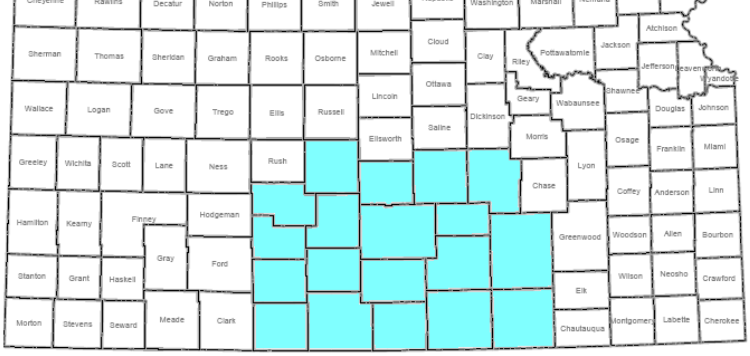
MULTI-COUNTY HAZARD ANALYSIS
OF
SOUTH CENTRAL KANSAS



COUNTIES OF BARBER, BARTON, BUTLER, COMANCHE, COWLEY, EDWARDS, HARPER, HARVEY, KIOWA, MARION, MCPHERSON, PAWNEE, RENO, RICE, SEDGWICK, STAFFORD, AND SUMNER

PREPARED BY:

STATE & LOCAL
EMERGENCY MANAGEMENT
CONSULTANTS, LLC

DECEMBER 2011

SIGNATURE OF CONCURRENCE

THE PROVISIONS OF THIS HAZARD ANALYSIS STUDY WILL BE EFFECTIVE UPON PRINTING UNLESS OTHERWISE NOTED.

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Director, Barber County Emergency Mgmt

Date:

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Director, Barton County Emergency Mgmt

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Director, Butler County Emergency Mgmt

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Director, Comanche County Emergency Mgmt

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Director, Edwards County Emergency Mgmt

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Director, Harper County Emergency Mgmt

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Director, McPherson County Emergency Mgmt

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Director, Pawnee County Emergency Mgmt

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Director, Pratt County Emergency Mgmt

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Director, Rice County Emergency Mgmt

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Director, Stafford County Emergency Mgmt

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Director, Sumner County Emergency Mgmt

Date:

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INTRODUCTION

1 PURPOSE

The purpose of a hazards analysis plan is to identify the potential hazards facing a community - whether they are natural, technological or national security related. The plan follows a three-step decision making process and is designed to consider all potential hazards within the planning district and to identify which hazards are of high priority and should be addressed in the emergency planning process. The three components or processes of the plan include:

> Hazards Identification – Typically provides specific information on situations that have the potential for causing injury to life or damage to property and the environment due to a hazardous materials spill or release.
>
> Vulnerability Analysis – Identifies areas in the community that may be affected or exposed, individuals in the community who may be subject to injury or death from certain specific hazardous materials, and what facilities, property, or environment may be susceptible to damage should a hazardous materials release occur.
>
> Risk Assessment – An assessment by the community of the likelihood (probability) of an accidental release of a hazardous material and the actual consequences that might occur based on the estimated vulnerable zones. The risk analysis is a judgment of probability and severity of consequences based on the history of previous incidents, local experience, and the best available current technological information.

Preparation of this plan has been conducted under the planning guidance outlined in the National Response Team's (NRT) 2001 Hazardous Materials Emergency Planning Guide (NRT-1), and the U.S. Environmental Protection Agency's Chemical Emergency Preparedness Program "Green Book" supplemental guidance entitled "Technical Guidance for Hazardous Analysis."

Until further notice, requests for information related to industry storage reporting, layouts and emergency operating plans covered under the Superfund Amendments and Reauthorization Act (SARA) Title III will be reviewed by the Local Emergency Planning Committee (LEPC) on a case by case basis for determining applicability of K.S.A § 45-221(12) of the Kansas Open Records Act which states "Records of emergency or security information or procedures of a public agency, or plans, drawings, specifications or related information for any building or facility which is used for purposes requiring security measures in or around the building or facility or which is used for the generation or transmission of power, water, fuels or communications, if disclosure would jeopardize security of the public agency, building or facility."

