dams. Specifies different standards based on Dam hazard rating (risk to persons, property, and public infrastructure) should a Dam fail.

RULE TEXT:

The design to build a new Dam or to increase Dam Height shall characterize the soil and rock at and around the Dam site and shall include the following elements:

- (1) A description of the general and local geology and geomorphology at and around the proposed Dam and reservoir site;
 - (a) Field investigation by a geotechnical Engineer or engineering geologist or both is required for Dams rated High Hazard. For Dams rated Significant Hazard, field investigation by a geotechnical engineer or engineering geologist or both is required where landslides, faults, dispersive soils, or liquefiable soils could reasonably be expected near or at the Dam site. All such features shall be shown on a map of the Dam site and be described as necessary for design of the Dam;
 - (b) For Dams on located on rock, a drawing must also contain mapping of discontinuities relevant to the safety of the Dam and include evaluation of whether grouting is required;
- (2) A subsurface investigation to determine the distribution of relevant earth materials, which shall include borings or test pits; identification of springs, seeps, and groundwater encountered at the Dam site; and evaluation of the potential for landslides into the Dam or reservoir;
 - (a) All materials shall be logged by the Unified Soil Classification System; blow counts (for borings only); and include a description of samples taken for testing;
 - (b) Subsurface investigations for High Hazard Dams shall include drilling to a minimum depth of 1.5 times the Dam Height or at least ten feet into bedrock, whichever is less;
- (3) An evaluation of soil and rock and the testing of relevant materials, which may include: proctor compaction testing from all borrow areas, estimation or testing the permeability of soils to be used in Dam construction, and an assessment for the presence of dispersive soils. There must be a sufficient number of tests to characterize the variability in each borrow area. In addition, an evaluation must contain the following information as applicable and as may be required by the State Engineer:
 - (a) An analysis of materials in the Foundation and proposed Embankment if materials are prone to liquefaction or significant settlement;
 - (b) Where suitable materials can be collected, strength tests shall be required for all High Hazard Dams, and may be required by the State Engineer for Significant Hazard Dams;
 - (c) Testing of dynamic soil properties may be required for High Hazard Dams in areas with large ground acceleration potential from earthquake loading, if soils have potential for significant strength loss upon seismic loading;
- (4) Borrow area locations. Areas proposed for borrow shall be identified and shown on the drawings;
- (5) Earthquake considerations. Seismic site characterization is required for High Hazard Dams, and may be required for Significant Hazard Dams. A seismic site characterization shall include earthquake sources, ground motion hazard, peak ground acceleration, and recommended ground motions (time histories); and
- (6) Site preparation criteria. The site evaluation shall recommend a depth of stripping unsuitable materials, and also a minimum, and where necessary, maximum depth for the Cutoff Trench.

STATUTORY/OTHER AUTHORITY: ORS 536.027, 540.488

STATUTES/OTHER IMPLEMENTED: ORS 540.449, 540.488

AMEND: 690-020-0037

RULE TITLE: Design Requirements for New Dams or to Increase Dam Height: Hydrology and Inflow Design Flood

NOTICE FILED DATE: 04/29/2020

RULE SUMMARY: This is an existing rule with minor changes to existing rule language. Provides minimum technical standards for design of hydrologic parameters for dams. Specifies different standards based on Dam hazard rating (risk to persons, property and public infrastructure) should a Dam fail.

RULE TEXT:

The design to build a new Dam or to increase Dam Height shall characterize flow into and through the reservoir and the Dam and shall include the following elements:

- (1) A topographic map delineating the drainage area contributing to the Dam, with the drainage area size labeled in square miles and showing the specific location of the proposed Dam;
- (2) For Dams on stream channels, the name of the stream where the Dam is located, the name of the principal watershed, and a determination of average annual inflow into reservoir and potential to fill the reservoir;
- (3) The Inflow Design Flood that is the basis of hydraulic design for the Dam shall be determined based on the Hazard Rating of the Dam as follows:
 - (a) The Inflow Design Flood for a High Hazard Dam is the Probable Maximum Flood (PMF) unless the Engineer of Record proposes to determine an Inflow Design Flood based on a quantitative analysis of risk to people;
 - (b) The minimum Inflow Design Flood for a Significant Hazard Dam is the 0.2 percent Annual Exceedance Probability Flow;
 - (c) The minimum Inflow Design Flood for a Low Hazard Dam is a 1.0 percent Annual Exceedance Probability Flow;
 - (d) The Inflow Design Flood for a lagoon or off channel reservoir is the maximum capacity of inflow pumps or ditches plus the maximum local storm precipitation over the lagoon; and
 - (e) For watersheds under 30 square miles, the Engineer of Record may consider just the 24-hour storm to help determine the PMF, while for larger basins the Engineer of Record shall utilize at least a 72-hour storm for calculating the PMF for a general storm;
- (4) Designs shall include a description of all hydrologic parameters and the method used to determine the Inflow Design Flood hydrograph and the volume of the Inflow Design Flood, which is to be determined considering basin size and other factors as appropriate to the watershed above the Dam; and
- (5) The design report must include the information used to develop the stage and storage capacity curve for the reservoir, including the capacity with and without excavation for construction.

STATUTORY/OTHER AUTHORITY: ORS 536.027, 540.488

STATUTES/OTHER IMPLEMENTED: ORS 540.449, 540.488

AMEND: 690-020-0038

RULE TITLE: Design Requirements for New Dams or to Increase Dam Height: Embankment Dam Structures

NOTICE FILED DATE: 04/29/2020

RULE SUMMARY: This is an existing rule with minor changes to rule language for clarity. Provides minimum technical standards for design of embankment structures. Specifies different standards based on Dam hazard rating (risk to persons, property and public infrastructure) should a Dam fail.

RULE TEXT:

Designs to build a new Dam or to increase Dam Height for Embankment (soil or rock) Dams shall include the following elements:

(1) A determination of Embankment stability and stable Embankment slope angles as follows:

(a) Embankment Dams shall be designed to have stable slopes during construction, and under all conditions of reservoir operation;

(b) Standard slopes of 3:1 upstream and 2:1 downstream may be used at the discretion of the Engineer of Record for Low and Significant Hazard Dams as long as low strength materials are not used in the Embankment and conditions leading to elevated pore Water pressures are not present;

(c) For High Hazard Dams, an analysis of static and seismic slope stability, and of deformation. The State Engineer may require static and seismic slope stability analysis for Significant Hazard Dams. At a minimum, seismic analysis shall be based on full reservoir under steady state seepage conditions. Factors of safety shall be evaluated by slope stability analyses using appropriate strength parameters based on laboratory or in situ testing. For materials that can be reasonably tested either on site or in a laboratory, soil strength values may not be based on assumptions and must be made on strength testing of the appropriate soil or rock units;

(d) High Hazard Dams shall be designed for the maximum credible earthquake. If the State Engineer requires seismic analysis of a Significant Hazard Dam, deformation analysis shall be designed for the 0.2 percent Annual Exceedance Probability earthquake; and

(e) Abrupt changes in depth of compressible Foundation material shall be identified and where present, the design shall prevent significant differential settlement;

(2) Analysis of seepage and leakage expected through the Dam and design of measures to prevent internal erosion and excess leakage as follows:

(a) Steady state seepage and internal drainage conditions beneath, around, and through the Dam shall be quantified for all High Hazard Dams, and may be required by the State Engineer for Significant Hazard Dams;

(b) A Core of low permeability material protected by a Soil Filter is required for all High Hazard Dams. A Core and Soil Filter is required for any Significant Hazard Dams where the Engineer of Record or State Engineer determines piping could potentially occur. All Core and filter zones must be of a configuration with dimensions that can be readily constructed;

(c) Internal drains and Soil Filters shall be used as needed to drain Water and prevent internal erosion of the Dam. Toe Drains shall be standard design practice for Water storage Dams, but not for most wastewater lagoons; and

(d) Internal drain pipes to collect and distribute seepage flows from internal filters and drains shall be comprised of material that is non-corrodible, designed to carry the overburden load, and be no smaller than six inches in diameter;

(3) A safe and accessible Crest as follows:

(a) The Crest shall be of sufficient width to be accessible by equipment and vehicles for emergency operations and maintenance, and shall have a road to allow Crest access during periods when the Spillway is flowing;

(b) The Crest shall have a camber sufficient to maintain the design Freeboard, based on the anticipated Crest settlement, and in no case shall the camber be less than 0.5 feet;

(c) Roads located on the Crest shall have appropriate surfacing to provide a stable base that resists rutting and provides adequate traction for access and safety in wet conditions; and

(d) The Crest shall have adequate cross slopes to prevent ponding;

(4) Measures to control wave and surface erosion as follows:

(a) For reservoirs large enough to generate significant waves, the design shall include a determination of minimum Freeboard based on expected waves. The design shall also include slope protection for wave action if significant waves are likely; and

(b) The downstream slope shall be provided with non-woody vegetative cover, or a gravel or rock surface, to prevent surface erosion.

STATUTORY/OTHER AUTHORITY: ORS 536.027, 540.488

STATUTES/OTHER IMPLEMENTED: ORS 540.449, 540.488

AMEND: 690-020-0041

RULE TITLE: Design Requirements for New Dams or to Increase Dam Height: Concrete Dam Structures

NOTICE FILED DATE: 04/29/2020

RULE SUMMARY: This is an existing rule with minor changes to existing rule language for clarity. Provides minimum technical standards for design of concrete structures. Specifies different standards based on Dam hazard rating (risk to persons, property and public infrastructure) should a Dam fail.

