Final Proposed Rules
Chapter 690, Division 20
November 19, 2009

WATER RESOURCES DEPARTMENT

DIVISION 20

[***APPROPRIATION AND USE OF SURFACE WATER***]

[*Dams*]

DAM SAFETY

690-020–00 [***21***] **00**

[***General Statement***]

[*The following Oregon Administrative Rules (OAR), 690-020-0022 through 690-020-0040, apply to construction of dams. For administrative purposes dams have been classified as "small" and "dams over the statutory limits". Information concerning small dams is found in 690-020-0029, and information concerning dams over the statutory limits is contained in 690-020-0035. Small dams are those that are either under ten feet in height or store less than 3,000,000 gallons (9.2 acre-feet). OAR 690-020-0040 is concerned with enforcement procedures.*]

Purpose and Applicability

(1) These rules describe the standards and requirements under which the department will administer and enforce the design, construction, maintenance, inspection, and fees regarding dams in Oregon. The purpose is to provide the guidance necessary for dams to be constructed and operated in a manner that will ensure the protection of life and property and to provide the department with the resources necessary to manage and support the construction and safe operation of dams in accordance with these rules.

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(2) These rules apply to:

a. Dams that are not subject to ORS 540.350 to 540.390 as described in ORS 540.400.

b. Dams that are subject to ORS 540.350 to 540.390 and which exceed the statutory limits as described in ORS 540.400 (1) & (2).

(3) These rules do not apply to metal or reinforced concrete water storage tanks or various types of tanks that are part of water treatment facilities.

Stat. Auth.: ORS 540.350 - ORS 540.400; **ORS 536.050**
Stats. Implemented: ORS 183 [&] **;** ORS 540 **; ORS 536**
Hist.: WRD 12-1986, f. & ef. 10-3-86; WRD 12-1994, f. & cert. ef. 11-7-94

690-020-0022

[***Statutory Authority and***] **Definitions**

[*(1) Statutory authority for these rules is: ORS 537.130, 537.190, 537.211, 537.260, 537.410 through 537.450, 540.330 through 540.400.*

(2) The statutes in section (1) of this rule primarily provide for the protection of life and property, and for protection of other water rights. The following definitions are provided for the applicant's reference:]

The following definitions apply in OAR 690, Division 20:

[*(a)*] **(1) "**Abutment**"** [:] **means** [*A*] **a** natural valley or canyon side against which the dam is built;

[*(b)*] **(2) "**Acre-foot**"** [:] **means** [*T*] **t**he equivalent volume of one acre covered with one foot of water (325,900 gallons);

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[*(c)*] **(3) "**Conduit**"** [:] **means** [*A*] **a** closed conveyance used to release water through a dam.

[(d) Cutoff Collar: A thin collar placed at uniform intervals along an outlet conduit to retard water seepage;]

[*(e)*] [***(d)***] **(4) "**Cutoff Trench**"** [:] **means** [*A*] **a** trench excavated beneath the dam foundation and backfilled with **low permeability** [*impermeable*] material to retard water seepage;

[***(e)***] **(5) "Dam" means a hydraulic structure built above the natural ground grade line that is used to impound water. Dams include wastewater lagoons and other hydraulic structures that store water, attenuate floods, and divert water into canals** [**,** ***and store and treat wastewater***]**;**

[*(f)*] **(6) "**Dam Crest**"** [:] **means** [*T*] **t**he top of the dam;

[***(g)***] **(7) "Department" means the Oregon Water Resources Department;**

[***(h)***] **(8) "Director" means the Director of the Oregon Water Resources Department;**

[*(g)]*[***(i)***] **(9) "**Embankment**"** [:] **means** [*A*] **a**n engineered earth fill;

[*(h)*] [***(j)***] **(10) "**Emergency Spillway**"** [:] **means** [*A*] **a**n overflow structure constructed to bypass flood water and prevent overtopping the dam crest**. Often, dams have two spillways. The lower elevation spillway that spills first is referred to as the principle spillway. The higher elevation spillway is referred to as the emergency spillway**;

[*(i)*] [***(k)***] **(11) "**Foundation**"** [:] **means** [*T*] **t**he ground surface upon which a dam is constructed;

[*(j)*] [***(l)***] **(12) "**Freeboard**"** [:] **means** [*T*] **t**he vertical distance between the designed high-water level in the reservoir and the dam crest; [*and*]

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[*(k)*] [***(m)***] **(13) "**Gate**" or "Valve"** [:] **means** [A] **a** permanent device for regulating water flow **through the dam**;