2 FEDERAL GUIDANCE

NATIONAL RESPONSE FRAMEWORK (NRF)

The National Response Framework (NRF) presents the guiding principles that enable all response partners to prepare for and provide a unified national response to disasters and emergencies. It establishes a comprehensive, national, all-hazards approach to domestic incident response. It is built upon *scalable, flexible, and adaptable coordinating structures* to align key roles and responsibilities *across the Nation*. It describes specific authorities and best practices for managing incidents that range from the serious but purely local, to large-scale terrorist attacks or catastrophic natural disasters. The National Response Framework defines the principles, roles, and structures that organize how we respond as a nation. The National Response Framework:

- describes how communities, tribes, states, the federal government, private-sectors, and nongovernmental partners work together to coordinate national response;
- describes specific authorities and best practices for managing incidents; and builds upon the National Incident Management System (NIMS), which provides a consistent template for managing incidents.

The term "response" as used in NRF includes immediate actions to save lives, protect property and the environment, and meet basic human needs. Response also includes the execution of emergency plans and

actions to support short-term recovery. In each county, the Local Emergency Operations Plan (LEOP) applies the NRF principles that guide the response, roles and responsibilities, response actions, response organizations, and planning requirements to achieve an effective local and regional response to any incident that occurs.

NATIONAL INCIDENT MANAGEMENT SYSTEM (NIMS)

In Homeland Security Presidential Directive (HSPD)-5, *Management of Domestic Incidents*, the President directed the Secretary of Homeland Security to develop, submit for review to the Homeland Security Council, and administer a National Incident Management System (NIMS). This system will provide a consistent nationwide approach for Federal, State, local, and tribal governments to work effectively and efficiently together to prepare for, prevent, respond to, and recover from domestic incidents, regardless of cause, size, or complexity. The NIMS enhances the management of domestic incidents by establishing a single, comprehensive system for incident management and will help achieve greater cooperation among Departments and agencies at all levels of government.

Incident Management

Emergency Support Functions (ESFs) are used by the Federal Government and many State and local governments as the primary mechanism to organize and provide resources needed for efficient incident management. ESFs align categories of resources and provide strategic objectives for their use.

ESFs utilize standardized resource management concepts such as typing, inventorying, and tracking to facilitate the dispatch, deployment, and recovery of resources before, during, and after an incident.

CRITICAL INFRASTRUCTURE/KEY RESOURCE AS IT RELATES TO INCIDENT MANAGEMENT

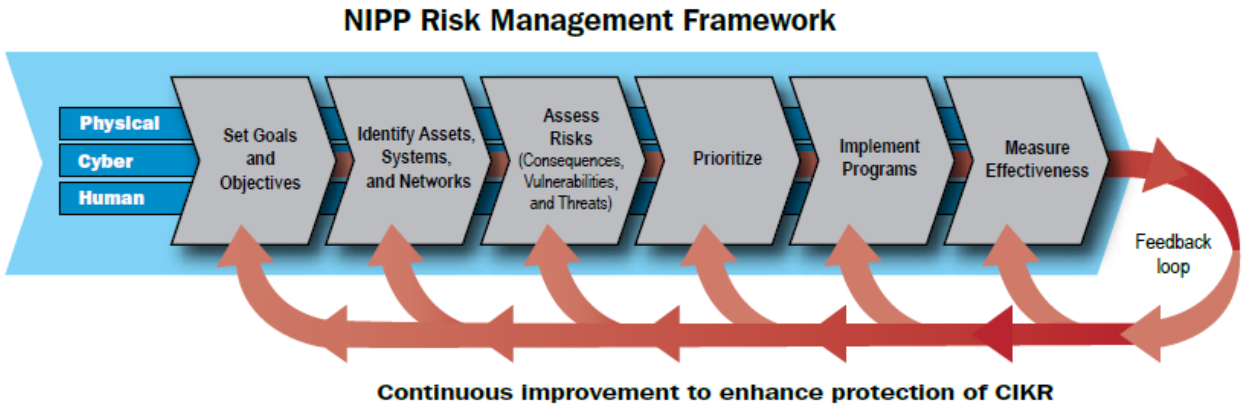
Critical Infrastructure/Key Resource	ESF #1	ESF #2	ESF #3	ESF #4	ESF #5	ESF #6	ESF #7	ESF #8	ESF #9	ESF #10	ESF #11	ESF #12	ESF #13	ESF #14	ESF #15
Agriculture & Food							X	X			X				
Banking & Finance														X	X
Chemical										X			X		
Commercial Facilities						X	X						X	X	X
Communications		X					X								
Critical Manufacturing	X	X			X		X			X		X	X		
Dams			X									X			
Defense Industrial Base							X								X
Emergency Services	X	X	X	X	X	X	X	X	X	X		X	X	X	X
Energy															
Government Facilities			X	X	X		X								X
Healthcare & Public Health						X	X	X							X
Information Technology		X					X								X
Monuments & Icons			X				X				X		X		X
Nuclear Reactors, Materials & Waste							X			X		X			
Postal & Shipping	X						X						X		X
Transportation Systems	X						X								X
Water			X											X	X

