

Model Dam Breach Inundation Area Zoning Regulation

The Division of Water Resources, Kansas Department of Agriculture, has prepared this Model Zoning Regulation to assist counties and municipalities in learning how they can reasonably regulate new development below dams to minimize additional damage to life and property, and, if possible, avoid expenditures by dam owners necessary to upgrade dams that have to be raised to a higher hazard classification because of additional development below them. The Model Zoning Regulation will also allow regulation of development in those areas in a manner that is compatible with the Division of Water Resources, Kansas Department of Agriculture's dam breach inundation mapping requirements and hazard classifications, which are attached.

In general the Model Zoning Regulation sets up procedures for determining the areas below dams that may be flooded if the dams were to be breached or fail, a process for designating them as Dam Breach Inundation Areas (DBIAs), a process for applying to construct development within DBIAs, and standards for what type of development should be allowed within DBIAs.

As counties and cities review this draft language, they will need to:

1. Consult with their legal counsel to determine whether their entity has the authority to adopt such a zoning regulation, the proper method for adopting the regulation, and any additions, deletions and/or amendments that should be made for that particular entity;
2. Decide in Section II whether the entity will allow Dam Breach Inundation Areas (DBIAs) to be created below: (a) all publically owned dams, (b) some classes of publically owned dams, (c) privately owned dams, or (d) some combination thereof;
3. Decide whether to use the application process set forth in Section II to separately approve each DBIA, or whether the entity would like to automatically designate DBIAs downstream of certain classes of dams. If the entity desires to automatically designate DBIAs below all existing and future dams of certain classes, a mechanism will need to be provided to have the proper inundation maps prepared and designate who will pay for such mapping. The current draft requires the permitting entity to take no action until an application is made;
4. Determine whether the permitting entity should bear any of the costs, such as 50 percent, associated with the survey required to amend DBIA boundaries as set forth Section V (i);
5. Decide in Section X which position will be designated as the Enforcement Officer; and
6. Decide in Section XII on the amount of the fine to be levied for violation of this zoning regulation.

Notice

Below is the body of a Model Dam Breach Inundation Area Zoning Regulation that may be enacted by a county, municipality, or any combination thereof. Before an entity adopts any form of this zoning regulation, that entity should consult with legal counsel to determine whether the entity has the authority to adopt such a zoning regulation, the proper method for adopting the regulation, and any additions, deletions and/or amendments that should be made for that particular entity.

This Model Regulation is provided solely for educational purposes. The Department of Agriculture, its employees, officials and contractors assume no liability for its use and make no assurances that the following ordinance is legal or appropriate for any particular county, municipality, or combination thereof, and assume no liability whatsoever for its use.

Draft Dam Breach Inundation Area Model Zoning Regulation --April 30, 2009

INDEX

- I. Purposes of zoning regulation
- II. Application to designate a DBIA
- III. Review and approval of an application to designate a DBIA
- IV. Permit required for development within DBIA boundaries
- V. Application requirements for DBIA permit
- VI. Permitted development within a DBIA
- VII. DBIA effect on existing development or uses
- VIII. Amendment of boundaries of a DBIA
- IX. Appeals
- X. Designation and duties of Enforcement Officer
- XI. Interpretation of zoning regulation
- XII. Penalties for violation of zoning regulation
- XIII. Effect on existing easements, covenants, and deed restrictions
- XIV. Warning and disclaimer of liability
- XV. Severability
- XVI. Definitions

Attachment 1 K.A.R. 5-40-20. Hazard classes of dams.

Attachment 2 K.A.R. 5-40-24. Dam breach analysis.

I. Purposes of zoning regulation

Although the presence of a dam poses a hazard to the area below the dam that might be inundated if the dam were to fail or be breached (the Dam Breach Inundation Area or DBIA), it is desirable to permit gainful development of land in DBIAs with low flood damage potential in a manner that:

- a. Protects life, health, and human safety,
- b. Minimizes damage to structures and property,
- c. Will not unduly restrict surface flow through the area,
- d. Will not cause undue increases in flood heights or velocities,
- e. Prevents disruption of commerce, governmental services, and utilities,
- f. Reduces impairment of the tax base,
- g. Protects individuals from buying lands for the purpose of developing within a DBIA which is unsuited for the intended purposes because of flood hazard,
- h. Minimizes public expenditures for flood or disaster assistance, and
- i. Reduces the need to upgrade the hazard classification of dams and the costs associated with those renovations.