[***(n)***] **(14) "Hazard Rating" means the rating established by the department for a large dam that pertains to the potential level and degree of damage to life and property downstream of a dam in the event dam failure results in a catastrophic release of water;**

[***(o)***] **(15) "Large Dam" for dam safety purposes, means a dam with a height of 10 feet or more and impounding** [*more than*] **3,000,000 gallons (9.2 acre-feet) or more of water;**

(16)"Significant dam work" means an activity to repair, rehabilitate, enlarge or otherwise alter a dam in which: 1) at least 30% of the fill material is impacted by the activity, 2) a spillway is being enlarged or repaired that affects the height or hydraulics of the spillway, 3) dam height and/or reservoir size is being increased, 4) a low level outlet conduit or inlet gate is being reworked with excavation or 5) any other activity that could affect the integrity of the dam or its auxiliary works;

[***(p)***] **(17) "Small** [*d*] **Dam" for dam safety purposes, means a dam with a height of less than 10 feet or impounding less than 3,000,000 gallons (9.2 acre-feet) of water; and**

(18) "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.

Stat. Auth.: ORS 183 & ORS 540
Stats. Implemented: ORS 183 [&] **;** ORS 540 **; ORS 536**
Hist.: WRD 12-1986, f. & ef. 10-3-86

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690-020-0025

General Requirements for all Dams

(1) The [*Water Resources*] [*D*] **d**irector may require any information or data in addition to that outlined herein which the [*Water Resources*] [*D*] **d**irector finds necessary for determining the safety of the proposed structure.

(2) Whenever possible, precipitation [*or rainfall*] and runoff records shall be submitted **as part of the design for** [***a***] **new,**[***enlarged***] **or** [***rehabilitated structure***] **significant dam work on existing dams**. If records are not available for the basin in which the dam is located, the hydrological/hydraulic criteria used in the design shall be submitted.

(3) The [*Water Resources*] [**D**] **d**irector may include as part of any permit to construct a [*reservoir*] **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 certificate and remain in effect throughout the life of the water right.

(4) Approved plans and specifications for construction are, by reference, considered limitations and conditions placed on the water right permit and water right certificate. The [*Water Resources*] [*D*] **d**irector retains the authority to place additional limitations and conditions on the water right relative to operation and maintenance.

(5) Dams constructed or operated in violation of limitations and conditions included in the permit or certificate are subject to restricted use and permit cancellation procedures. The certificate affirms the applicant's right to store water subject to the limitations and conditions therein.

(6) An outlet conduit with a minimum diameter of 8" must be installed in any instream reservoir to permit drainage of the reservoir and for passage of flow to downstream prior rights [*if necessary*]. The [*D*] **d**irector may waive this requirement if the Director determines that the conduit is not needed for dam safety and will not be needed to pass flow for the benefit of other water rights, minimum perennial streamflows, or if the Director determines an adequate alternative for passing flow is provided. Adequate

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alternatives must be capable of passing flow in sufficient quantity to satisfy downstream needs, and can include pumps, by-pass channels and siphons.

Conduit material should be chosen based on design and site condition requirements. Acceptable conduit materials include reinforced concrete cylinder pipe; cast-in-place, reinforced concrete; **appropriate PVC;** [*zinc-coated, fiber-treated, bituminous-coated corrugated steel; coal tar enamel-coated welded steel*] **concrete-encased corrugated metal pipe or plastic pipe**; ductile iron; and cast iron. All joints should be water tight. The conduit valve should be installed at the upstream end and should be industry-manufactured with specifications consistent to the applied usage. Special provisions should be made for pressure conduits gated on the downstream end.

(7) The department shall determine the height of a dam by calculating the vertical distance (measured in feet) between the center point of the dam crest relative to and above the stream channel and the lower of either the natural soil surface that was in place prior to the construction of the dam or where a channel incision exists, the bottom of the channel incision. This measurement is to be taken at the maximum section along the dam's longitudinal axis.

(8) The department shall determine water impoundment volumes (in acre-feet or millions of gallons) as follows:

(a) For dams impounding water for an authorized beneficial use, the impoundment volume indicated in the area-capacity curve from the bottom of the reservoir to the [***emergency***] **spillway crest**. **For dams with multiple spillways, 'spillway crest' is referring to the crest of the principle or lower elevation spillway.**

(b) For [***sewage***] **wastewater treatment lagoons, the impoundment volume indicated in the** [***sewage***] **wastewater lagoon plans and specifications, and**

(c) For diversion or flood control dams, the impoundment volume calculated at full reservoir at the dam emergency (highest elevation) spillway crest level.