RULE TEXT:

Designs to build a new Dam or to increase Dam Height for concrete mass Dams must be prepared by a structural Engineer and a geotechnical Engineer or engineering geologist. This rule does not apply to concrete flashboard Dams. Designs for all other concrete Dams shall include the following elements as applicable:

- (1) Concrete Dams shall be specified as gravity, arch, arch-gravity, or buttress. Gravity Dams can be of conventional mass concrete or roller compacted concrete;
- (2) Dams shall be designed to be stable during construction and under all conditions of reservoir operation;
 - (a) Headwater and tailwater elevations pertinent to the design shall be described with respect to both static and dynamic loading;
 - (b) Uplift pressure distributions assumed for design shall be provided; and
 - (c) When Foundation drains are used to reduce uplift, the assumed drain efficiency shall be indicated and permanent access shall be provided at the project to inspect and maintain the drains;
- (3) Sliding stability shall be evaluated at lift joint surfaces, at the Dam Foundation interface, and at discontinuities in the Foundation materials beneath the Dam and Abutments;
 - (a) Factors of safety shall be based on limit equilibrium methods;
 - (b) For earthquake loadings, a permanent sliding displacement may be determined in lieu of a sliding factor of safety; and
 - (c) Overturning of the Dam on its Foundation shall be evaluated for static and seismic loading;
- (4) Seismic stability analysis may be required for Concrete Dams and if required shall demonstrate the Dam can withstand the design earthquake without loss of life or damage to property or public infrastructure;
 - (a) High Hazard Dams shall be designed for the maximum credible earthquake based on current information from the US Geological Survey or a site specific seismic evaluation. A dynamic stress analysis that considers the dynamic characteristics of the Dam and the ground motions of the design earthquake shall be provided for High Hazard Dams; and
 - (b) Where the State Engineer requires seismic analysis on Significant Hazard Dams, they shall be designed for the 0.2 percent Annual Probability of Exceedance earthquake. The Department may require a dynamic stress analysis for Significant Hazard Dams;
- (5) When Foundation grouting is needed, the design for the grout curtain and consolidation grouting of the Foundation shall be described;
- (6) Any property essential for the structural design of the concrete shall be included in the design documents. These may include, but are not limited to, compressive strength (at 28 days and one year), modulus of elasticity, Poisson's ratio, shear strength, tensile strength, volume change during drying, thermal coefficient of expansion, specific heat, thermal conductivity, permeability and durability;
 - (a) As a minimum for static loadings, the assumed compressive and shear strengths for the parent concrete, lift joint surfaces, and the Dam Foundation contact shall be provided;
 - (b) In addition, tensile strength assumptions for the aforementioned regions for dynamic loadings (seismic) shall also be provided; and
 - (c) Air entraining agents shall be provided in the concrete mix to provide freeze-thaw protection and to improve the workability of lean mass concrete mixes. The quantity of air entrained in mass concrete shall be in the order of five percent;

(7) Mix design and construction methods used to minimize cracking due to temperature gradients between interior regions subject to heat of hydration effects and surfaces exposed to ambient temperatures shall be specified. Treatment of lift joint surfaces to achieve desired shear and tensile strengths shall be indicated. Treatment of contraction joints to prevent leakage or to transfer load between adjacent monoliths shall be described;

(8) When reinforcing steel is used, the strength properties of the reinforcement shall be provided and contract drawings shall clearly indicate the size, location, spacing, and cover requirements; and

(9) The minimum Crest width must be 15 feet unless otherwise approved. The Crest and appurtenant structures shall be accessible by equipment and vehicles for emergency operations and maintenance.

STATUTORY/OTHER AUTHORITY: ORS 536.027, 540.488

STATUTES/OTHER IMPLEMENTED: ORS 540.449, 540.488

AMEND: 690-020-0042

RULE TITLE: Minimum Design Requirements for New Dams or to Increase Dam Height: Spillways

NOTICE FILED DATE: 04/29/2020

RULE SUMMARY: This is an existing rule with minor changes to existing rule language related to spillways for off-channel dams. Provides minimum technical standards for design of Dam spillways. Specifies different standards based on Dam hazard rating (risk to persons, property and public infrastructure) should a Dam fail.

RULE TEXT:

- (1) Dams on stream channels and all High Hazard Rated Dams must have a Spillway.
- (2) Spillway(s) design to build a new Dam or to increase Dam Height shall include the following minimum elements:
 - (a) Utilization of Inflow Design Flood. Determination of Inflow Design Flood as described in OAR 690-020-0037 is required to determine the required Spillway capacity;
 - (b) Hydraulic evaluation of flow through control section. Flood flow through the control section must be calculated and the minimum Freeboard at the Inflow Design Flood must be one foot for High Hazard Dams and two feet for Significant and Low Hazard Dams;
 - (c) Optional low elevation Spillway. An interior Spillway connected to the low level Conduit may be used for Low and Significant Hazard Dams, and for High Hazard Dams only with specific approval by the State Engineer. The capacity of the low elevation Spillway may be considered in design of the overflow Spillway;
 - (d) Stable Spillway control section. The Spillway control section must be hydraulically and structurally stable for the Inflow Design Flood and have permanent features so that the control section is identifiable for re-measurement of cross section during routine inspections;
 - (e) Spillway channel stability. Spillways shall be designed to be structurally adequate and stable under all conditions of reservoir operation. Spillway structures of High Hazard Dams shall be designed for earthquake ground motions per OAR 690-020-0036;
 - (f) Reinforced concrete specifications for spillways. Structural elements of reinforced concrete shall be designed for both strength and serviceability. The 28 day strength of structural concrete shall be provided. The strength properties of the reinforcing materials shall also be provided and contract drawings shall clearly indicate the size, location, spacing, and cover requirements. Treatment of construction joints and contraction/expansion joints shall be described and special provisions for strength transfer and leakage prevention identified. Air entrainment shall be provided in cast-in-place concrete if needed for freeze-thaw protection, durability, and workability;
 - (g) Debris booms. For High and Significant Hazard Dams, debris or log booms may be required. Where required, they shall be designed for the Spillway approach where logs and other debris may block or damage the Spillway structure. The design shall specify the necessary anchor capacity, and the design of the anchors;
 - (h) Gates and Flashboards. Detailed drawings and specifications are required for Spillway Gate structures or flashboards, if present on the proposed Dam. Operations and maintenance plans are required for any Dam with a Gated Spillway, or where flashboards or stop-logs are used in the Spillway as per OAR 690-020-0350; and
 - (i) Energy dissipation. The design of stilling basins for High Hazard Dams, and where required by the State Engineer for Significant Hazard Dams, shall be based on calculated hydraulic forces and designed to dissipate energy and minimize scour and erosion from the Inflow Design Flood.
- (3) Low and Significant Hazard Dams constructed off channel are not required to have a Spillway, if redundant mechanisms to prevent overfilling are included in the design.

STATUTORY/OTHER AUTHORITY: ORS 536.027, 540.488

STATUTES/OTHER IMPLEMENTED: ORS 540.449, 540.488

AMEND: 690-020-0043

RULE TITLE: Design Requirements for New Dams or to Increase Dam Height: Penetrating Conduit(s) and Control of Flow through Conduits

NOTICE FILED DATE: 04/29/2020

RULE SUMMARY: This is an existing rule with minor changes to existing rule language for clarity. Provides minimum technical standards for design of conduits through dams. Specifies different standards based on Dam hazard rating (risk to persons, property and public infrastructure) should a Dam fail.

RULE TEXT:

New Dams on stream channels must have a low level Conduit. All other new Dams and Dams with increases to Dam Height must have a low level Conduit or other means to safely drain the reservoir. The Conduit and related control structures must be designed to meet the following criteria:

(1) Ability to lower the reservoir. The minimum diameter of the Conduit should be determined through analysis of the time required to drain the Dam at average annual inflow;

(a) The Conduits for High Hazard Dams shall be capable of releasing the amount of Water which could be stored in the top five feet of the reservoir in five days;

(b) The Conduits for Significant and Low Hazard Dams must be able to release the amount of Water which could be stored in the top five feet of the reservoir in ten days;

(c) All Conduits must be of sufficient size to allow passage of inflows as needed;

(d) In no case shall Conduits be smaller than eight inches in diameter;

(2) Durable and water-tight Conduits. Conduits must be made of medium to heavy gage durable materials. Pipe joints must be designed to seal and prevent leakage. Corrugated metal culverts are only acceptable for Low Hazard Dams, and only when the Conduits are encased in concrete. Encasement of Conduits in concrete may be used to assist in the design of a durable Conduit and to reduce the potential for seepage and erosion adjacent to the Conduit;

(a) Diaphragms using materials designed as an effective Soil Filter are required for any Conduits not designed as encased in concrete, and are required regardless of encasement for all High Hazard Dams;

(b) Seepage collars may not be used;

(3) Control Mechanisms. The design for the control mechanism must be sturdy and durable. The control mechanism must allow for air venting when needed, and allow manual operation to drain the reservoir if hydraulic or other power controls are inoperable. Hydraulic or other power controls must have redundancy if control relies on any submerged hydraulic or pneumatic hoses or electrical conduits. Intake structures for outlet works must have trash racks unless the Engineer of Record shows trash racks are unnecessary, or not safe to construct due to conditions at the Dam site. For High and Significant Hazard Dams, measures to prevent unauthorized use of the control mechanism must be included in this design;

(4) Outlet structure. The outlet structure must not be submerged when the inlet control Gate or Valve is fully closed. The outlet structure must be designed to protect the Conduit from mechanical damage and convey Water to the stream channel without channel erosion and cavitation near the Gate structure; and

(5) Pressurized operation. Conduits must be specified as suitable for pressurized operation if they are to be operated with controls other than at the inlet of the Conduit. Dams with Pressurized Conduits shall have a guard Gate installed at the upstream end of the Conduit. Operations and maintenance plans are required for any Dam designed for pressurized operation as per OAR 690-020-0350.

STATUTORY/OTHER AUTHORITY: ORS 536.027, 540.488

STATUTES/OTHER IMPLEMENTED: ORS 540.449, 540.488

AMEND: 690-020-0044

RULE TITLE: Design Requirements for New Dams or to Increase Dam Height: Instrumentation for Monitoring

NOTICE FILED DATE: 04/29/2020

RULE SUMMARY: This is an existing rule with minor changes for clarification only. Provides minimum technical standards for design of instrumentation for general monitoring dams. Specifies different standards based on Dam hazard rating (risk to persons, property and public infrastructure) should a Dam fail.

