

Kansas Water Plan

January 2009

The current policy and institutional framework through which flood damage mitigation and small dam safety are addressed in this Kansas Water Plan section.

Basin sections of the *Kansas Water Plan* provide additional basin-specific detail and recommended actions regarding priority basin issues, including flooding.

“Mitigation” refers to sustained actions taken before a flood to reduce or eliminate the long-term risk to people and property. Mitigation differs from emergency response, which is outside the scope of this document.

The 2007 *Kansas Hazard Mitigation Plan*⁽¹⁾ (KHMP) also provides important guidance for flood mitigation and small dam safety efforts. In the prioritization of risk included in the KHMP, flooding and winter storms ranked second behind tornadoes. Dam and levee failure was ranked sixteenth in total of 22 risks.

Overview

Flooding is a natural event associated with streams and rivers. “Floodplains” are those valley lands adjacent to a defined river channel that may be inundated during a flood. Flooding can generally be defined as the accumulation of too much water in too little time within too small an area. Floods can also be characterized by type, such as riverine, flash, ice-jam, storm surge and dam or levee failure. Riverine and flash flooding and dam or levee failure are of most concern in Kansas. Flooding provides benefits under natural conditions, but the encroachment of urban and agricultural development onto floodplains has resulted in the potential for flood damage to development.

Riverine flooding occurs as a result of persistently wet weather conditions. Stream channel capacity is exceeded and water flows over the banks onto the adjacent floodplain. The warning time preceding such flooding often is quite long, allowing for some mitigation measures to take place. Large regional floods, such as occurred in the Kansas River basin and beyond in 1993 are generally riverine in nature.

Some areas of Kansas are particularly prone to flash flooding. Flash floods are a rapid rise in water level, with fast-moving water and flood debris. Hilly terrain subject to intense thunderstorms is particularly vulnerable. Activities associated with urban development such as replacement of natural or agricultural landscapes with impermeable surfaces (roofs, streets and parking lots) and

altering of drainage systems to increase runoff speed elevate the threat of flash flooding.

Nearly 6,000 small dams have been constructed in Kansas for flood control, water supply, recreation and other purposes. Many were constructed in the mid-20th century and are showing the effects of aging. In some cases, development downstream from the dam has resulted in a higher dam hazard classification requiring upgrades to the dam.

Kansas Flood History

The earliest flood event noted in Kansas was the Kansas River flood of 1844. Available information suggests that this flood exceeded the magnitude of any succeeding floods on the Kansas River. Other major 19th century floods included those of 1858, 1867 and 1877 on the Kansas at Topeka, Neosho River flooding in 1885 and Arkansas River flooding at Hutchinson and Wichita in 1877. Major flooding of the Smoky Hill River occurred at Lindsborg in 1895.

Snowden D. Flora summarizes flood events occurring around the state from 1903 through 1945 in *Climate of Kansas*.⁽²⁾ Information regarding the frequency of river “overflows” as opposed to major flooding is provided for some locations during this 42-year period. Snowden notes that overflows of the Kansas River occurred 29 times at Manhattan and 25 times at Topeka. The Marais des Cygnes River at Ottawa overflowed 27 times. Overflows on the Cottonwood-Neosho River were most frequent, occurring 43 times at Emporia and 88 times at



1951 Flood

Kansas Water Plan

Oswego. Overflows were less frequent on the Arkansas River.

Significant flooding was experienced during the years 1903-1945 along the following streams:

- Kansas River – 1903, 1908 and 1935
- Blue River – 1903 and 1941
- Republican River – 1903, 1915, 1935 and 1941
- Solomon River – 1903, 1908, 1915, 1919, 1935 and 1941
- Smoky Hill River – 1903, 1938 and 1941
- Marais des Cygnes River – 1928, 1944 and 1945
- Cottonwood – Neosho River – 1903, 1904, 1941, 1944 and 1945
- Arkansas River – 1921, 1923 and 1942
- Little Arkansas River – 1944

The most significant flood events during the latter-half of the 20th century were the floods in the Kansas River basin in 1951 and 1993, which are described below. Other flood events of note since 1951 occurred on the Arkansas River in 1965, the Solomon River in 1973, the Verdigris River in 1976, the Arkansas River in the Great Bend area in 1981, and Fort Scott (Marmaton River and Mill Creek) in 1986. In 1977 and 1998, significant flash-flooding took place in the Kansas City Area.

The 1951 Flood – The 1951 flooding described in *The 1951 Floods in Kansas Revisited*,⁽³⁾ primarily affected the Kansas, Marais des Cygnes, Neosho and Verdigris river basins in eastern Kansas and the Osage (Marais des Cygnes) and Missouri river basins in Missouri. Peak discharges on the Kansas, Marais des Cygnes and Neosho rivers were greater than any previously measured discharges and have remained the highest to date.

According to the American Red Cross, 19 people were killed and about 1,100 injured during the floods in Kansas and Missouri. The most damaging flooding occurred along the Kansas River. Manhattan, Topeka, Lawrence and Kansas City sustained extensive damage.

Total damages from the 1951 flood were unprecedented. Between the headwaters of the Kansas River at Junction City and the mouth of the Missouri at St. Louis, 2 million acres were flooded, 45,000 homes and 17 major bridges were damaged or destroyed. Total damage estimates were as high as \$2.5 billion, (\$17 billion, adjusted to year 2000 dollars). During the height of the flood, on July 13, 1951, nearly 90 percent of the flow in the Missouri River

at Kansas City came from the Kansas River, a tributary comprising only 12% of the Missouri's drainage basin.

The 1993 Flood – The historic flood of 1993 affected nine states in the Lower Missouri – Upper Mississippi river basins, including Kansas as described by the U.S. Geological Survey (USGS).⁽⁴⁾ Flooding occurred from mid-June to early August, resulting in 50 deaths (none in Kansas) and flood damages of nearly \$15 billion.

The magnitude and timing of several rainstorms on top of already saturated soils contributed to moderate to major flooding in much of the Kansas River basin during July 1993. From July 22 to July 24, 2 to 13 inches of rain fell in parts of Kansas and Nebraska, contributing large inflows to already full reservoirs in the Kansas basin. Eighteen of the 163 USGS stream gages in operation in Kansas during 1993 measured record maximum peak daily flows and 69 stations measured the highest mean annual streamflow during their period of record for Water Year 1993.

In the Kansas City metropolitan area, the Missouri and Kansas rivers reached their highest flows almost simultaneously on July 27. The USGS estimates that without the upstream reservoirs, the maximum daily peak flow at Kansas City, Missouri may have reached 713,000 cubic feet per second, a level that would have overtopped the federal levee system.

Major Disaster Declarations – Federal major disaster declarations provide a means of documenting flooding in recent decades. As of April 2008, 26 of 37 declarations involved flooding since 1955. These declarations authorize individual and/or public assistance from the federal government in declared counties.