National Infrastructure Protection Plan

The National Infrastructure Protection Plan provides the unifying structure for the integration of a wide range of efforts for the enhanced protection and resiliency of the critical infrastructure and key resources (CIKR) into a single program. The overarching goal of the NIPP is to build a safer, more secure, and more resilient America by preventing, deterring, neutralizing, or mitigating the effects of deliberate efforts by terrorists to destroy, incapacitate, or exploit elements of the CIKR and to strengthen national preparedness, timely response, and rapid recovery of CIKR in the event of an attack, natural disaster, or other emergency. It establishes the overarching concepts relevant to all CIKR sectors identified under the authority of Homeland Security Presidential Directive 7, and addresses the physical, cyber, and human considerations required for effective implementation of protective programs and resiliency strategies.

Risk Management

The NIPP specifies the key initiatives, milestones, and metrics required to achieve the CIKR protection mission. It sets forth a comprehensive risk management framework and clearly defined roles and responsibilities for the Department of Homeland Security (DHS), Federal Sector-Specific Agencies (SSAs), and other Federal, State, local, tribal, territorial, and private sector partners. The cornerstone of the NIPP is its risk management framework, which establishes the processes for combining consequence, vulnerability, and threat information to produce a comprehensive, systematic, and rational assessment of national or sector risk.



The NIPP, the National Preparedness Guidelines (NPG), and the National Response Framework (NRF) together provide a comprehensive, integrated approach to the homeland security mission. The NIPP establishes the overall risk-informed approach that defines the Nation's CIKR protection posture, while the NRF provides the approach for domestic incident management. The NPG sets forth national priorities, doctrine, and roles and responsibilities for building capabilities across the prevention, protection, response, and recovery mission areas. Increases in CIKR protective measures in the context of specific threats or that correspond to the threat conditions established in the Homeland Security Advisory System (HSAS) provide an important bridge between NIPP steady-state protection and the incident management activities under the NRF.

Sector-Specific Agency

HSPD-7 designates a Federal Sector-Specific Agency (SSA) to lead CIKR protection efforts in each sector. The directive allows for the Department of Homeland Security to identify gaps in existing CIKR sectors and establish new sectors to fill these gaps. Each SSA developed a Sector-Specific Plan that details the application of the NIPP framework to the unique characteristics of their sector.

A sector is a logical collection of assets, systems, or networks that provide a common function to the economy, government, or society. There are a total of 18 CIKR sectors, identified by the criteria set forth in Homeland Security Presidential Directive 7 (HSPD-7). HSPD-7 established U.S. policy for enhancing CIKR protection by establishing a framework for NIPP partners to identify, prioritize, and protect the Nation's CIKR from terrorist attacks.

Sector-Specific Agencies and Assigned CIKR Sectors

Sector Specific Agency	Critical Infrastructure and Key Resources Sector
Department of Agriculture[a] Department of Health and Human Services[b]	Agriculture and Food
Department of Defense[c]	Defense Industrial Base
Department of Energy	Energy[d]
Department of Health and Human Services	Healthcare and Public Health
Department of the Interior	National Monuments and Icons
Department of the Treasury	Banking and Finance
Environmental Protection Agency	Water[e]
Department of Homeland Security *Office of Infrastructure Protection*	Chemical Commercial Facilities Critical Manufacturing Dams Emergency Services Nuclear Reactors, Materials, and Waste
Office of Cybersecurity and Communications	Information Technology Communications
Transportation Security Administration	Postal and Shipping
Transportation Security Administration *United States Coast Guard*[f]	Transportation Systems[g]
Immigration and Customs Enforcement, Federal Protective Service	Government Facilities[h]