RULE TEXT:

Designs must include methods for determining if the Dam is operating properly based on the Hazard Rating of the Dam, and include:

- (1) A plan to share monitoring data with the Department;
- (2) Staff gage near controls for the Conduit or where they can be easily seen by the Dam owner or operator. The staff gage shall be clearly marked in feet and tenths of feet, and extend to within one foot of the Crest. Markings and numbers on the gage rod shall be of sufficient size to be easily readable from the Crest;
- (3) Multiple and easily accessible outlets of all Toe Drains. Toe Drains shall be designed to discharge into locations where flows can be evaluated and monitored. Multiple discharge points are required in order to isolate seepage to various sections of the Dam and Foundation. Discharge points must be located where routine Dam maintenance is not likely to damage the drains;
 - (a) For High Hazard Dams, drains must have a measuring weir or other device, and a basin for settling drainage Water so that internal erosion can be identified;
 - (b) Where drainage galleries are provided for concrete Dams, seepage measuring devices should be provided and accessible for making the necessary readings;
- (4) Unique Identification. All instrumentation and exterior drains shall be labeled with a unique identifying marker designed for durability and to withstand maintenance activities; and
- (5) All High Hazard and, when required by the Engineer of Record or State Engineer, Significant Hazard Dams shall have the following instrumentation:
 - (a) Monuments that allow measurement of the horizontal and vertical movements of the Dam. Control or benchmark monuments shall be placed in areas not subject to movement;
 - (b) Piezometers to allow monitoring of the phreatic surface within the Dam or for concrete Dams, to determine uplift pressures. Standpipe piezometers must be installed pursuant to monitoring well standards per OAR 690-240-0525;
 - (c) Instrumentation to measure strong ground motions for publically owned Dams in locations where the peak ground acceleration in the 0.2 percent Annual Probability of Exceedance earthquake is greater than 0.3g at the ground surface.

STATUTORY/OTHER AUTHORITY: ORS 536.027, 540.488

STATUTES/OTHER IMPLEMENTED: ORS 540.449, 540.488

AMEND: 690-020-0047

RULE TITLE: Design Requirements for New Dams or to Increase Dam Height: Geosynthetics

NOTICE FILED DATE: 04/29/2020

RULE SUMMARY: This is an existing rule with minor changes to existing rule language for clarification only. Geosynthetics are excluded from certain uses in dams.

RULE TEXT:

Geosynthetics shall not be used as the sole element employed to perform a Dam safety function. Redundant design features are required whenever geosynthetics are used for Dam safety functions.

STATUTORY/OTHER AUTHORITY: ORS 536.027, 540.488

STATUTES/OTHER IMPLEMENTED: ORS 540.449, 540.488

AMEND: 690-020-0048

RULE TITLE: Exceptions to Standard Design Requirements

NOTICE FILED DATE: 04/29/2020

RULE SUMMARY: This is an existing rule with no changes, other than to update the statutory authorities and the rule title. Allows Engineers to adjust rule standards if demonstrated to be inapplicable to the dam.

RULE TEXT:

Exceptions to design standards may only be obtained with written approval from the State Engineer. Where the Engineer of Record requests design exceptions, the request must be in writing, be affixed with the Engineer of Record professional stamp, and include a report describing why design standards are inapplicable to the safety of the Dam.

STATUTORY/OTHER AUTHORITY: ORS 536.027, 540.488

STATUTES/OTHER IMPLEMENTED: ORS 540.449, 540.488

AMEND: 690-020-0055

RULE TITLE: Design Requirements for New Dams or to Increase Dam Height: Design Drawings

NOTICE FILED DATE: 04/29/2020

RULE SUMMARY: This is an existing rule with minor changes for clarity. Describes requirements for engineer's drawings, to allow Department review and approval.

RULE TEXT:

The Engineer of Record shall submit applicable drawings when the Engineer believes the design is ready for review and approval by the State Engineer.

- (1) Drawings must accurately portray the work to be accomplished and be of sufficient detail to clearly define all features of the project. After all changes required by the State Engineer are made, final design drawings must be neatly and accurately drawn to a scale sufficiently large for the drawings to be readily interpreted.
- (2) Drawings must be uncluttered and easy to understand for determination of design compliance by the contractor, the Engineer of Record, and the State Engineer.
- (3) Drawings must be no larger than 24" X 36". Other acceptable sizes for drawings are 17" X 22" and 22" X 34". All drawings must have a graphic scale bar so that scale can be determined after enlargement or reduction. Each sheet shall be numbered sequentially with the first sheet being sheet number one along with the total number of sheets; e.g., 1 of 6.
- (4) Drawings shall include the following information:
 - (a) An official Dam name, which must not have already been used for a Dam as indicated in the Oregon Dam Safety Database. This unique name must be affixed on each drawing;
 - (b) The first drawing must include a location map with the drainage basin, the Dam and reservoir, streams within the drainage area, and the location of the nearest access highway. This drawing must include legal location of the Dam including Section, Township and Range, and the location of the survey reference point with latitude, longitude, elevation, and datum elevation in NAVD1988;
 - (c) A contour map of the reservoir site showing the legal location of the Dam with a contour interval no greater than five feet. A plan of the Dam should be superimposed on this map. If scale permits, this drawing should show the location of the Spillway(s), Conduit inlet and outlet, and the location, distance and direction to a government land corner or other permanent survey marker;
 - (d) An area capacity curve showing the total capacity to the Crest, with the Spillway invert elevation identified. Surface area and storage capacity curves must be in acres and Acre-feet, respectively;
 - (e) A profile of the Dam site at the center of the Dam;
 - (f) A cross section of the Dam at maximum section;
 - (g) Plan view(s) of Dam at maximum section, and other sections as needed;
 - (h) Cross section(s) of Dam, including the maximum section with the official Dam Height;
 - (i) Spillway details, Spillway approach control discharge, and energy dissipation;
 - (j) Low level Conduit details, including diameter, material, encasement; and
 - (k) Slide Gate or Valve details including the trash rack, control stem, pedestal and wheel, or other control details, and air vent.
- (5) Elevations must be clearly labeled on applicable drawings and include the:
 - (a) Base of Dam and official Dam Height;
 - (b) Crest;
 - (c) Spillway control section;
 - (d) Base of Spillway discharge; and
 - (e) Invert of the Conduit at both the inlet and outlet.
- (6) All drawings must be dated and have sufficient space for State Engineer's approval stamp, at least 3" x 3" near the lower right hand corner of the drawing.
- (7) Drawings must be designated as final design drawings or As-built Drawings.

STATUTORY/OTHER AUTHORITY: ORS 536.027, 540.488

STATUTES/OTHER IMPLEMENTED: ORS 540.449, 540.488

AMEND: 690-020-0060

RULE TITLE: Design Requirements for New Dams or to Increase Dam Height: Construction Specifications

NOTICE FILED DATE: 04/29/2020

RULE SUMMARY: This is an existing rule with minor changes for clarity. Describes minimum information in engineers' submittal of specifications to allow Department review and approval.

RULE TEXT:

All drawings for Dams must be accompanied by construction and material specifications that include the following:

- (1) Construction conditions. Specifications must include the construction period based on typical weather and stream conditions for that location and if applicable, may include a process for the Engineer of Record to modify the construction period;
- (2) Clearing of the Dam site and reservoir. Specifications must include the area to be submerged by the new or enlarged reservoir and specify that the submerged area shall be cleared of logs and debris prior to filling the reservoir. The specifications must require that the footprint of the Dam shall be cleared of all soils containing organic materials, and that this material may not be used for Dam construction;
- (3) Cutoff Trench requirements. Specifications must include the minimum trench depth, width at base of the trench, and maximum side slope steepness. These specifications shall be based on the subsurface investigations and direct that the Cutoff Trench may not be filled if it contains standing Water. Specifications must also include a requirement not to begin filling the Cutoff Trench until approved by Engineer of Record, and where specified, approved by the Department;
- (4) Material specification standards. The specifications shall include material and testing specifications for Dam materials, Conduits, control structures, and other appurtenant structures, using an ASTM standard methodology if available;
- (5) Soil Compaction. The typical compaction specification is 95 percent of standard proctor density, though the Engineer of Record may use a different compaction standard. Specifications shall include the types of acceptable compaction equipment, by material source if necessary. Specifications shall also include maximum lift thickness. Specifications shall prohibit soil compaction dry of optimum moisture content to reduce potential for leakage around the Conduit. For materials placed immediately above or adjacent to the Conduit, specifications must also include verification testing of soils, with representative samples selected for testing as directed by the Engineer of Record. Specifications must also require verification of testing of soil compaction, with representative samples selected for testing by the Engineer of Record, or Engineer's representative;
- (6) Concrete placement. Specifications shall include means to prevent separation of aggregate and cement, air entrainment requirements if needed, methods for placement and vibration of concrete, required minimum 28 day strength, slump, moisture and temperature requirements for curing. Alkali reactive aggregate shall not be used in the concrete;
- (7) Conduit specifications. Specifications must include the material, diameter, and thickness of the Conduit, and the length of Conduit required for the project. Methods for sealing joints must be specific. Specifications must require that all materials from a manufacturer are certified to meet this test, or that the Engineer of Record has tested the materials directly;
- (8) Accepting and Rejecting Materials. Specifications must include tolerances for acceptable departure from material specifications and a process for rejection of defective materials or workmanship;
- (9) Notification by the Engineer of Record to the State Engineer of changed conditions critical to the safety or operations of the Dam. Specifications shall include State Engineer notification if previously unidentified springs, slope movement or sand lenses are identified, or if storm or other damage occurs during construction;
- (10) The Engineer of Record or their qualified employees must supervise construction as needed to assure compliance with the approved construction plans and specifications; and
- (11) The specifications must also contain a provision to the effect that plans or specifications shall not be altered or changed without the written approval of the State Engineer.

STATUTORY/OTHER AUTHORITY: ORS 536.027, 540.488

STATUTES/OTHER IMPLEMENTED: ORS 540.449, 540.488

AMEND: 690-020-0065

RULE TITLE: Plan Requirements for New Dams or to Increase Dam Height: Construction Administration

NOTICE FILED DATE: 04/29/2020

RULE SUMMARY: This is an existing rule with changes to clarify requirements related to provisions to be included in plans for administering dam construction. Describes minimum information in Engineer's plan for Dam construction to allow Department review and approval.