State Planning Authority and Guidance

Kansas Water Plan

The *State Water Resources Planning Act*⁽⁵⁾ provides the statutory authority for addressing flood management in the *Kansas Water Plan*. The *Planning Act* established long-range goals for the management, conservation and development of the waters of the state, including the reduction of damaging floods and of losses resulting from floods.

Policies designed to achieve these *Planning Act* long-range goals include:

Kansas Water Plan

- Utilization of non-structural methods, including floodplain regulation, and structural measures for the reduction of flood damage.
- The design of proposed levees and dikes so as to reduce flood risks in agricultural areas to a chance of occurrence, in any one year, of 10 percent or less.
- Design proposed levees and dikes to reduce flood risks in urban areas to a chance of occurrence, in any one year of 1 percent or less.
- Design proposed storage structures for the protection of agricultural areas to provide sufficient capacity to control the volume of a flood having a chance of occurrence, in any one year, of 25 percent or less.
- The design of proposed storage structures for the protection of urban areas to provide sufficient capacity to control the volume of a flood having a chance of occurrence in any one year of 2 percent or less.

In formulating the *Kansas Water Plan*, the *Planning Act* requires consideration for plans, projects and recommendations of public corporations, the federal government and state agencies prepared pursuant to statutory authority.



Flooding in the Walnut Basin, July 2007

Objectives - Objectives provide targets for quantifying progress in implementing *Kansas Water Plan* policy recommendations. The Objective addressing flood management is:

- Reduce the vulnerability to damage from floods within identified priority communities or areas.

Policy and Basin Sections – Since the inception of the current state water planning process, flood management has been addressed in policy and basin plan sections of the *Kansas Water Plan*. In 1985, the Kansas Water Authority (KWA) approved the Rural Flood Management Sub-section⁽⁶⁾ of the *Kansas Water Plan*. Three basic policy issues were addressed: land treatment funding; watershed dam construction funding; and watershed planning.

Rural flooding was also included as an issue in basin plan sections of the *Kansas Water Plan* approved in 1986. These basin plans contained priority sub-watersheds for rural flood damage reduction that were identified by the former U.S. Department of Agriculture Soil Conservation Service. These sub-watersheds continue to be used for targeting of programs. Flooding was identified as a basin priority issue in several river basins as part of the FY 2005 *Kansas Water Plan* Update conducted in 2003.

The issue of the appropriate level of state involvement in facilitating necessary repairs to dams was addressed in the FY 1999 planning process. This policy subsection did not move past the working draft stage and was not approved by the KWA.

Dam safety was addressed in the *Kansas Water Plan* with the 2005 Small Dam Safety and Rehabilitation Policy Section review by the KWA. The major policy issues addressed were:

1. controlling dam hazard class changes due to development,
2. limiting dam owner liability for damages due to dam failure, and
3. financial assistance for small dam rehabilitation and upgrades.

[Twenty-one recommendations are contained in this policy section.](#)

Kansas Water Plan

Kansas Hazard Mitigation Plan

The 2007 update of the *Kansas Hazard Mitigation Plan* (KHMP)⁽¹⁾ was developed by the Kansas Hazard Mitigation Team (KHMT) to meet the requirements of the federal *Disaster Relief and Emergency Assistance Act*. The KHMT includes members from various state and local governments and other interested parties. The Kansas Water Office (KWO) is a KHMT member.

The KHMP is an integral part of state programs for management of disasters and their impacts. The KHMP is intended to be consistent with and supportive of the policies, plans and implementation procedures that govern these state programs. In the event of any inconsistency, state agency policies supersede the provisions of the KHMP.

As defined by the Federal Emergency Management Agency (FEMA), mitigation is “any sustained action taken to reduce or eliminate long-term risk to life and property from a hazard event.” The purpose of the KHMP is to guide hazard mitigation to better protect the people and property of the state. KHMP serves as a tool to help decision makers direct mitigation activities and resources. The KHMP is intended to encompass actions by the State of Kansas as well as local governments.

The Adjutant General, who serves as the Director of Emergency Management and Homeland Security, adopted the 2007 update of the KHMP on November 26, 2007.

As part of the 2007 KHMP update, a risk assessment of 22 hazards was conducted. Flooding was considered to have the second-highest risk (tied with winter storms) following tornadoes. Dam and levee failure was ranked sixteenth.

The Mitigation Strategy within the KHMP includes several actions related to flooding or dam and levee failure. These are summarized in Table 1 on page 5.

Flood Damage Mitigation

Available Mitigation Measures

Attempts to reduce flood losses follow two basic strategies; elimination or reduction of the hazard (flood control), and reduction or prevention of the risk associated with flooding (basically, stay out of the way). Various structural and non-structural mitigation measures may

be used with either basic strategy. A brief description of several general categories of mitigation measures provided by the Association of State Floodplain Managers in *Using Multi-Objective Management to Reduce Flood Losses in Your Watershed* is provided below.⁽⁷⁾

Prevention – Measures are intended to keep a flood problem from occurring or becoming worse. Preventative measures also ensure that future development does not increase the risk for flood damage. Included are: planning and zoning, open space preservation, floodplain development regulations, watershed restoration and protection, wetlands protection, drainage system maintenance, and real estate disclosure laws and policies.

Property Protection – These measures reduce susceptibility to flood damage. They are often inexpensive for a community because they are implemented or cost-shared with property owners. These measures include: relocation and acquisition, flood proofing, flood insurance, and community information and assistance programs.

Structures – Structural projects seek to control the flow of water and are intended to prevent flood waters from reaching structures or other property at risk of damage. The three general types of structures are: levees and floodwalls, dams and diversions and channel and drainage modifications.

Emergency Services – Emergency services protect people during and after a flood. Most counties and many cities have emergency management offices to coordinate disaster warning, response and recovery efforts. Emergency service measures include: flood warning, flood response and post-flood activities.

State and Federal Programs and Authorities

Federal involvement with flood control has a long history. As early as 1850, Congress directed the U.S. Army Corps of Engineers (Corps) to plan flood control for the lower Mississippi River. The modern era of flood control started with the *Flood Control Act of 1936*,⁽⁸⁾ which declared flood control to be a proper federal activity in the national interest. Major federal interest in watershed development related to flood control came later with enactment of the *Watershed Protection and Flood Prevention Act of 1954*.⁽⁹⁾

Initial federal involvement was primarily structural in nature; non-structural approaches have been added in