a The Department of Agriculture is responsible for agriculture and food (meat, poultry, and egg products).
b The Department of Health and Human Services is responsible for food other than meat, poultry, and egg products.
c Nothing in this plan impairs or otherwise affects the authority of the Secretary of Defense over the Department of Defense (DoD), including the chain of command for military forces from the President as Commander in Chief, to the Secretary of Defense, to the commander of military forces, or military command and control procedures.
d The Energy Sector includes the production, refining, storage, and distribution of oil, gas, and electric power, except for commercial nuclear power facilities.
e The Water Sector includes drinking water and wastewater systems.
f The U.S. Coast Guard is the SSA for the maritime transportation mode.
g As stated in HSPD-7, the Department of Transportation and the Department of Homeland Security will collaborate on all matters relating to transportation security and transportation infrastructure protection.
h The Department of Education is the SSA for the Education Facilities Subsector of the Government Facilities Sector.

CRITICAL INFRASTRUCTURE / KEY RESOURCE (CI/KR) SECTORS

The following sectors have been changed from a federal definition to a local government perspective; however, the basic purpose of these sectors has been retained.

Agriculture and Food Sector

The Agriculture and Food Sector is vast, comprising the Nation's agricultural production and food systems from farm to table. Because of the open nature of many portions of the Agriculture and Food Sector, attacks using food or agricultural infrastructure or resources as a means to deliver biological, chemical, or radiological agents could have a devastating impact on public health and the economy.

The sector includes the supply chains for feed, animals, and animal products; crop production and the supply chains of seed, fertilizer, and necessary related materials; and the post-harvesting components of the food supply chain, from processing through distribution to consumption.

Agroterrorism supported critical infrastructure/key resource assessments helps to identify vulnerabilities and potential mitigation strategies for those identified vulnerabilities. Agroterrorism targets include livestock, crops, water supplies, food in grocery stores, farm workers, food processors, and restaurants.

The Agriculture and Food Sector shares dependencies and interdependencies with other CIKR sectors, including: Banking and Finance, Chemical, Energy, Government Facilities, Healthcare and Public Health, Information Technology, Transportation Systems, and Water.

Banking and Finance Sector

The Banking and Finance Sector is the backbone for the world economy, overseeing:

- Deposit, consumer credit, and payment systems.
- Credit and liquidity products.
- Investment products.
- Risk-transfer products (including insurance).

As direct attacks and public statements by terrorist organizations demonstrate, the sector is a high-value and symbolic target. Additionally, large-scale power outages, recent natural disasters, and economic troubles demonstrate the wide range of potential threats facing the sector. Faced with these threats, financial regulators and private-sector owners and operators work collaboratively to maintain a high degree of resiliency.

Terrorist organizations view the sector as a valuable and symbolic target. Large-scale power outages, recent natural disasters, and economic troubles demonstrate the range of potential threats facing the sector.

The Banking and Finance Sector shares dependencies and interdependencies with other CIKR sectors, including: Communications, Energy, Information Technology, and Transportation Systems.

Chemical Sector

Facilities in some manner use, manufacture, store, transport, or deliver chemicals, encompassing everything from petrochemical plants to pharmaceutical manufacturers. The Chemical Sector infrastructure can be divided into three key functional areas in the Chemical Sector value chain:

- Manufacturing plants
- Transport systems
- Distribution systems (including storage/stockpile/supply areas)

Based on the end product produced, the Chemical Sector can be divided into five segments.

- Basic Chemicals: industrial chemicals manufactured in large quantities such as sulfuric acid, nitrogen, oxygen, chlorine, and fertilizers.
- Specialty Chemicals: manufactured in lower volumes and include adhesives, sealants, flavors and fragrances, food additives, explosives, institutional and industrial cleaners, and other specialties.
- Agricultural Chemicals: chemical pesticides, fungicides, insecticides, and herbicides.
- Pharmaceuticals: includes medicines, biological products, diagnostic substances, and vitamins.
- Consumer Chemicals: generally packaged goods and include soap, detergents, bleaches, toothpaste, shampoo, cosmetics, perfume, paints, and many more.