RULE TEXT:

The Engineer of Record shall submit plans for administering the construction of the Dam to the State Engineer for approval. Construction plans must include the following:

- (1) A provision stating that the Engineer of Record or an employee working for the Engineer of Record shall be on-site as needed for instructions to the contractor, approval of initial excavation, acceptance of materials, and general project administration;
- (2) A provision stating that the Dam owner shall cease construction activity if the Engineer of Record is no longer retained or for any reason cannot complete necessary construction administration activities. Construction may resume when a new Engineer of Record is employed, the State Engineer has been notified of the new Engineer of Record, and both Engineers have discussed the project;
- (3) A provision stating that the Engineer of Record will observe the Dam during construction as needed to determine if construction is consistent with approved design and construction documents. This provision shall also include a description of how the Engineer of Record will determine if construction work in progress fails to conform to the approved plans and specifications, and that such nonconforming work will be corrected;
- (4) A provision stating that the Engineer of Record shall confirm Foundation design assumptions once surface materials have been stripped and the Cutoff Trench excavated. Changes in actual Foundation conditions from assumptions made in the initial site evaluation shall be communicated to the State Engineer;
- (5) A provision in which the Engineer of Record shall maintain a record of construction that shall include:
 - (a) Logs of construction inspections whenever such inspections are made by the Engineer of Record or the Engineer of Record's employee;
 - (b) All test results pertaining to construction;
 - (c) Photographs; and
 - (d) Construction problems and remedies.
- (6) A provision stating that the Engineer of Record shall complete and stamp As-built Drawings and a final construction report, including statements that the observations are either consistent or inconsistent with the design drawings and specifications. If key elements of construction were not observed, the construction report shall detail those specific elements that were not observed.

STATUTORY/OTHER AUTHORITY: ORS 536.027, 540.488

STATUTES/OTHER IMPLEMENTED: ORS 540.449, 540.488

ADOPT: 690-020-0068

RULE TITLE: Plan Requirements for New Dams or to Increase Dam Height: Operations and Maintenance Plan

NOTICE FILED DATE: 04/29/2020

RULE SUMMARY: Replaces similar rule that was repealed. Describes minimum elements needed in Operations and Maintenance manuals submitted with design information, to allow Department review and approval.

RULE TEXT:

(1) The Engineer of Record shall include an operations and maintenance plan with the submittals for building a new Dam or increasing Dam Height for:

(a) Any Dam rated Significant or High Hazard; and

(b) Any Low Hazard Dam with:

(A) A Gate or flashboard as part of the Spillway; or

(B) A Valve on a Conduit that is not on the upstream side of the Dam.

(2) The Department may review implementation of the operations and maintenance plan during Dam safety inspections.

(3) Operations and maintenance plans shall include, but are not limited to:

(a) Directions for filling and emptying the reservoir when needed;

(b) Frequency of inspection of the interior of Conduits, including qualifications and guidance for Persons conducting and reporting on this inspection;

(c) Procedures for operation of all Gates and Valves;

(d) Specified minimum frequency for cycling and lubrication of all Gates and Valves;

(e) Standards for removal of trees and brush, and mowing other vegetation; including the frequency for the Dam owner to monitor vegetation and to take action to control brush if it obscures any face of the Dam, the Conduit, or the Spillway;

(f) Frequency of routine Dam observations, including identification of changes in seepage and maximum permissible Dam deformations;

(g) A Water release plan in the event of a flood forecast when reservoir is above the maximum safe operating level established by the Engineer of Record;

(h) The measurement frequency for all monitoring instrumentation installed at the Dam; and

(i) Review and evaluation of conditions of the Dam as necessary to keep the Dam in good repair and properly maintained, including actions identified in OAR 690-020-0250.

STATUTORY/OTHER AUTHORITY: ORS 536.027, 540.488

STATUTES/OTHER IMPLEMENTED: ORS 540.449, 540.488

AMEND: 690-020-0070

RULE TITLE: New Dams or to Increase Dam Height: Submittals and Notifications by the Engineer of Record

NOTICE FILED DATE: 04/29/2020

RULE SUMMARY: This is an existing rule with changes for clarity. Describes all elements needed in engineers' submittals of documents needed for new Dam construction or modification to increase Dam height, to allow Department review and approval.

RULE TEXT:

- (1) The Engineer of Record must include an inundation analysis that complies with OAR 690-020-0120 prior to submitting the design report, plans and specifications and other documents, so that the Department can determine the Hazard Rating of the Dam.
- (2) All final designs, drawings and specifications submitted to the State Engineer for approval must be prepared and stamped by an Engineer. The first page of the drawings, the specifications, and the construction administration plan must be stamped by the Engineer of Record. All submitted materials must be addressed directly to the State Engineer and labeled as a Dam safety submission.
- (3) Final drawings shall be submitted on full size paper. The design reports and specifications must be submitted as packaged 8.5" x 11" bound documents, with maps folded within.
- (4) For High Hazard Dams, the final Emergency Action Plan and any additional inundation analysis required for the EAP as described in OAR 690-020-0400 must be submitted by the Dam owner, or the Engineer of Record on behalf of the Dam owner, prior to commencing construction.
- (5) A schedule of construction shall be provided to the State Engineer prior to initiating construction of any Significant or High Hazard Dam.
- (6) The Engineer of Record shall notify the State Engineer to allow for Department inspection of the excavation prior to completion of the Cutoff Trench and all stripping of Foundation and Embankments. The required notice to the State Engineer is as follows:
 - (a) 48-hours for a Low Hazard Dam;
 - (b) 120-hours for a Significant Hazard Dam; and
 - (c) 240-hours or the time specified in the approval, whichever is longer, for High Hazard Dams.
- (7) Any changes made to the designed location, Height or width of the Dam, or to materials used in Dam construction shall be reported in writing immediately to the State Engineer.
- (8) Any slope instability observed during construction in the Embankment or adjacent to the Dam or into reservoir, shall immediately be reported to the State Engineer by phone.
- (9) The Engineer of Record must immediately notify the State Engineer if they are no longer the Engineer of Record. The notification shall be by phone and in writing.
- (10) The Engineer of Record must submit a project completion report upon completion of the Dam. A project completion report must include the following:
 - (a) As-built Drawings. If possible, As-built Drawings shall be on the same sheet as the initial design drawings;
 - (b) Sufficient information to document that the Dam has been built according to the drawings with changes to improve safety as documented in the As-built Drawings, or that critical safety functions are unknown;
 - (c) A list of the dates the Engineer of Record was on site, the number and location of material tests, and observations of all changed conditions;
 - (d) Material testing results (compaction, strength, permeability);
 - (e) Observations and decisions made and communicated to the contractor or Dam owner;
 - (f) Photographs of key stages of construction, including, but not limited to, photographs of the Cutoff Trench, borrow pit development, trenching and placement of the Conduit, the Spillway before and after placement of concrete; and
 - (g) The signed professional stamp of the Engineer of Record.

STATUTORY/OTHER AUTHORITY: ORS 536.027, 540.488

STATUTES/OTHER IMPLEMENTED: ORS 540.449, 540.488

AMEND: 690-020-0080

RULE TITLE: New Dams, or to Increase Dam Height, Written Approval by State Engineer

NOTICE FILED DATE: 04/29/2020

RULE SUMMARY: Amends existing rule, describes process for approval of design documents, and outlines parameters of that approval.

RULE TEXT:

- (1) No person shall build a new Dam or increase Dam Height unless the State Engineer has reviewed all necessary reports, drawings, plans and other information as submitted by the Engineer of Record and has approved those documents as indicated in written communication with the Engineer of Record.
- (2) Prior to commencing construction activity, the Engineer of Record shall verify that all necessary documents related to the final design as identified in OAR 690-020-0035 are approved as indicated by the State Engineer's stamp on those documents.
- (3) The State Engineer's approval of design plans and specifications shall be valid only for five years from the date of approval. Upon request, written requests for time extensions may be granted in writing by the State Engineer.
- (4) No newly constructed Dam or Dam that has had Height modified may store Water until final written acceptance of a satisfactory project completion report has been submitted to and accepted by the Department.
- (5) The Department shall notify the Engineer of Record and Dam owner in writing when the final project completion report has been received and accepted by the Department.

STATUTORY/OTHER AUTHORITY: ORS 536.027, 540.488

STATUTES/OTHER IMPLEMENTED: ORS 540.449, 540.488

AMEND: 690-020-0100

RULE TITLE: Hazard Rating of Dams

NOTICE FILED DATE: 04/29/2020

RULE SUMMARY: This is an existing rule with minor changes to existing rule language. Provides minimal technical criteria for establishing Dam hazard ratings. Provides general information on setting and revising Dam hazard ratings.

RULE TEXT:

(1) The Department shall assign all Dams a Hazard Rating of High, Significant, or Low.

(2) A High Hazard Rating will be based on the Dam breach inundation analysis as described in OAR 690-020-0120 using the following criteria to determine expected loss of life:

(a) An inundation depth of flowing Water of at least two feet over the finished floors of dwellings, other frequently occupied buildings, or road surfaces where a vehicle is likely to be present is likely to result in loss of life. The Department may also consider Water velocity in its determination of inundation depth establishing a High Hazard Rating;

(b) An incremental increase of depth of flowing Water of one foot where recreational or other frequent use occurs downstream is likely to result in loss of life. The Department will also use Water velocity in its determination of inundation depth establishing a High Hazard Rating.

(3) A Significant Hazard Rating will be based on the Dam breach inundation analysis as described in OAR 690-020-0120, using depth and velocity of the flowing Water at affected structures, public infrastructure, and other properties which shows likely damage to property and infrastructure but no loss of life.

(4) Any Dam subject to regulation under these rules that is not rated as High or Significant by the Department will be rated as Low Hazard.

(5) The Hazard Rating of a Dam shall remain in effect until the rating is revised by the Department. The Department may conduct Hazard Rating reviews and dam breach inundation analyses as evidence indicates the impacts to people, property, or infrastructure may have changed since the Hazard Rating was first set. The Dam owner will be notified of the change and have an opportunity to meet with the Department and obtain records of the Department's analyses.