Kansas Water Plan

**Table 1
Kansas Hazard Mitigation Plan Action Summary**

Mitigation Action	Lead Agency	Support Agencies	Planning Priority
Coordinate GIS capability improvements for emergency management with the Kansas Statewide GIS Strategic Plan	KDEM	KDHE, DWR, rural electric cooperatives, local jurisdictions	High
Provide automatic weather stations	KWO	KSU (state climatologist), NWS, KDOT, USGS	High
Rehabilitate and repair identified deficient dams	KDA	SCC, KDEM, KWO, dam owners	High
Enforce and assist with development of emergency action plans for high and significant hazard dams	KDA	SCC, KDEM, KWO, dam owners	High
Develop inundation maps for high hazard dams	KDA	SCC, KDEM, KWO, dam owners	High
Increase support for and participation in the National Flood Insurance Program (NFIP) and Community Rating System (CRS)	DWR	KWO, KDEM	High
Continue support for floodplain mapping studies	DWR	KWO	High
Mitigate repetitive flood loss and severe repetitive flood loss structures	DWR	KDEM	High
Improve coordination between the <i>Kansas Water Plan</i> and the Kansas Hazard Mitigation Plan	KWO	DWR, KDHE, KSU, SCC, KDEM	High
Identify priority flood issues in river basin sections of the revised <i>Kansas Water Plan</i>	KWO		High
Focus National Flood Insurance Program (NFIP) and Community Rating System (CRS) outreach efforts to priority areas	KDA	KDEM	Medium
Document statewide participation in NFIP & CRS	KDA		Medium
Conduct a flood hazard vulnerability study as a part of the pilot multi-hazard vulnerability assessment to develop an acceptable approach to vulnerability assessments in Kansas	KDA	KWO	Medium
Create a model ordinance for local jurisdictions interested in regulating dam breach inundation areas	KDA		Medium
Compile example local codes and ordinances addressing flood hazards and floodplain management	KDA	KWO	Medium
Acquire new statewide elevation data (two-foot contours)	KDA	KDEM	Medium
Enhance the system for tracking buyouts to incorporate mitigation projects for all hazards	KDEM	KITO, KDOA	Medium
Integrate flood mitigation into KDOT construction projects	KDOT	KDA	Medium

Source: Kansas Hazard Mitigation Plan, November 2007

more recent decades. A prime example of non-structural approaches is the *National Flood Insurance Program*⁽¹⁰⁾ authorized under the *National Flood Insurance Act of 1968*.⁽¹¹⁾

State involvement with flood control also has a long history, going back at least as far as the *Drainage Act of 1905*⁽¹²⁾ which authorized the organization of drainage districts. State involvement also focused on structural measures. State and local partnerships have been particularly vital to the development of watershed projects as described below. Nonstructural approaches to flood control have been explored in recent years. The riparian and wetland protection and restoration efforts conducted

through state-local partnerships are one example. These efforts are described in the [Wetland and Riparian Management Policy Section](#) of the *Kansas Water Plan*.

Major Federal Reservoirs - The *Flood Control Act of 1944*,⁽¹³⁾ which included the *Pick-Sloan Missouri Basin Plan*, significantly expanded the Corps' involvement in large multi-purpose projects. It authorized massive flood control and irrigation development within the Missouri River basin, including portions within Kansas. Other federal legislation authorized construction of reservoirs within the Arkansas river basin. Eighteen Kansas reservoirs were built between 1944 and late 1960.

Kansas Water Plan

By the late 1960s, construction of major water projects had declined. Changing national priorities, increasing construction costs and completed projects at most prime locations were contributing factors. Between 1970 and 1985, no major water projects were authorized. Congress reduced several projects that had been previously authorized. In Kansas, a total of 55 major federal reservoirs were authorized, but only 24 were built as illustrated by Figure 1.

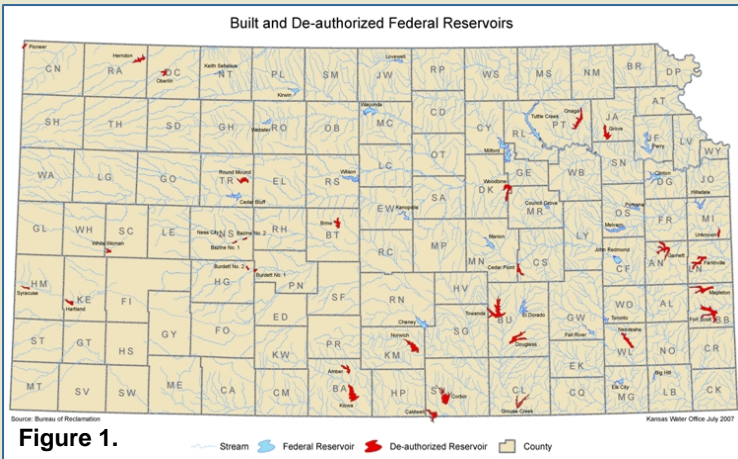


Figure 1.

The peak of the reservoir construction period was in the 1960s when 13 reservoirs were constructed. The 24 federal reservoirs in Kansas have a combined contributing drainage area of over 40,000 square miles and a flood control storage capacity of nearly 10 million acre feet. Table 2 on page 7 provides summary information about these reservoirs.

Corps' water project planning and funding was fundamentally changed by the *Water Resource Development Act (WRDA) of 1986*.⁽¹⁴⁾ WRDA established new cost-share formulas, resulting in financial and decision-making roles for non-federal project sponsors. WRDA provided the Corps with authority to determine if changes can be made in existing structures or operations to improve environmental quality.

Watershed Projects - Kansas ranks third among the states with 63 active PL 83-566 projects. Only Texas and Oklahoma have more. Figure 2 shows the location of these projects and their status as of March 2006.

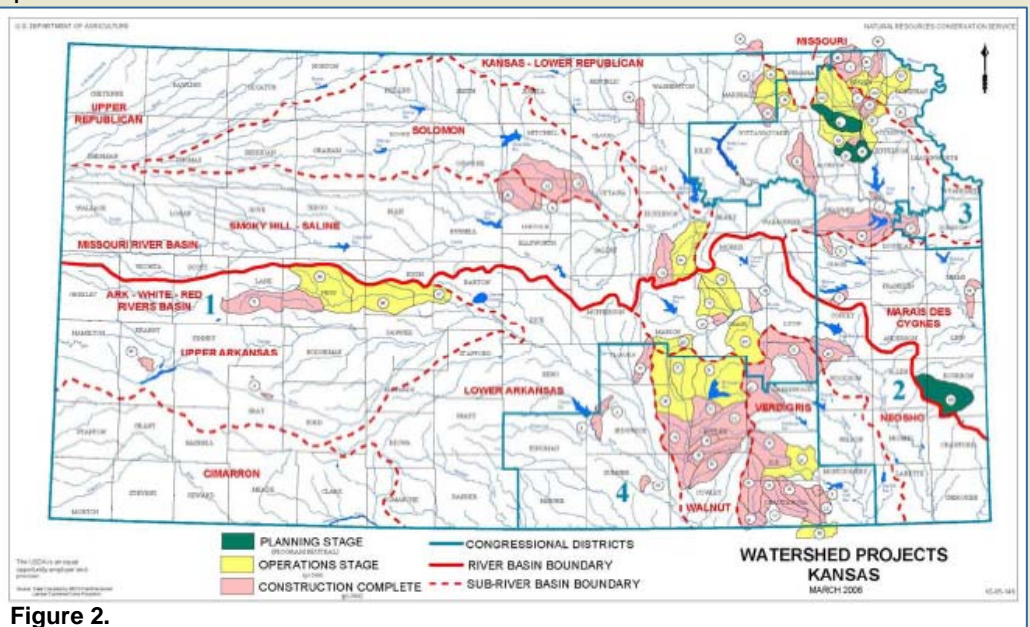


Figure 2.