Stat. Auth.: ORS 540.350 - ORS 540.400

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Stats. Implemented: ORS 183, ORS 536 & ORS 543
Hist.: WRD 3, f. & ef. 2-18-77; WRD 12-1986, f. & ef. 10-3-86; WRD 12-1994, f. & cert. ef. 11-7-94

690-020-0029

Small Dams, Recommended Minimum Standards

The following information is presented for the applicant's assistance in constructing small earthfill dams[*less than ten feet in height or impounding less than 3,000,000 gallons (9.2 acre feet) (see Exhibit 1)*]:

(1) **It is recommended that** [*T*] **t**he The crest width of the dam [*should*] be not less than 8 feet.

(2) **It is recommended that** [*T*] **t**he upstream slope of the dam [*should*] be no steeper than 3:1.

(3) **It is recommended that** [*T*] **t**he downstream slope of the dam [*should*] be no steeper than 2:1.

(4) **It is recommended that** [*T*] **t**he spillway channel [*should*] be constructed around the dam, not over the top of the fill. The spillway is [*normally*] **commonly** excavated in natural material and, if necessary, lined to prevent erosion. The spillway should be large enough to pass the 50-year flood flow without overtopping the dam. Assistance is available from [*this*] **the department** [*or the watermaster*] in sizing the spillway. Flow passing through the spillway should be returned to the creek channel at a sufficient distance downstream to prevent erosion of the [*fill*] **dam's embankment**.

(5)) **It is recommended that** [*A*] **a**ll brush, stumps, roots, and organic matter should be cleared from the area to be occupied by the dam. All such material should also be removed from the borrow area.

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(6) [*A minimum of two cutoff collars should be constructed on the outlet conduit. These cutoff collars are normally constructed of concrete with a minimum thickness of 6 inches and should extend from the outside of the conduit a minimum of 24 inches in all directions. Prefabricated asphalt-dipped metal cutoff collars are acceptable, provided a watertight joint is obtained between conduit and collar.*] **It is recommended that** [*T*] **t**he **outlet pipe** [***should***] **be encased with concrete or other method to allow for proper compaction and the prevention of uncontrolled seepage.**

(7) Embankment material should be spread parallel [*e*] with the dam axis in layers not exceeding eight inches in thickness and adequately compacted with sheepfoot roller or other similar equipment.

(8) It is recommended that prior to construction the dam owner have the dam's potential hazard to downstream properties studied using methods listed in 690-020-0100. It is recommended that any dam with a potential significant or high hazard rating be designed by a registered engineer familiar with dam engineering. It is also advisable for any dam nearing or surpassing the dam height or storage thresholds for a "large dam" to be designed by a registered engineer.

[*ED. NOTE: The Exhibit referenced in this rule is not printed in the OAR Compilation. Copies are available from the agency.*]

Stat. Auth.: ORS 183 & ORS 540
Stats. Implemented: ORS 183 & ORS 540
Hist.: WRD 12-1986, f. & ef. 10-3-86

690-020-0035

[***Dams Over the Statutory Limits***] **Large Dams; Minimum Engineering Design Requirements**

All maps, plans, and specifications for the construction [, *enlargement, repair, or alteration*] of [*all*] **new large dams or significant dam work for existing large** dams [*which are, or will be, 10 feet or more in height and will impound 3,000,000 gallons (9.2*

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acre-feet) or more], must be prepared by a professional engineer licensed to practice in the State of Oregon.

(2) Before initiating design, the engineer shall obtain design criteria from the [*D*] **d**epartment.

(3) No newly constructed **large** dam [*that is 10 feet or more in height and impounds 3,000,000 gallons (9.2 acre-feet) or more*], shall be permitted to store water until written approval is received from the [*Water Resources*] [*D*] **d**epartment. Approval will be given after construction has been completed and is certified by the supervising engineer to have been constructed in accordance with the approved plans and specifications.

