Kansas Administrative Regulations

Kansas Department of Agriculture—Division of Water Resources

Article 40.—Design of Earth Dams

5-40-24. Dam breach analysis.

A dam breach analysis shall be conducted on each proposed dam as specified in this regulation. If a dam breach analysis is required for an existing dam, the analysis shall be conducted in the same manner as that specified in this regulation for a proposed dam. (a) To determine the appropriate water surface elevation in the reservoir when the breach begins, the breach analysis shall route the appropriate design duration one percent-chance storm determined by K.A.R. 5-40-31 through the reservoir. The routing shall begin by assuming that the water surface elevation is at the elevation of the lowest uncontrolled spillway inlet, not including any low-flow augmentation works. The antecedent moisture condition (AMC) used to determine the runoff shall be determined according to K.A.R. 5-40-32. The minimum water surface elevation used to begin the breach analysis shall be the greater of the following:

(1) The water surface elevation determined by routing the required design duration one percent-chance storm through the reservoir; or

(2) the elevation of the crest of the auxiliary spillway.

Routing the storm through the reservoir may account for the discharge of the primary spillway and any open-channel spillways. If the dam does not have an open-channel spillway, the water surface elevation used shall be the elevation of the top of the dam or the elevation resulting from using PMP as the runoff event, whichever is lower.

(b) The breach discharge shall be determined by using the peak breach discharge criteria section on pages 1-1 through 1-2 in "earth dams and reservoirs," TR-60, dated July 2005, published by the conservation engineering division of the natural resources conservation service, and hereby adopted by reference, unless the applicant receives written approval of the chief engineer to use a model that is more appropriate for a particular dam. The breach discharge hydrograph shall be determined by methods in

NRCS TR-66, third edition, "simplified dam-breach routing procedure ," dated September 1985, which is hereby adopted by reference, including the appendices. If another model is used, the following breach modeling assumptions shall be used, unless the applicant demonstrates to the chief engineer that more appropriate assumptions should be used:

(1) The parameters shall support the assumption of a rapidly developing breach that is either an overtopping failure or a spillway failure caused by intense, localized erosion beginning at the downstream end of the auxiliary spillway or service spillway and working its way upstream.

(2) If the breach model has breach width as a variable, the minimum bottom width of the breach shall be twice the height of the dam. If there is a well-defined physical floodplain, the height of the dam may be measured from the top of the low bank of the stream to the top of the dam for the purpose of determining the minimum breach width.

(3) If the side slopes of the breach are a parameter of the model, vertical side slopes shall be used.

(4) If the breach model has breach time as a variable, the maximum breach time shall be one minute per foot of height of the dam.

(c) The breach discharge shall be routed downstream using a hydraulic flow model in accordance with sound engineering principles and commonly accepted engineering practices. An unsteady state hydraulic flow model shall be used if it is necessary to model existing hydraulic structures in the inundation area. In all other instances, a steady state hydraulic flow model may be used.

(d) The inundation area analyzed shall meet both of the following requirements:

(1) Be from the downstream toe of the dam and the control section of any open-channel section of any open-channel spillway, downstream to the point where the crest of the breach wave intersects the flood level of the peak discharge of the one percent-chance storm, assuming that the dam was not in place; and

(2) be analyzed to the point at which there are no more hazards downstream.

The peak discharge of the one percent-chance storm may be determined by any of the methods provided in K.A.R. 5-42-5 or the appropriate published flood insurance study for the stream receiving the discharge from the breach of the dam.

(e) If there is more than one dam on a stream, it shall be assumed that the most upstream dam is breached first and that the peak flow of that breach arrives at the next downstream dam at the same time the peak water surface elevation from the inflow of the one percent-chance storm from the uncontrolled portion of the lower dam's drainage area occurs. An appropriate model may be used to demonstrate when the peaks will occur for an entire system of dams, in which case the water surface elevation modeled shall be used.

(f) If there are dams on separate tributaries above the dam being analyzed, the modeling assumption specified in subsection (e) shall be applied only to the tributary that has the upstream dam whose breach results in the greatest computed breach discharge at the dam being analyzed.

(g) If digital elevation data is used in the analysis of the breach, the data used shall have a root mean square error of 2.5 meters or less.

(h) Cross sections for modeling purposes shall be taken at appropriate locations, but in no case shall the intervals be greater than 2,640 feet measured along the floodplain of the watercourse. Cross sections shall be generally perpendicular to the direction of flow and the contour lines that the cross sections intersect. Cross sections may be broken into several connected segments as needed to meet the requirements of this subsection.

(i) Each bridge and any other hydraulic structure that has a significant hydraulic effect shall be included in the analysis.

(j)(1) The applicant shall submit a contour map of the valley with contour intervals of 10 feet or less and a scale of not less than 1:24,000, which shall show the following:

(A) The inundation area determined from the breach;

(B) the location of each existing hazard; and

(C) each cross section entered in the hydraulic flow model with a label identifying the cross section.

(2) The following items shall be shown on the contour map or on separate documentation:

(A) The elevation of each existing hazard;

(B) the water surface elevation at each existing hazard;

(C) the elevation of the streambed at the point nearest each existing hazard; and

(D) a tabular report including the following information for each cross section:

(i) The label identifying each cross section shown on the map;

(ii) the elevation of the maximum water surface attained during the breach;

(iii) the peak discharge; and

(iv) the computed width of the water surface.

(3) If there are more than 10 hazards in any 2,640-foot reach in the flood inundation area, the information required in paragraph (j)(2) may be noted only for the hazard in that reach that is closest to the maximum water surface elevation measured vertically and the hazard in that reach that is farthest from the maximum water surface elevation measured vertically.

(k) The applicant shall submit one copy of each data file used to perform each analysis in electronic form along with identification of the computer programs used to perform the analysis and any model documentation needed for the chief engineer to review the analysis.

(Authorized by K.S.A. 2007 Supp. 82a-303a; implementing K.S.A. 2007 Supp. 82a-302 and 82a-303a; effective May 18, 2007; amended Oct. 3, 2008.)