The 1960s and 1970s were the heyday for watershed dam construction in Kansas. More than 70 dams were constructed in 1965 alone. In recent years fewer than 10 dams have been constructed annually. Figure 3 shows this trend in the number of dams constructed.

As of 2006, 778 dams had been completed in Kansas, five were under construction and 190 remained to be built. The unfunded federal commitment resulting from this backlog in PL 83-566 construction in Kansas was \$68.4 million.

More than 1,500 small dams in Kansas have been constructed by watershed districts for flood control purposes. Financial and technical assistance was provided for some dams by the USDA NRCS as authorized by the *Watershed Protection and Flood Prevention Act of 1954*⁽⁹⁾ and other authorizations. Since 1977, state cost-share assistance for watershed dam construction has also been available from the State Conservation Commission (SCC).

The *Watershed Protection and Flood Prevention Act* authorized a permanent, nationwide program to provide technical and financial assistance to local watershed groups willing to assume responsibility for initiating, carrying-out and sharing in costs of upstream watershed conservation and flood control.

A Pilot Watershed Program within the former USDA Soil Conservation Service was funded in the *Agricultural Appropriations Act of 1953*. Fifty-four pilot watershed projects were authorized, of which five were in Kansas under this program.

Kansas Water Plan

The 2000 amendments authorized the NRCS to work with local communities and watershed project sponsors to address concerns related to aging dams.

The NRCS implements the provisions of PL 83-566 through three programs:

- Watershed Surveys and Planning
- Watershed Protection and Flood Prevention Opera-

tions

- Watershed Rehabilitation

State Role - The *Kansas Watershed District Act*⁽¹⁵⁾ was enacted in 1953 to provide a subdivision of state government with adequate powers to sponsor watershed projects developed with federal assistance under PL 83-566. Watershed districts have authority to levy taxes and special assessments, issue bonds and to acquire land

**Table 2
Major Federal Reservoirs in Kansas**

	Operating Agency ¹	Year Storage Began	Drainage Area (sq. miles) ²	Storage Capacity (acre-feet) ³	
				Conservation / Multi-purpose	Exclusive Flood Control
Big Hill	Corps	1981	37	26,650	12,571
Clinton	Corps	1977	367	120,643	394,000
Council Grove	Corps	1964	246	43,176	64,217
El Dorado	Corps	1981	234	157,973	79,259
Elk City	Corps	1966	634	38,385	248,667
Fall River	Corps	1949	585	19,433	232,249
Hillsdale	Corps	1981	144	71,950	160,000
John Redmond	Corps	1964	3,015	44,385	524,417
Kanopolis	Corps	1948	2,327	43,121	419,000
Marion	Corps	1968	200	75,133	61,213
Melvern	Corps	1970	349	147,973	360,000
Milford	Corps	1964	3,796	351,577	1,146,000
Perry	Corps	1966	1,117	199,824	723,000
Pomona	Corps	1962	322	59,642	240,000
Toronto	Corps	1960	730	15,734	179,808
Tuttle Creek	Corps	1963	9,628	253,265	2,151,000
Wilson	Corps	1965	1,917	243,000	773,000
Cedar Bluff	Bureau	1950	5,530	170,658	364,000
Cheney	Bureau	1964	933	143,427	80,857
Kirwin	Bureau	1955	1,373	99,435	313,000
Lovewell	Bureau	1957	364	41,690	86,000
Keith Sebelius	Bureau	1964	712	34,330	134,000
Waconda	Bureau	1967	5,076	217,426	942,000
Webster	Bureau	1956	1,125	77,370	260,000
Total			40,761	2,696,200	9,948,258

¹Corps – U.S. Army Corps of Engineers; Bureau – U.S. Bureau of Reclamation

²Contributing drainage area

³Conservation / Multi-purpose pool 2004 estimate by Kansas Water Office; Exclusive flood control from BOR or COE

Kansas Watersheds Dams Constructed by Year

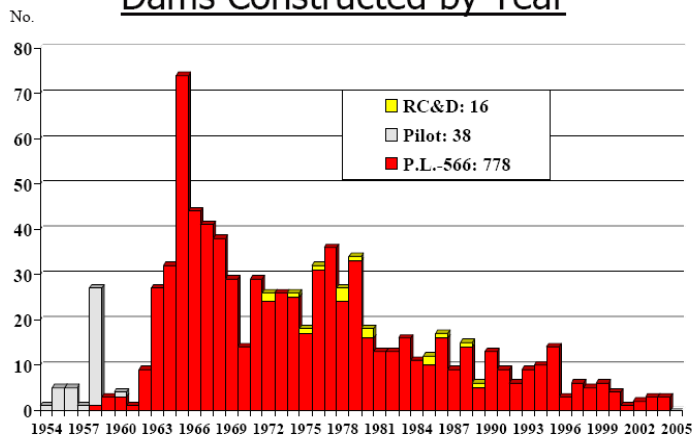


Figure 3.

and interests in land by gift, purchase, exchange or eminent domain.

The *Watershed District Act* requires that a general plan identifying planned works of improvement such as dams and their associated costs and benefits be prepared. The general plan is reviewed and approved by the Chief Engineer, DWR.

There are presently 86 organized [watershed districts](#) in Kansas that cover about 22% of the state's area. Approximately 60 districts have active general plans.

Improvements may be financed by general tax levy or special assessment against the area benefited. Bonds may be issued by the district following a vote. A majority of affected landowners must approve special assessments. General tax levy's may be used to finance operating costs and works of improvement without a special election. Most districts have found it necessary to finance their projects within their taxing authority with only a few utilizing the special assessment option.

Watershed district general plans usually include works of improvement beyond those eligible for federal financial assistance. The most common funding source other than federal PL 83-566 assistance has been the *Watershed Planning Assistance Program* managed by the SCC.

The *Watershed Planning Assistance Program* provides state financial assistance to organized watershed, drainage or other special purpose districts to implement flood control structural and non-structural practices. These practices provide protection for agricultural lands, urban

areas, roads, bridges and utilities. In addition, structures may provide water for livestock and in some instances for rural fire departments. The structures may benefit wildlife habitat and serve to trap sediment and pollutants. Construction and rehabilitation of flood control and/or grade stabilization dams are the main practices and components of the program.

FEMA - National Flood Insurance Program - The *National Flood Insurance Program* (NFIP) is a federal program enabling property owners in participating communities to purchase insurance protection against losses from flooding. This program is designed to provide an insurance alternative to disaster assistance to meet the escalating costs of repairing damage to buildings and their contents resulting from floods. A detailed program description is available from the FEMA: *National Flood Insurance Program: Program Description*.⁽¹⁰⁾

Participation in the NFIP is based on an agreement between local communities and the federal government providing that if a community adopts and enforces a floodplain management ordinance to reduce future flood risk to new construction in Special Flood Hazard Areas (SFHA) the federal government will make flood insurance available within the community as a financial protection against flood losses. A SFHA is a high-risk area defined as any land that would be inundated by a flood having a 1 percent chance of occurrence in any given year. One so-called "100-year flood" is also referred to as the base flood.