(4) Design documents shall include the following:

(a) Plans:

(A) Plans for dams submitted for approval must accurately portray the work to be accomplished and be of sufficient detail to adequately define all features of the project. Plans must be submitted on good-quality mylar or vellum and must be neatly and accurately drawn to a scale sufficiently large, with an adequate number of views, for the drawing to be readily interpreted. **To meet the requirements of this subsection, the director may allow plans for dams to be submitted electronically. The format of the plans in terms of file type, projection and other details must be approved by the department.**

(B) Several sheets may be used to eliminate the necessity of large bulky drawings. No map or plan should be larger than 24 x 36 inches. The following information will be required:

(i) A contour map of the reservoir site which will show the location of the dam by quarter-quarter section, township, range and tax lot; and the name and location of the stream flowing through the reservoir. Government survey lines must be indicated on this map, along with a survey tie to the dam axis from a government land corner. Area and capacity curves and/or tables of the proposed reservoir must be shown;

(ii) A map of the drainage basin showing the location of the dam and reservoir and the streams within the drainage area. This map may be prepared from existing reliable topographical maps and it must include: the number of square miles of drainage area; a brief description of the area; the percentage of bare and timbered lands; and general characteristics of the watershed, whether precipitous, rolling, or comparatively flat**. The estimated discharge as well as the spillway capacity at different reservoir water levels should also be provided in the plans or specifications. Extraneous information can also be included in specifications or a separate hydrology report as to not clutter up the map**;

(iii) A topographic map of the dam site with contour intervals [*of*] not to exceed 5 feet. A plan of the dam should be superimposed on this map showing the location of spillways, outlet conduits, and [*cutoff walls*] **other relevant auxiliary structures**;

(iv) A profile of the dam site taken on the axis of the dam and a profile of the spillway along its axis. The profile should also show the location of the outlet conduit and spillway. A log showing the classification of materials encountered below the surface as shown by test pits or borings [*should be included*];

(v) A cross section of the dam at maximum section showing complete details and dimensions;

(vi) Plans showing sections of the outlet conduit, control works, and spillways. These sections should be in sufficient number and detail to make definite all features of the structure.

(b) Specifications. All plans for dams must be accompanied by **construction and material** specifications:

(A) The specifications shall describe in detail the methods **and/or performance criteria** to be followed in performing each class of work and shall set forth the requirements for the various types of material to be used in [*the*] permanent construction;

(B) The specifications must contain a provision for supervision by the engineer during construction and for inspection by the [*D*] **d**irector **or director's authorized**

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representative [*of the Water Resources Department*] at any time during the construction period;

(C) 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 [*D*] **d**irector [*of the Water Resources Department*] or the [*D*] **d**irector's authorized representative.

(5) Construction: Construction should be supervised by an engineer licensed to practice in Oregon. As a minimum the following notices and construction reports shall be submitted to the Department:

(a) Notice of beginning of construction;

(b) Notice of intent to begin placement of fill materials;

(c) Completion report including test results, "as-built" drawings, and certificate of completion in accordance with approved plans and specifications.

(6) During the design process for any newly constructed [**,** ***enlarged or rehabilitated dam***] **dams or for significant dam work to existing dams that involves potentially changing the volume or rate of water released during failure, the dam owner or owner's representative must submit to the department an inundation analysis using methods described in 690-020-100. The department shall use this analysis to determine the hazard rating of the dam in accordance with 690-020-100.**

(a) If a dam is rated as high hazard, an emergency action plan is required and the plan must be reviewed and approved by the department.

(b) The inundation/evacuation map for the dam must be developed using methods described in 690-020-100(2) and must be reviewed and approved by the department.

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Hist.: WRD 3, f. & ef. 2-18-77; WRD 12-1986, f. & ef. 10-3-86; WRD 12-1994, f. & cert. ef. 11-7-94

690-020-00 [*39*] **50**

Enforcement Procedures

The [*Water Resources*] [*D*] **d**irector [*will*] **shall** maintain a program of inspecting existing [*hydraulic structures*] **dams**. When any structure is found to be in violation of the terms and conditions of the 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 to bring the structure up to design, operation, or maintenance standards. Failure by the owner to perform the required action may result in proceedings for one or more of the following:

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

(2) Cancellation of the permit.

(3) 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.

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

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

(6) Any other enforcement action permitted by law.

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Stat. Auth.: ORS 183 & ORS 540
Stats. Implemented: ORS 183 & ORS 540
Hist.: WRD 12-1986, f. & ef. 10-3-86

690-020-0100

Hazard Rating

(1) Hazard ratings for "large dams" are classified by the department as "high hazard", "significant hazard", or "low hazard" as follows:

(a) High Hazard: This rating indicates that if the dam fails there is a strong plausibility for loss of life. The plausibility is established because of inhabited infrastructure (such as homes and business) downstream that would be inundated to such a degree [see 690-020-0100 (2)(d) for specific criteria] that it would put the person who inhabits the structure in jeopardy. Any factor that puts a strong probability of people being downstream in an inundation area of a dam failure shall be considered. The department shall endeavor to inspect this class of dams on an annual basis.