(6) A Dam owner may request that the Department consider revision of a Hazard Rating. The owner may have an Engineer prepare and submit a Dam breach inundation analysis, in support of this request.

STATUTORY/OTHER AUTHORITY: ORS 536.027, 540.488

STATUTES/OTHER IMPLEMENTED: ORS 540.443, 540.488

AMEND: 690-020-0120

RULE TITLE: Dam Breach Inundation Analysis

NOTICE FILED DATE: 04/29/2020

RULE SUMMARY: This is an existing rule with minor changes to existing rule language. Provides general information on Dam Breach Inundation Analysis. Provides minimum submittal requirements for Dam Breach Inundation Analysis.

RULE TEXT:

- (1) A Dam breach inundation analysis will be conducted as specified in this section to determine or revise the Hazard Rating of a Dam.
- (2) Any simplified and conservative hydraulic model may be used for the Dam breach inundation analysis to show that a Dam should be rated Low Hazard. The State Engineer may determine if the model was used appropriately and conservatively.
- (3) An accepted and hydraulically consistent computational model must be used to conduct the inundation analysis for Significant and High Hazard Dams.
- (4) A report summarizing the model information and results must be stamped by the Engineer. The summary report shall contain sufficient information to reproduce the model and shall include at a minimum the following information:
 - (a) The specific proprietary model name or method used for the analysis;
 - (b) Details regarding the model geometry;
 - (c) The specific mode of failure and any assumptions made in the selection of the mode of failure;
 - (d) A list of Dam breach parameters and any assumptions made in the selection of the breach parameters. The breach parameters must be based on Dam material and thickness and any other factors that would influence the time it would take for the Dam to breach from internal erosion, overtopping, or displacement;
 - (e) A list of all boundary and initial conditions and any assumptions in the selection of these conditions. For High and Significant Hazard Dams, the analysis must be conducted with reservoir at full pool and inflow equal to the 0.2% Annual Exceedance Probability Flood flow;
 - (f) A map indicating the inundation boundary, areas inundated by a depth greater than two feet, and all frequently occupied structures that fall within or are immediately adjacent to the inundation boundary;
 - (g) The breach flow as calculated by the model immediately downstream of the Dam. If an empirical formula was used as the basis for determining breach flow, the formula and all inputs must be clearly stated; and
 - (h) A sensitivity analysis evaluating the variability in model inputs may be required when the Dam breach inundation analysis results indicate the Hazard Rating is on the border between two ratings.

STATUTORY/OTHER AUTHORITY: ORS 536.027, 540.488

STATUTES/OTHER IMPLEMENTED: ORS 540.443, 540.488

ADOPT: 690-020-0140

RULE TITLE: Modification of Dams

NOTICE FILED DATE: 04/29/2020

RULE SUMMARY: Replaces a similar rule that was repealed. Provides the process the Water Resources Department will use to determine approval of Dam modification plans.

RULE TEXT:

(1) No person shall make Modifications to a Dam unless the State Engineer has reviewed all required documents as described in this section and has approved those documents as indicated in written communication with the Engineer of Record or Dam owner.

(2) The following Dam Modifications require State Engineer approval of plans:

(a) Changes to or near the Spillway that may affect Spillway capacity or ability to pass flows safely;

(b) Placing, replacing, or relining any Conduit within the Dam;

(c) Removal or alteration of the Conduit control structure;

(d) Installation of a new Valve on the downstream side of the low level Conduit;

(e) Correction of damage where that damage has impacted the safe functioning of the Dam;

(f) Any activity where 10 percent or more of the fill material in the Dam is disturbed; or

(g) Any other change to the Dam that results in a Modification as defined in OAR 690-020-0022(28).

(3) Dam Modification plans shall include all details of the area of the Dam being modified. Specific modification plan requirements include, but are not limited to:

(a) For major Spillway damage or alteration, plans need to address passage of the required Inflow Design Flood based on the Hazard Rating of the Dam, with the same criteria as required for new Dams in OAR 690-020-0037;

(b) For stabilization of slope movement, plans require slope stability analysis and appropriate corrective measures;

(c) For replacement of Conduits or installation of a Valve on the downstream side of a Dam, plans require an analysis of internal erosion potential;

(d) For internal erosion, plans must address construction of a filter zone; and

(e) Items required by the State Engineer pursuant to subsection (4).

(4) The Dam owner shall provide sufficient notice to the Department to allow for adequate time for discussion of the proposed Modifications and the necessary design requirements.

(5) The State Engineer will determine the design and submittal requirements. Submittal requirements and Department reviews may be expedited in the event of emergency or unanticipated weather-related situations.

(6) Water is not to be stored in the reservoir during modification. The Engineer of Record may propose maintaining some Water in storage during Dam Modification or modifying Dam Height if it is demonstrated that it can be done in a manner that protects life, property, and infrastructure. The Department will review submitted materials for the proposed construction actions. The Department may consider the scope of the project, including how the proposed construction actions will maintain safe Water levels through the duration of construction.

STATUTORY/OTHER AUTHORITY: ORS 536.027, 540.488

STATUTES/OTHER IMPLEMENTED: ORS 540.443, 540.449, 540.488

REPEAL: 690-020-0150

RULE TITLE: Routine Inspection of Dams

NOTICE FILED DATE: 04/29/2020

RULE SUMMARY: Rules repealed to conform with changes to statute made in 2019, updates made to other sections of rules, and for clarity.

RULE TEXT:

- (1) The Department shall maintain a program of inspecting dams and may conduct routine safety inspections of dams with an inspection frequency based on the hazard rating of the dam and may specify modifications necessary to insure the safety of the works to prevent possible damage to life or property.
- (2) The frequency of inspections may be based on the hazard classification of the dam. Inspections may occur as follows:
 - (a) Inspections for high hazard dams may be scheduled on an annual basis;
 - (b) Inspections for significant hazard dams may be scheduled every three years; and
 - (c) Inspections for low hazard dams may be scheduled every six years.
- (3) Expedited inspections may be conducted if an urgent dam safety issue is identified or if there is a potential change in hazard classification.
- (4) Following an inspection, the Department shall provide to dam owners a letter with the inspection observations and recommendations that assist the dam owner to ensure the safety of the dam.

STATUTORY/OTHER AUTHORITY: ORS 540.350 - 540.400

STATUTES/OTHER IMPLEMENTED: ORS 183, 536, 540

ADOPT: 690-020-0160

RULE TITLE: Removal

NOTICE FILED DATE: 04/29/2020

RULE SUMMARY: Describes requirements for owner submittals and department reviews of plans to remove certain dams, including necessary documentation, supervision and inspection.

RULE TEXT:

(1) Dam owner(s) seeking Removal of any Dam with a High or Significant Hazard Rating must notify the Department.

(2) Dam owner(s) shall provide the Department with a Removal plan for evaluation prior to removing the Dam. Plans must be submitted a minimum of 60 days in advance of Removal to allow reasonable time to evaluate the Removal plan, unless the Department agrees to a different timeframe.

(3) A Removal plan must include:

(a) Descriptions and assumptions for the Removal of the Dam;

(b) A description of the means for Removal of the Dam to prevent future impoundment and a method of draining the reservoir in a controlled manner prior to the start of the Removal;

(c) A schedule listing the major events and corresponding time frame that will occur during the Removal;

(d) A plan for disposal and stabilization of Dam material; and

(e) A drawing showing the planned Removal location, breach dimensions including side slopes, and lowest elevation of the breach. The Removal plan must show that there will sufficient material removed and left at slopes that will allow no breach flood by erosion of remaining materials.

(4) The Department may evaluate the Removal plan to ensure the plan includes appropriate safety precautions to protect life, property, and public infrastructure from temporary inundation in the area below the Dam during Dam Removal.

(5) The Department may require changes to the Removal plan or require that the work performed under the plan be supervised by an Engineer as necessary to protect life, property, or public infrastructure from temporary inundation during Dam Removal. If the Department requires changes to the Removal plan or requires that work be supervised by an Engineer, the Department shall notify the Dam owner and provide an opportunity to meet with the Department.

(6) Upon completion of the Dam Removal, the owner shall notify the Department. The Department shall make a final inspection, if appropriate, and remove it from Department Dam safety oversight.

STATUTORY/OTHER AUTHORITY: ORS 536.027, 540.488

STATUTES/OTHER IMPLEMENTED: ORS 540.452, 540.488

ADOPT: 690-020-0180

RULE TITLE: Requirement of Owners to Provide Contact and Transfer of Title Information

NOTICE FILED DATE: 04/29/2020

RULE SUMMARY: Requires Dam owner to provide contact information to the Department.

RULE TEXT:

(1) A Dam owner shall:

(a) Provide the Department with contact information for:

(A) The Dam owner;

(B) The operator of the Dam, if other than the owner; and

(C) The individual in immediate charge of the Dam.

(b) Provide the contact information in an Emergency Action Plan developed pursuant to OAR 690-020-0400, or in writing if no Emergency Action Plan exists.

(c) Notify the Department in writing of any changes in the contact information, as soon as practicable and without unreasonable delay.

(2) A Dam owner shall notify the Department in writing after completing a transfer of title for a Dam, as soon as practicable.

STATUTORY/OTHER AUTHORITY: ORS 536.027, 540.488

STATUTES/OTHER IMPLEMENTED: ORS 540.479, 540.488

REPEAL: 690-020-0200

RULE TITLE: Fees for Dams

NOTICE FILED DATE: 04/29/2020

RULE SUMMARY: Rule repealed to conform with changes to statute made in 2019, updates made to other sections of rules, and for clarity.

RULE TEXT:

(1) Dam owners subject to dam safety regulations shall submit to the Department an annual fee on the basis established under ORS 536.050(2).

(2) Dam owners who fail to pay an annual fee on or before six months after the billing date may be required to pay a late fee of \$100.

(3) If a dam owner fails to pay the annual fee or late fee charged by the Department, the Department may, after giving the dam owner notice by certified mail, place a lien on the real property where the dam is located for the fees owed by the dam owner.

(4) Multiple large dams connected together and separated only by embankments or other manmade materials (common with sewage lagoons) will count as one dam for fee purposes.