The Kansas Department of Agriculture-Division of Water Resources (DWR) works with both FEMA and local communities in coordinating NFIP activities in Kansas and providing technical assistance.

In support of the NFIP, FEMA identifies flood hazard areas throughout the nation by producing Flood Hazard Boundary Maps, Flood Insurance Rate Maps, and Flood Boundary and Floodway maps. Several areas of varying flood hazards are usually identified on these maps. One is the SFHA.

Development may take place within the SFHA so long as it complies with local floodplain management ordinances, which must meet minimum federal requirements. While purchase of flood insurance is usually voluntary, the *Flood Disaster Protection Act of 1973* and the *Flood Insurance Reform Act of 1994* mandate the purchase of flood insurance for insurable structures within the SFHA to protect federal financial investments and

Kansas Water Plan

assistance used for acquisition and/or construction purposes.

Community Participation Categories – NFIP defines a community as a political subdivision that has the authority to adopt and enforce floodplain management ordinances for the area under its jurisdiction. In most cases a community is an incorporated city or the unincorporated area within a county.

Community participation in the NFIP is voluntary, but non-participating communities are subject to certain restrictions on available federal assistance should a major disaster resulting from flooding be declared for the community by the President. Flood insurance under the NFIP is not available in non-participating communities.

The Emergency Program is the initial phase of a community's participation in the NFIP. A limited amount of insurance at less than actuarial rates is provided. A community participating in the Emergency Program either does not have an identified and mapped flood hazard area or has been provided with a Flood Hazard Boundary Map (FHBM) and the community is required to adopt limited floodplain management standards to control future use of its floodplains.

Communities participating in the Regular Program of the NFIP usually are provided with a Flood Insurance Rate Map (FIRM) and a detailed engineering study termed a Flood Insurance Study. Under the Regular Program additional comprehensive floodplain management requirements are imposed on the community in exchange for higher amounts of flood insurance coverage.

Participating communities are required to adopt and enforce a floodplain management ordinance that meets minimum NFIP requirements. Communities that do not enforce these ordinances can be placed on probation or suspended from the NFIP. Probation involves a formal notification to a community by FEMA that its floodplain management program does not meet NFIP criteria. Suspension of a participating community occurs when a community fails to solve its compliance problems or fails to adopt an adequate ordinance. If suspended, the community becomes non-participating and flood insurance policies can't be written or renewed. Policies in force at the time of suspension continue in force for the remainder of the policy term.

Community Rating System – The Community Rating System (CRS), implemented in 1990, provides discounts

on flood insurance premiums in those communities that establish floodplain management programs that exceed minimum NFIP standards. Under the CRS, communities receive credit for more restrictive regulations, flood-prone structure acquisition or relocation, structural flood proofing, open space preservation and other measures that reduce flood losses or protect the natural functions of floodplains.

Participation in the CRS is voluntary. Any community in compliance with NFIP rules and regulations may apply. The CRS recognizes 18 creditable activities organized under four categories: Public Information, Mapping and Regulations, Flood Damage Reduction and Flood Preparedness. Communities are assigned to one of 10 CRS classes depending upon their number of credit points. Class 1 requires the most credit points and gives the largest premium reduction. CRS flood insurance premium discounts range from five percent for Class 9 communities up to 45% for Class 1 communities. Class 10 communities receive no premium reduction.

Flood Hazard Assessment and Mapping – Flood hazard areas are determined using statistical analyses of precipitation and streamflow records, floodplain topographic surveys and hydrologic and hydraulic analyses. A FHBM is based on approximate data and identifies, in general, the SFHA within a community. It is used in the NFIP Emergency Program for floodplain management and insurance purposes. A FIRM usually is issued following a flood risk assessment conducted in connection with the community's conversion to the NFIP's Regular Program.

Several areas of flood hazard are commonly identified on the FIRM. One of these is the SFHA which is defined as the area that will be inundated by a flood event having a one percent chance of being equaled or exceeded in any given year. The one percent annual chance or "100-year flood" is also referred to as the "base flood." If a detailed assessment called a Flood Insurance Study (FIS) has been performed, the FIRM will show Base Flood Elevations (BFE's) and insurance risk zones in addition to floodplain boundaries. The FIRM may also delineate the regulatory floodway.

The regulatory floodway adopted into the community's floodplain management ordinance, is the stream channel plus that portion of the 100-year floodplain that must be kept free from encroachment in order to discharge the one percent annual chance flood without increasing flood levels by more than one foot. The community is responsible for prohibiting encroachments, including fill,

new construction and substantial improvements within the floodway unless it has been demonstrated that the proposed encroachment will not increase flood levels within the community.

In those areas that fall within the 100-year floodplain, but are outside the floodway (termed the “floodway fringe”), development will, by definition, cause no more than a 1.0 foot increase in the one percent annual chance flood water surface elevation. Figure 4 illustrates the concept of the floodway and the floodway fringe within a river’s 100-year floodplain.

repeated flooding of the same properties. A special target group of repetitive loss properties is identified and serviced separately from other NFIP policies by a Special Direct Facility (SDF). This target group includes every NFIP-insured property that, since 1978 and regardless of any change in ownership during this period, has experienced:

Map Modernization – Most FEMA flood maps were produced using manual cartographic techniques. Many maps are old and do not include recent development. As a result, DWR launched the Kansas Flood Mapping Initiative in 1993. By 2010, 39 counties will have modernized maps produced with a mix of state and federal funding. These counties are:

Allen	Franklin	Osage
Barton	Harvey	Ottawa
Bourbon	Jackson	Pottawatomie
Butler	Jefferson	Reno
Cherokee	Johnson	Republic
Cowley	Labette	Riley
Crawford	Leavenworth	Saline
Doniphan	Linn	Sedgwick
Douglas	Lyon	Seward
Edwards	Marion	Shawnee
Ellsworth	McPherson	Sumner
Finney	Miami	Wabaunsee
Ford	Neosho	Wyandotte

Digital Flood Insurance Rate Maps (DFIRMs) may be used for NFIP regulatory purposes once they become effective. A community is sent a Letter of Final Determination by the DWR where the effective date is stated: communities then have six months to adopt the appropriate ordinance for their community. Counties with DFIRM effective dates in 2007 or 2008 include Edwards, Linn, Lyon, Miami, Sedgwick and Wabaunsee.