Across the Chemical Sector, facilities are highly dependent on many other CIKR sectors to maintain operations, including: Communications, Emergency Services, Energy, Information Technology, Transportation Systems, and Water. In addition, many sectors rely on the Chemical Sector to maintain their functionality, including: Agriculture and Food, Critical Manufacturing, Defense Industrial Base, Emergency Services, and Healthcare and Public Health.

Commercial Facilities Sector

The Commercial Facilities Sector includes a wide range of business, commercial, residential, and recreational facilities where large numbers of people congregate. Commercial facilities allow the general public to move freely without the deterrent of highly visible security barriers. However, this freedom of movement makes these facilities vulnerable to attack.

This sector is diverse in both scope and function, and is divided into eight subsectors:

- Entertainment and Media
- Lodging
- Outdoor Events
- Public Assembly
- Real Estate
- Resorts
- Retail
- Sports Leagues

The Commercial Facilities Sector encompasses a wide range of facilities, such as hotels and convention centers, commercial offices and apartment buildings, stadiums, theme parks, and shopping centers.

The Commercial Facilities Sector shares dependencies and interdependencies with other CIKR sectors, including: Agriculture and Food, Banking and Finance, Communications, Defense Industrial Base, Emergency Services, Energy, Government Facilities, Healthcare and Public Health, Monuments and Icons, Postal and Shipping, Transportation Systems, and Water.

Communications Sector

The Communications Sector is an integral component of the U.S. economy, as it underlies the operations of all businesses, public safety organizations, and government. Over the last 25 years, the sector has evolved from predominantly a provider of voice services into a diverse, competitive, and interconnected industry using terrestrial, satellite, and wireless transmission systems.

Long-established processes and procedures for network security and rapid response and recovery under all hazards ensure the continued operation of vital communications services. Focused risk management and infrastructure protection are integral to the sector's business continuity planning and network design processes.

The Communications Sector shares dependencies and interdependencies with other CIKR sectors, including: Agriculture and Food, Banking and Finance, Chemical, Defense Industrial Base, Emergency Services, Energy, Healthcare and Public Health, Information Technology, Postal and Shipping, Transportation Systems, and Water.

Critical Manufacturing Sector

The Critical Manufacturing Sector is composed of four broad manufacturing industries: primary metal manufacturing; machinery manufacturing; electrical equipment, appliance, and component manufacturing; and transportation equipment manufacturing.

Primary Metal Manufacturing Industry – comprised of two manufacturing and processing industries:

- The iron and steel mills and Ferro alloy manufacturing industry includes the direct reduction of iron ore; manufacturing pig iron in molten or solid form; converting pig iron into steel; and manufacturing Ferro alloys. In addition, this industry involves making steel; manufacturing shapes such as bars, plates, rods, sheets, strips, or wire; and forming pipe and tube.
- Alumina and aluminum production and processing, the second primary metal manufacturing industry, converts aluminum-bearing bauxite ore into products such as alumina, aluminum ingots, and rolled or drawn aluminum products including plate, sheet, foil, and extrusions.

Machinery Manufacturing Industry – manufactures engine, turbine, and power transmission equipment. Machinery manufacturing includes generators, governors, and water, gas, steam, wind, and hydraulic turbines.

Electrical Equipment, Appliance, and Component Manufacturing – produces a wide variety of electrical equipment and parts including power, distribution, and specialty transformers; electric motors, generators, and motor generator sets; switchgear and switchboard apparatus; relays; and industrial controls.

Transportation Equipment Manufacturing – comprised of three related industries:

- Motor Vehicle Manufacturing: produces passenger cars, trucks, locomotives, motorcycles, motorcycle parts and components, and commercial ships.
- Aerospace Product and Parts Manufacturing: produces commercial and private aircraft; aircraft components and avionics; and satellites, space platforms, and launch vehicles.
- Railroad Rolling Stock Manufacturing: manufactures and rebuilds locomotives and their frames and parts. Additionally, this industry provides rail, light-rail, and rapid-transit cars for freight and passenger service, as well as railroad and track-maintenance equipment.