II. Application to designate a DBIA

Any person or entity that proposes to construct a publically [or privately] owned dam that desires to have development limited in the DBIA for the purposes set forth in Section I, shall file an application with the Enforcement Officer to have the area designated as a DBIA. An application to designate a DBIA shall contain:

- a. A request to designate a DBIA below the proposed dam,
- b. A plan view of the proposed dam and land owned by the applicant,
- c. A dam breach inundation map for the area below the dam meeting the Chief Engineer's requirements in K.A.R. 5-40-24(j) (Attachment 1) including:
 - i. The delineation of the boundaries of the area below the dam that may be inundated if the dam were to fail or be breached;

- ii. The elevations of the maximum water surface attained during the failure or breach at each cross section used to develop the map;
- iii. The boundaries of the floodplain through the DBIA if a flood insurance rate map or a flood hazard boundary map exists that shows the floodplain boundaries; and
- iv. Documentation of the Chief Engineer's approval of the DBIA map.

III. Review and approval of an application to designate a DBIA

- a. The County/Municipality shall review the application to designate a DBIA. The application to designate a DBIA may be approved if the application:
 - i. Has been properly completed in accordance with the requirements of Section II; and
 - ii. The County/Municipality determines that the application meets the purposes set forth in Section I of this zoning regulation.
- b. The applicant has demonstrated that the dam has been properly permitted by the Chief Engineer.

IV. Permit required for development within DBIA boundaries

If the County/Municipality designates an area as a DBIA, no person or entity shall initiate development within such DBIA without first obtaining a permit for such development.

V. Application requirements for a DBIA permit

Each application for a permit to begin development within a DBIA shall:

- a. Indicate the DBIA within which the proposed development will take place,
- b. Clearly identify the land, including legal description if necessary, on which the proposed development will take place,
- c. Describe the proposed development,
- d. Indicate the elevation of the proposed development, including the elevation of the lowest living floor, if any,
- e. Indicate the current assessed value of any existing structure and the fair market value of any proposed improvements,

- f. Be accompanied by the plans and specifications for the proposed development,
- g. Contain any requests to amend the boundaries of the DBIA meeting the requirements of Section VIII,
- h. Be signed by the applicant, or the applicant's authorized agent, and
- i. Provide any other information reasonably required by the Enforcement Officer, including a request that the owner obtain a survey by a licensed surveyor or engineer to more precisely locate the proposed development in relation to the boundaries of the DBIA.

VI. Permitted development within a DBIA

- a. The following types of development shall be allowed within the boundaries of a DBIA as long as:
 - i. any habitable buildings associated with such development are located outside the DBIA or are elevated so that the lowest living floor is at least one foot above the estimated breach water surface elevation at that building,
 - ii. surface flow within the area is not unduly restricted,
 - iii. No storage or processing of materials within the DBIA that are buoyant, flammable, explosive or otherwise potentially injurious to human, animal, or plant life is allowed,
 - iv. the development does not increase the hazard class of the dam as determined by the Chief Engineer pursuant to K.A.R. 5-40-20 (Attachment 2); and
 - v. the development does not substantially increase the potential for loss of life or property damage within the DBIA below a dam that is already classified as a high hazard dam.
- b. Permitted types of development shall include:
 - i. Agricultural uses, including crop land, pastures, nurseries, and forestry,
 - ii. Lawns,
 - iii. Gardens,
 - iv. Parking and loading areas,

- v. Public and private recreation areas, including golf courses, archery ranges, picnic areas, wildlife preserves, and play areas,
- vi. Landing strips,
- vii. Roads,
- viii. Lateral fields, and
- ix. Any other activity meeting all of the requirements of Section VI (a).

c. Within the DBIA all types of development not enumerated above are prohibited.