(5) The Department may use the dam safety fee to support dam safety inspections; conduct dam breach inundation analysis for existing dams; help dam owners complete emergency action plans for existing dams; conduct or support the technical analysis of the safety of specific dams; and other actions as needed to support the dam safety program.

STATUTORY/OTHER AUTHORITY: ORS 536.050

STATUTES/OTHER IMPLEMENTED: ORS 536.050

AMEND: 690-020-0250

RULE TITLE: Maintenance of Dams

NOTICE FILED DATE: 04/29/2020

RULE SUMMARY: Modification to existing rule to reference authority and to carry forward and identify elements for maintenance of typical dams.

RULE TEXT:

- (1) The Dam owner shall review and evaluate conditions of the Dam as necessary to keep the Dam in good repair and properly maintained, and address any detected conditions that may pose a risk of Dam Failure.
- (2) Proper maintenance includes, but is not limited to:
 - (a) Removing brush and trees from the Dam;
 - (b) Control of burrowing animals, especially nutria near the Dam or reservoir, including filling deep burrows;
 - (c) Restoration of areas of surface or wave erosion, and taking measures to prevent future erosion;
 - (d) Adding or moving fill to restore Crest Height and width;
 - (e) Clearance of soil, rock, vegetation and debris from the Spillway;
 - (f) Proper cycling and lubrication of Valves and Gates at least once a year, unless otherwise specified in a maintenance and operations plan approved by the Department;
 - (g) Patching, sealing, or replacing areas of cracked concrete on the Dam;
 - (h) Removing debris, rock, or earth from the inlet and outlet of penetrating Conduits and drains;
 - (i) Repair or replacement of worn or damaged parts of Gates or Valves;
 - (j) Ensuring access to the Dam is sufficient for inspection, repair and emergency actions, and that unauthorized access is controlled;
 - (k) Securing operating equipment such as Valve controls and Spillway controls;
 - (l) Evaluation of the Conduit and taking necessary actions to ensure the Conduit is not compromised, including patching pipes with minor corrosion; and
 - (m) Addressing other conditions that might affect the safety of the Dam, including Maintenance Actions identified by the Department in an inspection document.
- (3) Records necessary to track the conditions of the Dam should be maintained.

STATUTORY/OTHER AUTHORITY: ORS 536.027, 540.488

STATUTES/OTHER IMPLEMENTED: ORS 540.455, 540.479, 540.488

ADOPT: 690-020-0260

RULE TITLE: Inspection of Dams

NOTICE FILED DATE: 04/29/2020

RULE SUMMARY: Replaces similar rule that was repealed. Describes Department's Dam inspection process and includes requirement to provide an inspection document to the Dam owner.

RULE TEXT:

(1) The Department, or representatives of the Department, may inspect a Dam and the site, plans and specifications, features and other supporting information regarding the construction, maintenance and operation of a Dam.

(2) The Department will maintain a Dam inspection schedule based on the Hazard Rating of the Dam:

(a) High Hazard Dams are scheduled for inspection annually,

(b) Significant Hazard Dams are scheduled for inspection every three years, and

(c) Low Hazard Dams are scheduled for inspection every six years.

(3) Notwithstanding subsection (2), the Department may determine that a different inspection schedule is appropriate. The Department may consider staff resources and Dam risks or condition in determining that a different inspection schedule is appropriate.

(4) The Department shall provide the Dam owner with an inspection document describing the general condition of the Dam and specific Maintenance Actions recommended by the Department.

STATUTORY/OTHER AUTHORITY: ORS 536.027, 540.488

STATUTES/OTHER IMPLEMENTED: ORS 540.455, 540.467, 540.479

REPEAL: 690-020-0300

RULE TITLE: Modification of Dams Requiring Notification and/or Approval

NOTICE FILED DATE: 04/29/2020

RULE SUMMARY: Rule repealed to conform with changes to statute made in 2019, updates made to other sections of rules, and for clarity.

RULE TEXT:

- (1) The activities described in OAR 690-020-0080(3) are considered such significant modification of the dam so as to constitute new construction requiring approval of engineered designs prior to initiating these activities.
- (2) Any activity that will increase the volume or rate of water released during failure requires a new inundation analysis using methods described in OAR 690-020-0120 unless the dam is in a remote area with no downstream development or high recreational use areas that might be affected by a dam breach flood.
- (3) Certain repairs that may affect the safety of the dam require on site analysis by an engineer during the actual repair process in order to determine the specific repairs needed. Prior approval of drawings for these repairs will not be required, as conditions encountered on site are likely to deviate from plans. Therefore, submission of an as-built drawing by the engineer of record of the following repairs indicating the repairs have been made correctly may be deemed as evidence of the safety of the dam:
 - (a) Slip lining of existing conduits that does not involve excavation into the dam and does not result in a significant reduction in the time required for the conduit to empty the reservoir;
 - (b) Replacement of toe drains; and
 - (c) Any other such repairs as determined by the State Engineer.

STATUTORY/OTHER AUTHORITY: ORS 540.350 - 540.400

STATUTES/OTHER IMPLEMENTED: ORS 183, 536, 540

ADOPT: 690-020-0310

RULE TITLE: Requirement to Address Maintenance Actions Need for High or Significant Hazard Dams

NOTICE FILED DATE: 04/29/2020

RULE SUMMARY: Describes process for identification, communication and evaluation of Dam maintenance actions required by the Department, including possible imposition of civil penalties.

RULE TEXT:

- (1) If, as a result of an inspection of a Dam that is rated High or Significant Hazard, the Department concludes that Maintenance Actions are needed, the Department shall use the process contained in this section as outlined below.
- (2) Upon inspection of a Dam that is rated High or Significant Hazard, the Department shall provide specific written notice in the inspection document, describing the observed condition of the Dam and informing the Dam owner of needed Maintenance Actions. The notice in the inspection document shall inform the Dam owner of the opportunity to meet with the Department concerning the information provided in the inspection document.
 - (a) Upon request of the Dam owner, the Department may provide more specific information regarding the inspection and the maintenance needs of the Dam.
 - (b) The Department may evaluate whether Maintenance Actions were completed during the next scheduled inspection of the Dam or sooner, pursuant to OAR 690-020-0260(3).
- (3) If, upon inspection of the Dam, the Department determines that the Dam owner has failed to take the necessary Maintenance Actions as identified in the notice of a prior inspection document, the Director may proceed to issue a proposed final order as provided in OAR 690-020-0460 or the Department and the Dam owner may enter into a stipulated corrective plan that provides dates certain by which necessary Maintenance Actions are performed.
- (4) A proposed final order may include, but is not limited to, provisions:
 - (a) Requiring performance of the needed Maintenance Actions identified in the inspection document notice by a date certain as specified by the Department;
 - (b) An assessment of civil penalties consistent with OAR 690-020-0600.
- (5) At any time subsequent to receipt of a proposed final order, the Dam owner may enter into a stipulated corrective plan to resolve the matters asserted in the proposed final order as provided in ORS 183.417.
- (6) If the Dam owner performs needed Maintenance Actions to the satisfaction of the Department and consistent with the proposed final order or stipulated corrective plan, the Director may not assess or pursue civil penalties for the matters identified in the proposed final order or stipulated corrective plan.

STATUTORY/OTHER AUTHORITY: ORS 536.027, 540.488

STATUTES/OTHER IMPLEMENTED: ORS 540.455, 540.467, 540.488

ADOPT: 690-020-0340

RULE TITLE: Potentially Unsafe or Unsafe Conditions

NOTICE FILED DATE: 04/29/2020

RULE SUMMARY: Specifies process for determination of potentially unsafe and unsafe conditions at a Dam. Requires specific process for Department to issue proposed and final orders if the cooperative plan is not followed, or the Dam becomes unsafe.

RULE TEXT:

(1) The following conditions may result in the Department concluding that a Dam is Potentially Unsafe:

- (a) Embankment materials highly vulnerable to internal erosion;
- (b) Highly variable and increasing rates of seepage that may lead to internal erosion;
- (c) Seismic analysis determines significant Crest loss with little Freeboard remaining;
- (d) For Dams in high seismic zones, a layer of liquefiable material in the Dam or its Foundation;
- (e) Evidence of prior large rapidly moving landslides identified above the Dam, increasing the risk of Dam Failure from floods and earthquakes;
- (f) Spillways are unable to pass the Inflow Design Flood as stated in OAR 690-020-0037 or Probable Maximum Flood;
- (g) Issues on the Spillway invert that could lead to rapid loss of Spillway integrity during a flood; or
- (h) Any other condition that meets the definition of Potentially Unsafe.

(2) The following conditions may result in the Department concluding that a Dam is Unsafe:

- (a) A reduction in Spillway capacity;
 - (b) Movement of the Dam over a short period of time;
 - (c) Major loss of Freeboard;
 - (d) Wave erosion narrowing the Crest;
 - (e) Internal erosion with limited movement of Embankment material;
 - (f) Seepage level rising on the downstream face of the Dam;
 - (g) Landslide or other deformation on the Dam;
 - (h) Rapid erosion of the Spillway;
 - (i) Significant loss of mass of a concrete Dam;
 - (j) Concrete Spillway with large voids or openings through the slab;
 - (k) Conduit deteriorated to where Conduit collapse is reasonably possible;
 - (l) A Pressurized Conduit with holes in the pipe;
 - (m) Flashboards in place during high runoff season;
 - (n) Animal burrows penetrating deep into the Dam;
 - (o) Large trees growing near the Crest;
 - (p) Building a new Dam or increasing Dam Height without examination and written approval by the State Engineer of site plans, specification, and other supporting information for that Dam; or
 - (q) Any other condition that meets the definition of Unsafe.
- (3) Notification of Potentially Unsafe or Unsafe Conditions. If, as a result of an inspection or analysis of a Dam that has a High or Significant Hazard Rating the Department concludes that corrective action is necessary to address a condition allegedly rendering the Dam Unsafe or Potentially Unsafe, the Department shall provide written notification to the Dam owner by registered or certified mail with return receipt requested, sent to the address of record on file with the Department, as per OAR 690-020-0180, for the Dam owner.
- (a) The written notification shall include at least the following:
 - (A) An explanation of why the inspection or analysis of information and conditions causes the Department to conclude that the Dam is Unsafe or Potentially Unsafe;
 - (B) Any action the Department concludes is necessary to address the alleged Unsafe or Potentially Unsafe conditions;
 - (C) Notice to the Dam owner of the opportunity to meet with the Department to discuss the notification; and

(D) Notice to the Dam owner of the opportunity to provide information to explain why the Dam owner disagrees with the matters asserted in the notification alleging the Dam is Unsafe or Potentially Unsafe.