The Critical Manufacturing Sector shares dependencies and interdependencies with other CIKR sectors, including: Chemical, Communications, Defense Industrial Base, Emergency Services, Energy, Information Technology, and Transportation Systems.

Dams Sector

The Dams Sector is comprised of facility owners and operators at the Federal, State, and local levels, and the private sector. These assets encompass conventional dams, levees, dikes, industrial waste impoundments, and other similar water retention and/or water control facilities. Dams are vital to the infrastructure and provide a wide range of economic, environmental, and social benefits, including hydroelectric power, river navigation, water supply, flood control, and recreation.

However, dams and levees can fall victim to natural disasters or terrorist acts resulting in loss of human life, economic loss including property damage, and extensive environmental damage.

The Dams Sector shares dependencies and interdependencies with other CIKR sectors, including: Agriculture and Food, Emergency Services, Energy, Transportation Systems, and Water.

Defense Industrial Base (DIB) Sector

The Defense Industrial Base (DIB) Sector includes hundreds of thousands of domestic and foreign entities and subcontractors that perform work for the Department of Defense (DOD) and other Federal departments and agencies. These entities research, develop, design, produce, deliver, and maintain military weapons systems, subsystems, components, or parts. Defense-related products and services provided by the DIB Sector equip, inform, mobilize, deploy, and sustain forces conducting military operations worldwide.

The size and diversity of the sector results in an extraordinarily large and complex collection of industrial sites and operators across 15 subsectors and more than 90 segments governed by multiple regulations, laws, treaties, and precedents.

The Defense Industrial Base Sector provides the products and services that are essential to mobilize and sustain the Nation's military operations. The sector includes companies performing under direct contract with the Department of Defense, its subcontractors, and companies providing materials and services. Unlike other sectors, the Defense Industrial Base is defined by the customer rather than by the goods and services themselves.

The size and diversity of the sector results in an extraordinarily large and complex collection of industrial sites and operators who work within numerous subsectors and segments, which are governed by multiple regulations, laws, treaties, and precedents. The facilities that are included in this sector are very different from one another, so standardized risk assessments are not possible.

While new high-tech security and programs are both complex and expensive, defense-related businesses place a great deal of emphasis on protecting their assets and functions. The sector has prioritized the need to share information and develop assessment and security procedures that are implemented across the sector. McConnell AFB in Sedgwick County is the only Defense Industrial Base entity based within south central Kansas.

The Defense Industrial Base Sector shares dependencies and interdependencies with other CIKR sectors, including: Communications, Critical Manufacturing, Energy, Information Technology, and Transportation Systems.

Emergency Services Sector

The Emergency Services Sector comprises the assets, systems, networks, and functions that are critical to maintain, protect, and preserve our safety and health in case of a natural or manmade disaster or terrorist incident. By protecting these elements, the sector is better able to support all critical infrastructure, essential governmental missions, and public services. These functions are vital to community security, public health and safety, economic vitality, and way of life.

Through partnerships with public- and private-sector entities, this sector's mission is to accomplish the following:

- Save lives;
- Protect property and the environment;
- Assist communities impacted by disasters (natural or manmade); and,
- Aid recovery from emergency situations.

The Emergency Services Sector is a system of preparedness, response, and recovery that forms a coordinated approach to preventing—and mitigating the effects of—natural and manmade disasters.

Four distinct disciplines comprise this sector:

- Law Enforcement
- Fire and Rescue Services
- Emergency Management
- Emergency Medical Services

In addition, the sector includes specialized capabilities such as Explosive Ordnance Disposal, Special Weapons and Tactics and Tactical Operations, Hazardous Materials, Search and Rescue, Urban Search and Rescue, Public Safety Answering Points, and Public Works.

The Emergency Services Sector collaborates with multiple infrastructure sectors that supply essential operational elements, including Communications, Energy, Information Technology, and Water. In addition, two sectors that support emergency responders are Healthcare and Public Health and Transportation Systems.

Energy Sector

The Energy Sector consists of thousands of geographically dispersed electricity, oil, and natural gas assets that are connected by systems and networks. Without a stable energy supply, health and welfare is threatened and the economy of the United States cannot function.