Repetitive Loss Properties Strategy – The primary objective of the Repetitive Loss Properties Strategy is to eliminate or reduce losses and disruption of life caused by

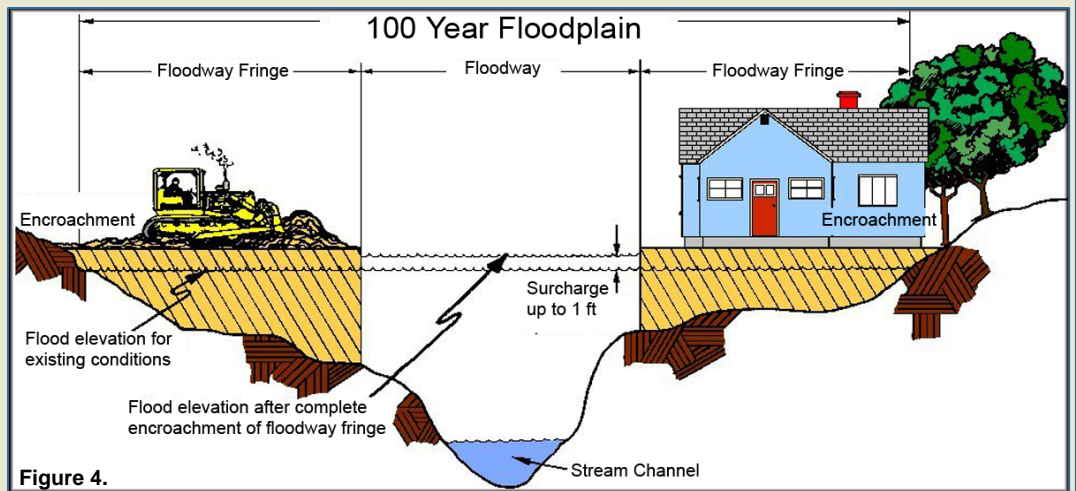


Figure 4.

At least 90 days before the policy renewal date, affected property owners and their flood insurance agents are notified that the policy is ineligible for renewal through the NFIP Write Your Own Program. Renewal is offered through the SDF.

- Four or more paid flood losses of more than \$1,000 each, or
- Two paid flood losses within a 10-year period that, in the aggregate, equal or exceed the current value of the insured property, or
- Three or more paid flood losses that, in the aggregate, equal or exceed the current value of the insured property.

Information about repetitive loss properties is provided to the appropriate FEMA Regional Office and state and local floodplain management officials. States or communities may sponsor projects to mitigate flood losses to these properties. Project grants are made through the *Flood Mitigation Assistance Program* authorized by the *National Flood Insurance Reform Act of 1994*. Planning and technical assistance grants are also available through this program.

The *Flood Insurance Reform Act of 2004* established two additional programs for addressing repetitive loss properties. Under the *Repetitive Flood Claims Program*, up to \$10 million is available annually for FEMA to pro-

Kansas Water Plan

vide funds to assist states and communities in reducing flood damages to insured properties that have had one or more NFIP claims. Eligible mitigation activities include acquisition of properties, and either demolition or relocation of flood-prone structures, where the property is limited in perpetuity to open space uses. Other eligible activities are elevation of structures, dry floodproofing of non-residential structures and minor localized flood control projects.

The *Severe Repetitive Loss Program* provides grants to reduce or eliminate the long-term risk of flood damage to severe repetitive loss properties insured under the NFIP. A severe repetitive loss property is defined as a residential property covered under an NFIP flood insurance policy and:

- That has at least four NFIP claim payments (including building and contents) over \$5,000 each, and the cumulative amount of such claims payments exceeds \$20,000; or
- For which at least two separate claims payments (building payments only) have been made with the cumulative amount of the building portion of such claims exceeding the market value of the building.

Eligible *Severe Repetitive Loss Program* mitigation activities include acquisition and relocation of flood-prone structures and conversion of the property to open space, elevation of existing structures to at least the base flood elevation, minor physical localized flood control projects, and dry floodproofing of historic properties only.

Kansas NFIP Claims Analysis - In updating the *Kansas Hazard Mitigation Plan* in 2007, the Kansas Division of Emergency Management analyzed NFIP flood loss data to determine areas in Kansas with the greatest flood risk. As of August 2007, 340 Kansas communities were participating in the NFIP, including 61 that do not have a delineated SFHA and 85 that are only minimally flood-prone. Ninety-eight Kansas communities that have mapped flood hazard areas are not NFIP participants.

Flood loss information was obtained from FEMA records documenting losses in participating NFIP communities from 1978 through May 31, 2007. The greatest losses have occurred in Wyandotte, Johnson, Butler and Sedgwick counties as indicated in Table 3. The level of payments in Bourbon County is also noteworthy given the relatively few current policies and flood claims there.

Repetitive and Severe Repetitive Losses – As indicated in the *Kansas Hazard Mitigation Plan*, there were 368 identified repetitive loss properties in Kansas in 2007; such properties were found in 32 counties. Johnson County had the most repetitive loss properties with 94, followed by Wyandotte (45), Sedgwick (36), and Butler counties (34). As of July 31, 2007, there were six validated severe repetitive loss properties in Kansas. An additional four properties were pending validation. Validated properties were located in Cherokee, Montgomery, Leavenworth, Johnson, Wyandotte and Saline counties.

**Table 3
Top Ten Counties for Flood Insurance Payments
(1978-2007)**

County	Dollars Paid (historical)	Number of		Coverage (\$)
		Flood Claims	Current Policies	
Wyandotte	9,319,262	388	300	71,282,000
Johnson	7,795,772	926	762	162,721,000
Butler	7,788,315	384	389	53,657,000
Sedgwick	6,736,441	647	1,914	264,100,000
Harvey	2,791,818	352	463	42,533,000
Barton	2,351,467	517	213	17,378,000
Bourbon	2,335,901	57	36	4,755,000
Leavenworth	2,163,416	193	165	27,991,000
Shawnee	1,914,209	241	576	74,407,000
Pottawatomie	1,532,460	236	215	42,907,000

Source: FEMA: "Policy and Loss Data by Community with County and State Data," June 29, 2007

FEMA - Hazard Mitigation Grant Program - The Hazard Mitigation Grant Program (HMGP) is a state administered federal program authorized under Section 404 of the *Disaster Relief and Emergency Assistance Act of 1988* (PL 100-707). The Adjutant General's Department, Division of Emergency Management administers the program in Kansas.

The HMGP is intended to help state and local governments carry out long-range mitigation projects following a major disaster declaration by the President. The amount of funding available is determined by calculating 15% of FEMA's costs for the other disaster assistance programs implemented as a result of the disaster. FEMA can contribute up to 75% of the individual project's cost. The remaining 25% must come from non-federal sources.

Either public or private property may be protected with the HMGP. Project examples include acquisition and relocation of structures from hazard-prone areas, construc-

Kansas Water Plan

January 2009

tion of tornado shelters in public facilities or schools and flood protection of critical community facilities.

Although priority is generally given to project applications from the area affected by the disaster, eligible applicants from other communities may also apply. Projects must be consistent with the mitigation priorities established in the KHMP and meet additional eligibility criteria as well.

Small Dam Safety

Dam failure occurs infrequently, but the consequences can be catastrophic, depending upon the degree of development downstream from the dam. The area that would be flooded should a dam fail is referred to as the "breach inundation zone". This zone may extend as much as 10 to 15 miles below a small dam depending upon such factors as the water storage capacity of the reservoir and local topography.