VII. DBIA effect on existing development or uses

This zoning regulation shall not apply to the use of any buildings or land in existence in a DBIA on the effective date of this zoning regulation, nor shall it prevent the restoration of a building damaged not more than 50 percent of its assessed valuation by fire, explosion, act of God or the public enemy, or prevent the continuance of the use of such building or part thereof as such use existed at the time of such damage, but shall apply to any alteration of a building to provide for a change in such use of any building or land after the effective date of this zoning regulation.

VIII. Amendment of boundaries of a DBIA

- a. The boundaries of a DBIA may be amended if the following requirements are met:
 - i. The applicant provides the Enforcement Officer with one of the following:
 - 1. An engineering analysis that shows that boundaries of a DBIA are incorrect and do not meet the requirements of K.A.R. 5-40-24(j);
or
 - 2. An engineering analysis that shows that the proposed development is protected by works of improvement and that the boundaries of the DBIA should be amended to include the works of improvement, and
 - ii. The applicant provides documentation that the Chief Engineer has approved the change in the boundaries of the DBIA.

IX. Appeals

- a. If the applicant does not agree with any final determination of the Enforcement Officer, the applicant may appeal to the Board of Zoning Appeals in accordance with zoning appeal procedures.
- b. Within 30 days of the final decision, any person aggrieved thereby may maintain an action in the district court of the county to determine the reasonableness of such final decision.

X. Designation and duties of Enforcement Officer

The _____ (Designated official by title or office) is hereby appointed to administer and implement the provisions of this zoning regulation. The duties of the Enforcement Officer shall include:

- a. Maintaining the official record of all DBIA designations and the maps of their boundaries within the County/Municipality,
- b. Reviewing all applications for proposed development within a DBIA to determine if the requirements of this zoning regulation have been met,
- c. Conducting any necessary onsite investigations to determine if whether a proposed development is within the boundaries of a DBIA,
- d. Making all interpretations as to the exact boundaries of each DBIA,
- e. Issuing permits for uses and development that are allowed within a DBIA in accordance with this zoning regulation,
- f. Denying permits for uses and development that are not allowed within a DBIA pursuant to this zoning regulation, and
- g. Receiving and forwarding to the Board of Zoning Appeals all appeals of rulings by the Enforcement Officer.

XI. Interpretation of zoning regulation

In their interpretation and application, the provisions of this zoning regulation shall be held to be minimum requirements, shall be liberally construed in favor of the governing body, and shall not be deemed a limitation or repeal of any other powers granted by Kansas statutes.

XII. Penalties for violation of zoning regulation

Violations of the provisions of this Zoning regulation or its requirements shall be a misdemeanor. Any person convicted of a violation hereof shall be fined not more

than \$ _____, and in addition shall pay all of the County's/Municipality's costs and expenses involved in the case. Each day a violation continues after notification by the Enforcement Officer shall be considered to be a separate offense. Nothing herein shall prevent the appropriate authority from taking any other lawful action necessary to prevent or remedy a violation.

XIII. Effect on existing easements, covenants, and deed restrictions

It is not intended by this zoning regulation to repeal, abrogate, or impair any existing easements, covenants or deed restrictions. However, where this zoning regulation imposes greater restrictions, the provisions of this zoning regulation shall prevail. All other zoning regulations inconsistent with this zoning regulation are hereby repealed to the extent of the inconsistency only.

XIV. Warning and disclaimer of liability

The boundaries of DBIAs have been determined based on engineering studies using accepted scientific methods, but flows resulting from a dam breach or failure may exceed the boundaries of the DBIA because of man-made or natural causes, such as ice jams or bridges clogged with debris. This zoning regulation does not imply that there will be no flooding outside a DBIA. This zoning regulation does not create any liability on behalf of the County/Municipality, any officer or employee thereof, for any flood damage that may result from reliance on this zoning regulation or administrative decision lawfully made thereunder.