The energy infrastructure is divided into three interrelated segments:

- Electricity
- Petroleum
- Natural gas

The energy sector is composed of several interrelated subsectors including: electricity, petroleum, and natural gas. Each of these segments are comprised of their own production and distribution systems, over 85% of which are privately owned and operated.

All CIKR sectors are dependent on the Energy Sector for electricity to light and operate homes, offices, and factories and on petroleum products to transport goods to and from their facilities. Many sectors are also dependent on natural gas for heating and/or product processing.

Significant interdependencies exist with the Chemical and Transportation Systems Sectors that provide critical assets and services to the production and distribution of energy. However, due to the ubiquitous use of energy, the Energy Sector shares other dependencies and interdependencies with all other CIKR sectors, including: Emergency Services, Water, Dams, Communications, Banking and Finance, and Government Facilities.

Government Facilities Sector

The Government Facilities Sector includes facilities owned or leased by all levels of government domestically or overseas. Many of these facilities are open to the public, such as courthouses, educational facilities, libraries, and archives. Other facilities not open to the public contain highly sensitive information, materials, processes, and equipment, such as military installations, embassies, and research facilities. These facilities are differentiated from other CIKR sectors because they are uniquely governmental.

The Government Facilities Sector ensures the safety and security of governmental facilities owned or leased by all levels of government domestically or overseas. Many government facilities are open to the public for business activities, commercial transactions, or recreational activities. Other facilities are not open to the public because they contain highly sensitive information, materials, processes, and equipment.

The sector also includes the Education Facilities Subsector, which covers prekindergarten through 12th grade (preK-12) schools, institutions of higher education, and business and trade schools. This subsector includes both government-owned facilities and facilities owned by private-sector entities, so it faces some unique challenges.

In addition to physical structures, the sector considers cyber elements that contribute to the protection of sector assets, such as access control systems and closed-circuit television systems, and individuals who possess tactical, operational, or strategic knowledge or perform essential functions.

Government facilities face a range of natural and human-caused threats. These facilities are attractive targets for terrorist groups and criminals because they provide unique services, perform sensitive functions, and have significant symbolic value.

The Government Facilities Sector shares dependencies and interdependencies with all other CIKR sectors, including but not limited to the Communications, Energy, Information Technology, and Water. The Education Facilities Subsector shares dependencies and interdependencies with the following sectors: Agriculture and Food, Chemical, Commercial Facilities, Emergency Services, and Transportation Systems.

Healthcare and Public Health Sector

The systems, networks, services, facilities, functions, and roles needed to prevent disease and disability, treat patients, foster public health, and respond to public health emergencies span all levels of government and the private sector, and touch every citizen of the United States.

Ensuring a resilient healthcare and public health system capable of withstanding disruption and poised to protect lives and health during emergencies is vital for people's safety and security.

The Healthcare and Public Health Sector provides a full array of goods and services, including acute hospital and ambulatory healthcare, public health, laboratories, blood banks, mass fatality management, insurers/payors, and medical supply manufacturing and distribution.

Private-sector as well as Federal, State, territorial, tribal, and local agencies provide healthcare and public health services, and participate in ongoing surveillance and detection of potential threats from bioterrorism and other manmade and natural threats.

The Healthcare and Public Health Sector shares dependencies and interdependencies with other CIKR sectors, including: Agriculture and Food, Chemical, Communications, Emergency Services, Energy, Information Technology, Postal and Shipping, Transportation Systems, and Water.

Information Technology Sector

The Information Technology (IT) Sector is central to community security, economy, public health, and safety. Businesses, governments, academia, and private citizens are increasingly dependent upon IT Sector functions. These virtual and distributed functions produce and provide hardware, software, and IT systems and services, and—in collaboration with the Communications Sector—the Internet.

Many other critical infrastructure and key resources (CIKR) sectors rely on the IT Sector for products and services, including the reliable operation of networks and systems, and the movement and storage of critical data. The sector's complex and dynamic environment makes identifying threats and assessing vulnerabilities more difficult and requires that these tasks be dealt with in a collaborative and creative fashion.

Although the IT infrastructure has a certain level of inherent resilience, its interdependent and interconnected structure presents challenges as well as opportunities for coordinating public- and private-sector preparedness and protection activities.