As is the case with other physical infrastructure, dams need regular maintenance and upkeep. Many dams were constructed in the 1950s and 1960s and are now showing the effects of aging. These effects include physical deterioration of structural components, sediment deposition in reservoirs and increased runoff due to upstream development.

Demographic and land use changes have greatly altered the physical setting of some projects. Dam construction standards have been revised since many dams were built. The hazard class of some dams has been increased due to breach zone development. Dams elevated to a higher hazard class may need to be upgraded to meet the design standards for that class regardless of their current condition. Dam owners may be challenged by the costs of routine maintenance and upkeep.

The *Kansas Stream Obstructions Act*⁽¹⁶⁾ gives the Chief Engineer the exclusive authority to regulate the construction, operation and maintenance of dams in Kansas. As of 2005, nearly 6,000 small dams falling under this authority had been constructed in Kansas, as summarized in Table 4. These dams provide flood control, public water supply, recreation and other benefits. Many dams were built by local watershed districts using federal or state cost-share assistance. Others have been constructed by municipalities and by the state.

State and Federal Programs and Authorities

FEMA: National Dam Safety Program - The *Dam Safety*

and Security Program, addresses safety and security for dams through the coordination of federal programs by the FEMA and the transfer of federal best practices in dam security to the states. The Act includes resources for the development and maintenance of a national dam safety information network and the development by the National Dam Safety Review Board of a strategic plan that established goals, priorities and target dates to improve the safety and security of dams in the United States.

Table 4
Kansas Dam Summary

Item	Number of Dams
Total number of regulated ¹ dams	5,951
Number of high hazard dams	180
Number of significant hazard dams	247
Number of low hazard dams	5,524
Average age in years (based on 4,000 dams)	37.1
Number of permits for dams held by watershed districts	1,513
Number of federally owned dams in 2002	38

¹Dams regulated by the Kansas Dept. of Ag, DWR.
Source: KDA, DWR as of July 15, 2005

The 2002 Act continues programs established by the *Water Resources and Development Act*, including grants to the state dam safety programs, training for state dam safety staff and inspectors, and development of devices for the continued monitoring of dam safety. The Corps is charged under PL 107-310 with conducting a national dam inspection program. All dams in the nation are to be inspected except as excluded by this Act. Among these exclusions are dams determined not to pose any threat to human life and property. The state dam safety agency may request to participate in these inspections.

A *National Dam Safety Program* is to be established and maintained by the FEMA. One feature of this program is financial assistance for state dam safety programs. In order to qualify for assistance, a state program must be authorized by state legislation to include:

1. The authority to review and approve plans and specifications to construct, enlarge, modify, remove and abandon dams.
2. The authority to perform periodic inspections to ensure compliance with approved plans and specifications.
3. A requirement that, on completion of the dam, state

Kansas Water Plan

- approval must be given prior to the operation of the dam.
4. The authority to require or perform the inspection, at least once every five years, of all dams and reservoirs that would pose a significant threat to human life and property in case of failure.
 5. A requirement that all inspections be made under the supervision of a state-registered professional engineer with related experience in dam design and construction.
 6. The authority to issue notices, when appropriate, to require owners of dams to perform necessary maintenance or remedial work, improve security, revise operating procedures, or take other actions, including breaching dams when necessary.
 7. Regulations for carrying out the legislation of the state.
 8. Provisions for necessary funds to ensure timely repairs to or removal of a dam in order to protect human life and property, and, if the owner of the dam does not take action, to take appropriate action as expeditiously as practicable.
 9. A system of emergency procedures to be used if a dam fails or if the failure of a dam is imminent.
 10. Identification of each dam, the failure of which: a.) could be reasonably expected to endanger human life; b.) the maximum area that could be flooded if the dam failed; and c.) necessary public facilities that would be affected by the flooding.

NRCS Watershed Rehabilitation Program - There is growing national concern that many small flood control dams that were built by local watershed districts with United States Department of Agriculture (USDA) technical and financial assistance are at or near the end of their 50-year planned design life. Watershed rehabilitation amendments to the *Watershed Protection and Flood Prevention Act of 1954*⁽⁹⁾ (PL 83-566) were enacted in 2000, establishing the *Watershed Rehabilitation Program*. These amendments authorize the USDA NRCS, to work with local communities and watershed project sponsors to address the public health and safety concerns and potential adverse environmental impacts of aging dams.

Only dams that were constructed through USDA assisted water resource programs or authorizations qualify for rehabilitation assistance. Rehabilitation projects must be cost-shared between the federal government and local project sponsors. The NRCS may provide up to 65% of the total cost of the rehabilitation project.

There are 829 watershed dams in Kansas that qualify for this rehabilitation assistance. Most of these dams have a 50-year design life. Their average age is 33 years. Thirty-four of these dams have exceeded their design life; an additional 462 dams will do so by 2018. Also, 126 dams have had a hazard class change due to development below the dam or because of a change in definitions, methods, criteria, and/or policy. Fifty-seven other dams have had a hazard class change due to removal of potential hazards.

Between 1958 and 1979, 105 dams were built with corrugated metal pipe as the principal spillway. A study of one of the first watershed projects showed that 40% of such spillway pipes needed replacement which would also include upgrading the dam to today's design standards.

Presently, the NRCS has completed assessment of 47 dams in Kansas. Of these, structural deficiencies were discovered in 5 dams and 18 dams have had a hazard class increase since construction.

To date, the NRCS has received four applications for rehabilitation planning in Kansas from the following sponsors:

- Rock Creek in Butler County
- Sand Creek in Harvey County
- Switzler Creek in Osage County
- Spring Creek in Sedgwick County.

NRCS Rehabilitation Needs and Costs in Kansas - In a 1999 report, the NRCS estimated that it would cost approximately \$20 million to repair or upgrade 97 PL 83-566 watershed dams in Kansas needing rehabilitation. An inspection of dams in the Little Delaware-Mission Watershed in northeast Kansas identified 11 grade stabilization structures in need of major rehabilitation. The cost of rehabilitating one of these dams, constructed in 1958, to current dam safety standards, was estimated to be \$155,000.

Another cost example is provided by a Pilot Rehabilitation Project conducted by the NRCS in the Sergeant Major Creek Watershed in Oklahoma. Two dams in this watershed were determined to be unsafe. They both had deteriorated metal and concrete components in the principal spillways. Also, both structures had collected a considerable amount of sediment, resulting in lost flood storage. Rehabilitation work included:

Kansas Water Plan

- The old principal spillway pipes were plugged for abandonment and new pipes and concrete towers were installed.
- Foundation drains were installed in the back of the dams to stabilize the embankment.
- The earthen spillways were enlarged.
- The height of Dam No.2 was increased to provide additional downstream protection and to protect a state highway.
- Rehabilitation extended the life expectancy of the dams for another 100 years.

Rehabilitation costs were \$325,998 for Dam No. 1 and \$431,822 for Dam No. 2, giving an average cost per dam of \$378,910. If this project had been completed under the dam rehabilitation provisions of the 2000 amendments to PL 83-566, the local sponsor would have been responsible for 35% of the total cost or \$265,237 (\$132,619 per dam).