(b) Following issuance of a notification, the Department may attempt to resolve the Unsafe or Potentially Unsafe conditions in cooperation with the Dam owner. The Dam owner may endeavor to develop a plan and timeframe for corrective action that is agreeable to the Department. If the plan and timeframe are agreeable, the Department and owner may enter into a consent order to address the corrective action for timely resolution of the Unsafe or Potentially Unsafe conditions. In determining whether a plan and timeframe is agreeable and developing a consent order, the Department may consider any relevant information, including, but not limited to:

(A) The design and construction of the specific Dam;

(B) The efforts and resources of the Dam owner; and

(C) The impacts associated with Dam failure.

(4) In addition to any other available remedies, the Director may issue a Proposed Final Order in the event the Department and the Dam owner do not agree to a plan and timeframe and enter into a consent order to address corrective actions, if the Dam owner fails to complete actions as provided in the consent order, in the event the Dam owner does not otherwise address the matters identified in the notification to the Department's satisfaction, or if the Department concludes based on inspection or analysis that the Dam is Unsafe.

(a) The proposed final order shall include the specific information and conditions that have caused the Department to conclude that a Dam is Unsafe or Potentially Unsafe, shall be consistent with ORS 183.415, and shall provide notice of the opportunity for a contested case hearing pursuant to ORS 183. The proposed final order shall include the notification in subsection (3) of this section, if notification has not already been provided for an Unsafe Dam.

(b) The proposed final order may include, but need not be limited to, any or all of the following provisions:

(A) A requirement that the Dam owner consult with an Engineer to assess the nature and extent of the Unsafe or Potentially Unsafe conditions identified by the Department and, as necessary, to identify corrective actions to address the Unsafe or Potentially Unsafe conditions;

(B) Commencement and completion dates for any corrective action the Department determines is necessary to remedy the Unsafe or Potentially Unsafe conditions;

(C) Restrictions on the maximum Water level in the reservoir until corrective action has been completed to the satisfaction of the Department;

(D) Provisions directing that the Dam may not be used for the impoundment, restraint, or conveyance of Water until corrective actions have been completed to the satisfaction of the Department;

(E) A requirement to install and maintain monitoring equipment if the Department concludes that monitoring is necessary to protect life, property, or public infrastructure. The provisions requiring the installation and use of monitoring equipment at a Dam to monitor the Unsafe or Potentially Unsafe conditions shall include the ability to use the most economical monitoring equipment sufficient to protect life, property, and public infrastructure as determined by the Department.

(5) Upon issuance of a proposed final order, the Dam owner and Department may enter into a consent order to resolve the matters in the proposed final order as provided in ORS 183.417. Any such document must include conditions to address the matters in the proposed final order as determined by the Department.

(6) If, following issuance of a proposed final order regarding a Dam that the Department has concluded is Unsafe, the Department receives a request for hearing from the Dam owner, the Director may request that the scheduling of any contested case hearing be expedited, and the Office of Administrative hearings shall expedite the contested case hearing to the extent that the office considers it practicable and will give the Dam owner reasonable time to prepare.

(a) In determining the expedited timeline practicable, the Office of Administrative Hearings shall consider, based on information provided by the Department, any conditions that may affect the urgency of the proceedings or the likelihood that Unsafe conditions may pose near-term threat to life, property, or public infrastructure.

(b) The reasonable time to prepare for a contested case hearing shall be based on the likelihood that Unsafe conditions may pose a near-term risk to life, property, or public infrastructure.

(7) Issuance of a proposed final order does not preclude the Department from pursuing any and all lawful remedies as the Department may determine are necessary to protect life, property, or public infrastructure including, but not limited to, seeking injunctive relief in the circuit court as provided in ORS 540.473.

(8) In addition to any other available lawful remedies, if a proposed final order issued under this section becomes final by operation of law or on appeal, and the Dam owner fails to comply with the order as specified in the order, the Director may request the Attorney General or the district attorney of any county where all or part of the Dam is located to bring an action declaring the Dam a public nuisance and ordering its Removal at the owner's expense.

STATUTORY/OTHER AUTHORITY: ORS 536.027, 540.488

STATUTES/OTHER IMPLEMENTED: ORS 540.458, 540.461, 540.470, 540.473, 540.476

REPEAL: 690-020-0350

RULE TITLE: Operations and Maintenance Plans

NOTICE FILED DATE: 04/29/2020

RULE SUMMARY: Rule repealed to conform with changes to statute made in 2019, updates made to other sections of rules, and for clarity.

RULE TEXT:

(1) As part of the plans submitted with the design, the engineer of record shall provide to the Department operations and maintenance plans for new significant and high hazard dams, and for any new dam with a gate or flashboard as part of the spillway. The dam owner shall be responsible for implementation of operations and maintenance plans, and compliance with these may be reviewed during dam safety inspections.

(2) Operations and maintenance plans may include but are not limited to:

(a) Procedures for operation of all gates and valves;

(b) Specified frequency for cycling of the slide gate and/or valves;

(c) The time of year flashboards are allowed in the spillway;

(d) Removal of trees and shrubs, and mowing other vegetation as needed;

(e) Routine inspections, including evaluation of seepage flow, and visual identification of any turbid seepage;

(f) Water release plan in the event of a flood forecast when reservoir is above a certain level; and

(g) Measurement frequency for all monitoring instrumentation installed at the dam.

STATUTORY/OTHER AUTHORITY: ORS 540.350 - 540.400

STATUTES/OTHER IMPLEMENTED: ORS 183, 536, 540

AMEND: 690-020-0400

RULE TITLE: Emergency Action Plans (EAP)

NOTICE FILED DATE: 04/29/2020

RULE SUMMARY: Provides information for planning and response to incidents at Dam rated as High Hazard. Provides criteria for elements included in Emergency Action Plans for updates and exercises of plans.

RULE TEXT:

- (1) An owner of a High Hazard Dam shall develop an Emergency Action Plan (EAP) consistent with this section. The EAP is to assist the Dam owner and local emergency management personnel to ensure human safety in the event of a potential or actual Dam Failure.
- (2) For new Dams or to increase the Dam Height of High Hazard Dams, the EAP is required to be submitted as part of the plans and specifications in OAR 690-020-0035 and OAR 690-020-0080(1), prior to commencing new Dam construction.
- (3) Owners of Dams which have been reclassified to a High Hazard Rating will be required to develop and submit an EAP within one year of being notified of the reclassification by the Department.
- (4) An EAP shall contain, at a minimum, the following key elements:
 - (a) Means for emergency condition detection;
 - (b) Means for emergency level determination;
 - (c) Identification of, and information necessary for, notification and communication to be made at each level of emergency condition, including, but not limited to, contact information required in OAR 690-020-0180(1);
 - (d) Description of actions to prevent a Dam Failure incident or to help reduce the effects of a Dam Failure and facilitate response to an emergency;
 - (e) A map of Dam Failure inundation zones developed using a Dam breach inundation analysis for varying conditions as specified by the Department, including, but not limited to, dry weather conditions and high flood conditions. The Department may require one inundation map if the dry weather and high flood flows are not substantially different. The inundation mapping must include cross sections at locations of concern, and a description of expected depth and velocity of maximum breach flows at each cross section; and
 - (f) Procedures for termination of the emergency.
- (5) The Dam owner shall file copies of the EAP with the Department, the Office of Emergency Management, and the local emergency services agency for the county where the Dam is located.
- (6) The Department will, in consultation with the local Office of Emergency Management:
 - (a) Periodically review the EAP and may require updates to the plan that recognize the actual capabilities of the local emergency managers; and
 - (b) Determine the appropriate frequency for conducting emergency response exercises.

STATUTORY/OTHER AUTHORITY: ORS 536.027, 540.488

STATUTES/OTHER IMPLEMENTED: ORS 540.449, 540.479, 540.482, 540.485, 540.488

ADOPT: 690-020-0420

RULE TITLE: Immediate Action to Prevent Dam Failure

NOTICE FILED DATE: 04/29/2020

RULE SUMMARY: Describes Water Resources Department actions in an emergency at a Dam rated High or Significant Hazard.

RULE TEXT:

- (1) If an actual or potential Dam Failure creates an imminent risk to life, property, or public infrastructure and an Emergency Action Plan exists for that Dam, a Dam owner shall immediately implement the actions specified in the plan.
- (2) If no EAP exists, and an actual or potential Dam Failure creates an imminent risk to life, property, or public infrastructure, the Dam owner shall immediately notify by telephone or other method that ensures immediate notification:
 - (a) The local emergency services agency for the county where the Dam is located, via 9-1-1 call, if the dam has a Significant Hazard Rating;
 - (b) The Department; and
 - (c) To the extent practicable, Persons in areas where the potential for Dam Failure creates a risk to life, property, or public infrastructure.
- (3) In addition, if an actual or potential Dam Failure creates an imminent risk to life, property, or public infrastructure, a Dam owner shall also take all practicable measures to prevent Dam Failure.
- (4) If the Department is aware of conditions which indicate that immediate action is needed to prevent a Dam Failure, the Department may contact and advise the owner, operator, or individual in charge of the Dam regarding necessary actions to prevent the Dam Failure.
- (5) If a Dam has a Significant or High Hazard Rating and presents an imminent risk of dam failure, the Department or its agents or representatives may enter the property without notice or permission of the pertinent landowner to access the Dam and evaluate the condition or risk or to undertake necessary actions described in subsections (6) and (7). The Department's entry onto property pursuant to this subsection shall be to the extent entry is reasonable or necessary.
- (6) The Department may communicate and coordinate actions necessary to reduce the risk of dam failure.
- (7) If the Department observes that there is a rapidly increasing leakage risk of overtopping at a Dam that has a Significant or High Hazard Rating, the Department may open Gates or Valves and siphon or pump Water to reduce the Water levels in the reservoir.
- (8) The Department may, as necessary to address an actual or potential Dam Failure that poses an imminent risk to life, property, or public infrastructure:
 - (a) Modify approval requirements for emergency construction work;
 - (b) Waive or modify the actions prescribed in an Emergency Action Plan; and
 - (c) Pursue any other lawful remedy.