XV. Severability

If any section, clause, provision, or portion of this zoning regulation is adjudged unconstitutional or invalid by a court of competent jurisdiction, the remainder of this zoning regulation shall not be affected thereby.

XVI. Definitions

Unless specifically defined below, the words and phrases used in this zoning regulation shall be interpreted to have the meaning they have in common usage and to give this zoning regulation its most reasonable application.

- a. "Base flood" means a flood event that has a one percent chance of being equaled or exceeded one or more times in a year.
- b. "Chief Engineer" means the Chief Engineer of the Division of Water Resources, Kansas Department of Agriculture.

- c. “Dam Breach Inundation Area” or “DBIA” means the area that may be inundated if a dam would be breached or would fail.
- d. “Development” means any manmade change to improved or unimproved real estate, including buildings or other structures, levees, levee systems, mining, dredging, filling, grading, paving, excavation or drilling operations, or storage of equipment or materials within the DBIA.
- e. “Floodplain” means any land adjacent to a watercourse subject to flooding from a flood having a chance of occurrence of one percent. For the purposes of this zoning regulation, “floodplain” means the land area estimated to be inundated by the base flood whether or not a flood insurance rate map or flood hazard boundary map exists.
- f. “Habitable building” means any structure, including a dwelling, modular home, mobile home or apartment, where any person lives or which is used for overnight accommodations of persons. A structure meeting this definition is habitable whether or not a person is actually present.
- g. “Lowest living floor” means the lowest floor of the lowest enclosed area. An unfinished or flood resistant enclosure, usable solely for parking of vehicles, building access, or storage, in an area other than in a basement, is not considered the building’s lowest living floor.

Attachment 1

K.A.R. 5-40-20. Hazard classes of dams. (a) The hazard classes of dams shall be determined from the following based on the location of the dam, the hazards found within the inundation area, and the impact of a failure of a dam:

(1) A “hazard class A dam” shall mean a dam located in an area where failure could damage only farm or other uninhabited buildings, agricultural or undeveloped land including hiking trails, or traffic on low-volume roads that meet the requirements for hazard class A dams as specified in subsections (b) and (c).

(2) A “hazard class B dam” shall mean a dam located in an area where failure could endanger a few lives, damage an isolated home, damage traffic on moderate-volume roads that meet the requirements for hazard class B dams as specified in subsections (b) and (c), damage low-volume railroad tracks, interrupt the use or service of a utility serving a small number of customers, or inundate recreation facilities, including campground areas intermittently used for sleeping and serving a relatively small number of persons.

(3) A “hazard class C dam” shall mean a dam located in an area where failure could result in any of the following:

(A) Extensive loss of life;

(B) damage to more than one home;

(C) damage to industrial or commercial facilities;

(D) interruption of a public utility serving a large number of customers;

(E) damage to traffic on high-volume roads that meet the requirements for hazard class C dams as specified in subsections (b) and (c) or a high-volume railroad line;

(F) inundation of a frequently used recreation facility serving a relatively large number of persons; or

(G) two or more individual hazards described in hazard class B.

(b) If there is a road across any part of the embankment or a spillway, including the auxiliary spillway or service spillway channel down to the receiving stream, the daily vehicular traffic shall be considered in determining the hazard classification, in addition to the criteria specified in subsection (a). The hazard classifications specified in this subsection shall be used if

these classifications are more stringent than the hazard classifications required by subsection (a).

Hazard class	Vehicles per day
A	0 through 100
B	101 through 500
C	more than 500

(c) If any road in the inundation area does not meet the criteria of subsection (b), the daily vehicular traffic shall be considered in determining the hazard classification, in addition to the criteria specified in subsection (a). The hazard classifications specified in this subsection shall be used if these classifications are more stringent than the hazard classifications otherwise required by subsection (a).

Hazard class	Vehicles per day
A	0 through 500
B	501 through 1,500
C	more than 1,500

(Authorized by K.S.A. 2006 Supp. 82a-303a; implementing K.S.A. 2006 Supp. 82a-303a and 82a-303b; effective May 18, 2007.)

Attachment 2

K.A.R. 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.) (Emphasis added)