KDA - DWR: Dam Safety Program - This program is part of the *Stream Obstructions Program* within the Water Structures Program of the DWR.

The *Kansas Stream Obstructions Act*⁽¹⁶⁾ gives the DWR Chief Engineer the exclusive authority to regulate the construction, operation and maintenance of dams in Kansas. Written consent or a permit from the Chief Engineer is required to construct a dam or make changes in any dam as required by the Act.

The Chief Engineer has the power and duty to inspect any dam and may issue orders requiring correction of deficiencies or removal of the dam if deemed necessary. An annual inspection of all dams found to be unsafe is required until the deficiency is corrected or the dam is removed.

Following amendments to the *Stream Obstruction Act* in 2002, a structure requires a permit as a dam if it meets either of the following two criteria:

1. It is an artificial barrier which can impound water or other liquids that has a height of 25 feet or more measured from the lowest point on the downstream toe to the top of the barrier; or
2. It is an artificial barrier which can impound water or other liquids that has a height of six feet or more, measured as in (1), and is capable of impounding 50 acre-feet or more.

Between 1978 and 2002, the statute exempted from the permitting requirement for all dams which impounded 30 acre-feet of water or less.

The Chief Engineer has the power and duty to inspect any dam and to issue orders requiring correction of deficiencies or removal of the dam. Where a dam's condition is so dangerous as to pose an immediate safety threat, the Chief Engineer shall immediately employ any remedial means considered necessary. The Chief Engineer continues in control of any such dam until it is considered safe or the emergency prompting the remedial action has ceased.

The *Stream Obstructions Act* requires that the Chief Engineer adopt rules and regulations to establish standards for the administration and enforcement of the Act. Three dam hazard classifications have been established as described in K.A.R. 5-40-9. These classes are:

1. Class A (low hazard) – dams located in rural or agricultural areas where failure may damage farm buildings, limited agricultural land, or county, township and private roads.
2. Class B (significant hazard) – dams located in predominately rural or agricultural areas where failure may endanger few lives, damage isolated homes, secondary highways or minor railroads or cause interruption of use or service of relatively important public utilities.
3. Class C (high hazard) – dams located in areas where failure may cause extensive loss of life, serious damage to homes, industrial and commercial facilities, important public utilities, main highways or railroads.

K.A.R. 5-40-73 requires the owner of each significant hazard dam to create an emergency action plan. Owners of high hazard dams are required to create and maintain an emergency action plan that meets FEMA guidelines presented in Handbook 64 – Federal Guidelines for Dam Safety. Plans are submitted to the Chief Engineer.

The DWR has received federal financial assistance for enhancement of the *Dam Safety Program*. Congressional authorization for these current grants runs through September 30, 2011. Grants are renewed each year.

State Conservation Commission: Watershed Planning Assistance Program - Since 1977, the Kansas Legislature has annually appropriated funds for cost-share as-

Kansas Water Plan

sistance for the construction of flood control detention and grade stabilization dams. The *Kansas Watershed District Act* and the *Watershed Planning Assistance Program* rules and regulations provide guidance for the administration of the assistance.

In 2006, the *Watershed Planning Assistance Program* was revised to provide for state cost-share financial assistance for dam rehabilitation and for breach inundation zone mapping. Any organized watershed district, drainage district, other special purpose district, or other dam owner authorized by the Legislature may apply. These revisions are summarized as follows.

Watershed Dam Rehabilitation – Rehabilitation means any work, except that is required due to inadequate dam operation and maintenance, needed to extend the service life of a dam or to meet applicable safety and performance standards. The state may provide up to 70% cost-share and an additional 10% for engineering fees for dam rehabilitation. Eligible activities may include sediment removal, structure upgrade and replacement of deteriorated components.

Inundation Zone Mapping – The SCC provides cost-share assistance for dam breach inundation zone mapping at a rate of 70%. Maps produced are approved by the Chief Engineer, DWR. Preparation of breach inundation zone maps is necessary to evaluate the need for development controls downstream from a dam. Mapping also assists in the preparation of emergency action plans to be implemented should a breach occur.

Resources

1. Adjutant General's Department, Kansas Division of Emergency Management, *lead*. November 2007. *Kansas Hazard Mitigation Plan*.
2. Flora, Snowden D. June 1948. *Climate of Kansas*. Report of the Kansas State Board of Agriculture, Vol. LXVII, No. 285.
3. Juracek, Kyle F., Perry, Charles A. and Putnam, James E. May 2001. *The 1951 Floods in Kansas Revisited*. U.S. Geological Survey, USGS Fact Sheet 041-01.
4. Combs, Lanna J. and Perry, Charles A. March 2003. *The 1903 and 1993 Floods in Kansas – The Effects of Changing Times and Technology*. USGS Fact Sheet 019-03.
5. State Water Resources Planning Act. K.S.A. 82a-901 et seq. <http://www.kslegislature.org/legsrv-statutes/getStatuteInfo.do>
6. Kansas Water Office, 1985. *Kansas Water Plan Management Section, Subsection: Rural Flood Management*.
7. Association of State Floodplain Managers, 1996. *Using Multi-Objective Management to Reduce Flood Losses in Your Watershed*.
8. Flood Control Act of 1936. PL 74-738.
9. Watershed Protection and Flood Prevention Act of 1954. PL 83-566.
10. Federal Emergency Management Agency. August 1, 2002. *National Flood Insurance Program: Program Description*.
11. National Flood Insurance Act of 1968. PL 90-448.
12. Drainage Act of 1905. K.S.A. 24-101. <http://www.kslegislature.org/legsrv-statutes/getStatuteInfo.do>
13. Flood Control Act of 1944. 33 U.S.C. 708.
14. Water Resources Development Act of 1986. 33–U.S.C. 2211.
15. Kansas Watershed District Act. K.S.A. 24-1201. <http://www.kslegislature.org/legsrv-statutes/getStatuteInfo.do>
16. Kansas Stream Obstructions Act. K.S.A. 82a-301 through 305a. <http://www.kslegislature.org/legsrv-statutes/getStatuteInfo.do>
17. Kansas Water Office, March 1984. *Flood Management*. State Water Plan Background Paper No. 9.
18. Kansas Water Office, October 1984. *Watershed Development and Land Treatment*. State Water Plan Background Paper No. 16.
19. Kansas Water Office, July 2005. FY 1997 Kansas Water Plan Management Section: Flood Management.

Kansas Water Plan

20. Kansas Water Office, July 2003. *Kansas Water Plan: Fiscal Year 2005 Update: Flood Management Policy Section*. Final Draft.
21. Kansas Water Office, July 2005. *Small Dam Safety and Rehabilitation*. Kansas Water Plan Background Paper No. 76.
22. USDA Natural Resources Conservation Service. *Kansas 2006 Update: Watershed Protection and Flood Prevention Program (PL-566)*. Salina, Kansas: March 23, 2006.