(b) Significant Hazard: This rating indicates that if a dam fails, infrastructure (such as roads, power lines or other largely uninhabited buildings) would be damaged or destroyed due to inundation and flooding. The department shall endeavor to inspect this class of dams at least once every three years.

(c) Low Hazard: This rating indicates that if the dam fails there is little plausibility for loss of life, and human infrastructure that could be affected by inundation downstream is minor or non-existent. The department shall endeavor to inspect this class of dams at least once every six years.

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(2) The department shall utilize inundation of infrastructure study results as a primary factor to determine the hazard rating of dams. Methods and modeling acceptable for inundation of infrastructure studies include:

(a) Hydraulic Modeling: Use of one-, two-, or three-dimensional modeling software (such as HEC-RAS, FLO-2D or MIKE) and hydrologic, topographic, and other data to estimate inundation of infrastructure downstream of dams.

(b) Hydrologic Routing Modeling: Use of modeling software such as HEC-HMS with hydrologic routing methods such as the Muskingum and Modified-Puls methods along with hydrologic and topographic data.

(c). Simplified Methods such as SMPDBK and the Washington State Method: "Dam Breach Analysis and Downstream Hazard Classification" may be used. A dam owner may request information on these methods from the department. Use of these or other simplified methods is only to be used in hazard ratings for dams, not for emergency action planning.

(d) Depth of inundation to trigger different hazard ratings: A depth of at least two feet over the [***floorboard***] **finished floors of buildings or road surface of infrastructure is required to establish a "high hazard" rating. Any depth of water over the floorboards of structural buildings such as homes, barns, pump houses or storage sheds can establish a "significant hazard" rating. For roads, a depth of two feet or evidence of depth and velocity capable of creating damage can be used to establish a "significant hazard" rating.**

(e) Specific data, methods and results for all methods must be reviewed and approved by the department prior to revising a hazard rating.

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3. The hazard rating of a dam shall remain in effect until the rating is revised by the department using one of the methods described in section 2. A dam owner may request that the department revise a hazard rating. The owner must provide information in support of the request. If the supporting information includes results and/or analysis using the methods described in subsections 2(a) or (b), the information must be prepared by an engineer licensed in Oregon and familiar with hydraulic and hydrologic modeling; if the information includes results and/or analysis using the methods described in subsection 2(c), the information must be prepared by a licensed engineer or a practicing hydrologist familiar with hydraulic and hydrologic calculations.

4. Exceptions to Hazard rating methods:

(a) Small dams are not assigned a hazard rating.

(b) Situations in which there are heavy recreational or other uses downstream, a dam may be rated as "high hazard" because of probable loss of life regardless of downstream infrastructure presence.

Stat. Auth.: ORS 183 & ORS 540
Stats. Implemented: ORS 183 & ORS 536, 540
Hist.:

690-020-0200

Fees for Dams

(1) Owners of a large dam shall submit to the department an annual fee in the amount and on the basis established under ORS 536.050.

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(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 in the amount established under ORS 536.050.

(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) Dams that are subject to the annual fee include dams partially or wholly in the State of Oregon that meet the definition of "dam" under OAR 690-020-0020.

(5) 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.

(6) Owners Exempt From Fee Requirements include:

(a) Owners of a "small dam",

(b) Owners whose dams [***are part of a networks of dams***] **that are directly controlled or regulated for safety by an agency of the U.S. Federal Government and the agency that controls or regulates the dam has its own safety program that meets the following criteria:**

(A) The program must allow for control of the design and construction process for dams under their control with licensed engineers designing and reviewing any major design or repair. Copies of all design drawings and construction records should be forwarded to the department for tracking and archival purposes.

(B) The program must have a regular dam inspection program that is either conducted by or directly supervised by a licensed engineer with expertise in dam safety. Formal documented dam inspections for high hazard dams should occur at least once per year. For significant

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hazard dams, inspections shall occur at least once every 3 years and for low hazard dams, once every 6 years. Other more frequent inspections and reports on dam conditions may be necessary depending on the condition of individual dams. Copies of mutually agreed upon inspections and reports should be forwarded to the department for archival and tracking purposes.

(C) The federal agency in charge of the dam via regulation or control must also have a regular maintenance program or be able to [***coerce***] [**require**] **maintenance activity from the regulated party that will address problems discovered in the inspection program.**

(D) The federal agency must have a memorandum of understanding or agreement with the department that outlines how the federal agency meets the criteria in paragraphs (b)(A) – (C), and must agree

to meet at least annually with the department to review the state of the federal program for continued exemption purposes.

Stat. Auth.: ORS 536.050
Stats. Implemented: ORS 536.050
Hist.:

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