STATUTORY/OTHER AUTHORITY: ORS 536.027, 540.488

STATUTES/OTHER IMPLEMENTED: ORS 540.449, 540.482, 540.485, 540.488

ADOPT: 690-020-0460

RULE TITLE: Proposed Final Order, Request for Hearing, Contested Case Process

NOTICE FILED DATE: 04/29/2020

RULE SUMMARY: Implements provisions to notify Dam owners of potential non-compliance with rules. Provides procedures for issuance of proposed final orders, hearings, and final orders.

RULE TEXT:

(1) Proposed Final Order, Notice of Assessment of Civil Penalty. A proposed final order or a notice of assessment of civil penalty must be consistent with the provisions of ORS 183.415, shall include notification of the right to a contested case hearing pursuant to ORS 183, and shall include any applicable or required element otherwise specified in Dam safety rules governing proposed final orders. A proposed final order or a notice of assessment of civil penalty must be served personally or by registered or certified mail.

(2) Request for Hearing. A Dam owner that receives a proposed final order or a notice of assessment of civil penalty has 30 calendar days from the date of service of the proposed final order in which to file a written request for hearing. The request for hearing must be filed either in person or by mail addressed to the Department's office in Salem, Oregon. The request for hearing may not be considered timely filed unless it is received in the Department consistent with this subsection. The request for hearing must include a written response specifying the reasons for disagreement with the proposed final order.

(3) Contested Case Procedure. Contested case hearings resolving requests for hearing to proposed final orders issued by the Department under these rules shall be heard by administrative law judges from the Office of Administrative Hearings. Hearings shall be conducted as provided in ORS 183 and the Attorney General's Uniform and Model Rules of Procedure under the Administrative Procedures Act in OAR 137-003-501 to 0700 except:

(a) Only a Dam owner or the Dam owner's authorized representative may request a contested case hearing and be considered a party in any contested case;

(b) For expedited contested case hearings regarding proposed final orders addressing Unsafe conditions, discovery methods as provided in OAR 137-003-0566 shall not be allowed because the availability of other forms of discovery would unduly delay proceedings to address conditions that address a near-term risk of threat to life, property, or public infrastructure. Notwithstanding, a party may request public documents pursuant to a request for public records made to the Department as described in OAR Chapter 690, Division 3; and

(c) Immediate review under OAR 137-003-0640 is to the Director only.

(4) Proposed Order in Contested Case. Following the close of the record for a contested case hearing, the administrative law judge will issue a proposed order and shall serve the proposed order on each participant to the contested case.

(5) Exception to Proposed Order. If the recommended action in the proposed order is adverse to any party, the party may file written exceptions to the Department within 15 calendar days after a proposed order is served.

(6) Final Order. The Director may consider any exceptions received and shall issue a final order as provided in OAR 137-003-0665. An order adverse to a party may be issued upon default as provided in OAR 137-003-0672.

(7) The Department and a Dam owner may at any time use informal or alternative means to resolve a contested case hearing. When informal disposition of a contested case is made by stipulation, agreed settlement or consent order, the final order that incorporates the informal disposition is not subject to judicial review.

STATUTORY/OTHER AUTHORITY: ORS 183, 536.027, 540.488

STATUTES/OTHER IMPLEMENTED: ORS 183, 540.458, 540.461, 540.467, 540.470, 540.488, 540.995

REPEAL: 690-020-0500

RULE TITLE: Enforcement

NOTICE FILED DATE: 04/29/2020

RULE SUMMARY: Rule repealed to conform with changes to statute made in 2019, updates made to other sections of rules, and for clarity.

RULE TEXT:

(1) When any dam is found to be in violation of the terms and conditions of the water right permit or certificate, or directly threatens life or property, or when any structure is found where lack of maintenance or unauthorized alterations could lead to a direct threat to life or property, the Department shall notify the owner in writing of the violation and the action necessary and specified time allowed to bring the structure up to design, operation, or maintenance standards.

(2) Failure by the owner to perform the required action may result in proceedings for one or more of the following:

(a) Notice and opportunity for a contested case hearing as provided for in ORS 540.350(5).

(b) Posting of the structure to prevent storage or to limit operation until the owner has complied with the requested action required to fulfill conditions of the permit or certificate.

(c) Instituting legal action by the District Attorney or Attorney General to have the facility declared a public nuisance.

(d) Issuance of an order to prevent storage or to breach the embankment as provided for in ORS 540.370.

(e) Any other enforcement action permitted by law.

(3) Engineering work that is inconsistent with any rules in this Division may be referred to the Oregon State Board of Examiners for Engineering and Land Surveying, for appropriate actions.

STATUTORY/OTHER AUTHORITY: ORS 540.350 - 540.400

STATUTES/OTHER IMPLEMENTED: ORS 183, 536, 540

ADOPT: 690-020-0600

RULE TITLE: Civil Penalty Assessment for Dam Safety

NOTICE FILED DATE: 04/29/2020

RULE SUMMARY: This rule provides criteria for issuance of civil penalties as authorized by Statute. Civil penalties may be issued for: failing to submit design and operation documents prior to Dam construction; impounding Water prior to final Dam documentation; not providing removal plans for Department review; not completing, updating or exercising an Emergency Action Plan; and not correcting a maintenance deficiency on a Dam. This rule provides a schedule of penalties, occurrence periods; and penalty remittance criteria.

RULE TEXT:

(1) The Department may assess civil penalties for the following violations:

- (a) Constructing a Dam without prior written approval from the Department of the final Dam design, construction documents, and operation documents as described in OAR 690-020-0080(1) and 0140(1);
- (b) Impoundment of Water behind a Dam before final documentation has been submitted and accepted by the Department as provided in OAR 690-020-0080(4) and 0150(6);
- (c) Removal of a High or Significant Hazard Dam prior to providing a Removal plan, as required in OAR 690-020-0160;
- (d) Failure to file an Emergency Action Plan with the Department, the Office of Emergency Management, and the local emergency services agency for the county where the Dam is located, as provided in OAR 690-020-0400; and
- (e) Failure to complete needed Maintenance Actions on a High or Significant Hazard Dam, as identified in a prior inspection document sent from the Department to the Dam owner, as described in OAR 690-020-0310.

(2) The civil penalty for Constructing a Dam prior to obtaining written approval from the Department of final Dam design, construction, and operation documents prior to Dam construction activity shall be \$2,000 for a High Hazard Dam, \$1,000 for a Significant Hazard Dam, and \$500 for a Low Hazard Dam.

(3) The civil penalty for impounding Water prior to submission and acceptance by the Department of the final plans and specifications shall be \$1,000 per occurrence for a High Hazard Dam, \$500 per occurrence for a Significant Hazard Dam, and \$250 per occurrence for a Low Hazard Dam.

(a) Each day the Dam impounds Water is considered a new occurrence and violation. A civil penalty may be assessed for each day of violation for the period the reservoir is impounding Water until satisfactory completion documents are submitted to and accepted by the Department, until the reservoir is emptied, whichever is sooner.

(b) The Department may remit all or a portion of a civil penalty if completion documents existed but were not submitted, and those documents meet the criteria, or for Dams which are modified to be exempt from Dam safety requirements as per ORS 540.446(1).

(4) The civil penalty for beginning construction work to remove a Dam rated as High or Significant Hazard prior to submission and acceptance of a Dam Removal plan, failure to modify the plan if required, or failure to follow the modified plan shall be \$2,000 for a High Hazard Dam and \$1,000 for a Significant Hazard Dam.

(a) Each day construction work is performed to remove the Dam is considered a new occurrence and violation. A civil penalty may be imposed for each day of violation beginning on the day Removal activities began until the Dam is no longer storing Water and construction work to remove the Dam has ceased.

(b) The Department may remit all or a portion of this civil penalty if the Department receives and accepts a Dam Removal plan and determines that Dam Removal was consistent with the plan and completed safely with no downstream damage.

(5) The civil penalty for failure to file an Emergency Action Plan for a High Hazard Dam with the Department, the Office of Emergency Management, and the local emergency services agency for the county where the Dam is located shall be \$2,000.

(a) Each month the Emergency Action Plan is not filed is a new occurrence and violation. A civil penalty may be imposed for each month of violation beginning on the date the notice of violation was first provided to the responsible party.

(b) The Department may remit all or a portion of the civil penalty if development of the plan is underway and the plan is

submitted within 60 days of the due date.

(6) The civil penalty for failure to complete needed Maintenance Actions identified in a prior inspection document for Dams rated as High or Significant Hazard shall be:

(a) A civil penalty of \$500 may be assessed for failure to perform required Maintenance Action(s) on a High Hazard Dam which could result in the Dam becoming Unsafe. Each month will be considered a new violation until the required Maintenance Action(s) is completed;

(b) A civil penalty of \$250 may be assessed for all other required Maintenance Action(s) for a High Hazard Dam. Each month will be considered a new violation until the required Maintenance Action(s) is completed;

(c) A civil penalty of \$250 may be assessed for failure to perform required Maintenance Action(s) on a Significant Hazard Dam which could result in the Dam becoming Unsafe. Each month will be considered a new violation until the required Maintenance Action(s) is completed;

(d) A civil penalty of \$150 may be assessed for failure to complete all other required Maintenance Action(s) for a Significant Hazard Dam. Each month will be considered a new violation until the required Maintenance Action(s) is completed; and

(7) The Department may remit all or a portion of a civil penalty, considering the Dam owner's efforts to comply.

STATUTORY/OTHER AUTHORITY: ORS 536.027, 540.488

STATUTES/OTHER IMPLEMENTED: ORS 540.449, 540.452, 540.467, 540.482, 540.488, 540.995