The IT Sector provides an infrastructure upon which all other CIKR sectors rely, coordinates with other CIKR sectors, and works to ensure that any disruptions or manipulations of critical functions are brief, infrequent, manageable, geographically isolated, and minimally detrimental to the welfare of the United States. The Information Technology Sector shares dependencies and interdependencies with other CIKR sectors, including: Banking and Finance, Chemical, Communications, Emergency Services, Government Facilities, Healthcare and Public Health, Postal and Shipping, and Water.

Monuments and Icons Sector

The assets of the Monuments and Icons Sector are managed and safeguarded by the local and state historical societies. These facilities memorialize or represent significant aspects of a jurisdiction's heritage, tradition, or values, and serve as points of interest for visitors and educational activities. Many of these sites represent the foundation of the jurisdiction and as such must be protected from harm either by attack or natural disaster. The primary goal, however, is to preserve public accessibility to national critical assets to the maximum extent possible.

The sector faces the challenges of maintaining security at these sites and developing protective measures to deal with emerging threats without restricting access.

Unlike other assets that have numerous interdependencies, Monuments and Icons assets are basically stand-alone assets. The loss of or damage to an Monuments and Icons asset generally will not have a cascading effect on other assets within the Monuments and Icons Sector, or other sectors, such as Energy, Transportation, Food, and so on. Cross-sector coordination related to sector assets for which the primary protective responsibility resides in another sector is, however, essential.

Nuclear Reactors, Materials, and Waste Sector (or Nuclear Sector)

The Nuclear Reactors, Materials, and Waste Sector (or Nuclear Sector) owns, oversees, and operates commercial nuclear power reactors that provide power to millions of homes and businesses across the country. The sector also includes:

- Non-power nuclear reactors used for research, training, and radioisotope production.
- Nuclear and radiological materials used in medical, industrial, and academic settings.
- Nuclear fuel-cycle facilities.
- The transportation, storage, and disposal of nuclear and radioactive materials and waste.

The Nuclear Sector is composed of the following primary subsectors: Nuclear Facilities, Nuclear Materials, and Nuclear Waste. Let's look at each of these subsectors.

- Nuclear Facilities Subsector: includes power plants that use nuclear fission to produce electricity. This subsector also includes non-power reactors that are used for research and in education or medical applications. And finally, the subsector includes the deactivated facilities that have not been fully decontaminated and decommissioned for release back to public use. The only nuclear power

plant in Kansas is Wolf Creek in Coffey County and serves the majority of the eastern portion of Kansas to include the following south central Kansas counties: Butler, Cowley, Kingman, Marion, McPherson, Reno, Rice, Sedgwick, and Sumner.

- Nuclear Materials Subsector: ranges from nuclear fuel cycle facilities that produce fuel for use in nuclear power plants to companies that transport nuclear materials for use and for waste disposal. The subsector also includes radioactive material users such as medical, research, irradiation, and industrial facilities, and private-sector facilities that import, fabricate, or remanufacture radioactive materials.
- Nuclear Waste Subsector: encompasses a wide range of radioactive waste handling and storage facilities. These facilities handle low-level radioactive wastes such as contaminated clothing and medical equipment, as well as large quantities of naturally occurring radioactive materials. The Nuclear Waste Subsector also includes facilities that store spent reactor fuel assemblies in both wet and dry environments.

While the loss of the electricity generated by a single nuclear power plant may have only a minor impact on the State's overall electrical capacity, a terrorist attack on the Wolf Creek nuclear power plant or University of Kansas (Manhattan) research reactor would be a significant security event. For this reason, Nuclear Sector facilities are among the best defended and most physically hardened of all critical infrastructures. These facilities are designed to withstand such extreme events as hurricanes, tornadoes, and earthquakes.

The sector shares dependencies and interdependencies with other CIKR sectors, including: Chemical, Communications, Emergency Services, Energy, Government Facilities, Healthcare and Public Health, Information Technology, and Transportation Systems.

Postal and Shipping Sector

The Postal and Shipping Sector's collection, transportation, and distribution assets include complex intermodal networks linking millions of potential delivery points across the country and the globe. Given the sector's vast networks of facilities, transportation assets, and cyber systems, achieving 100 percent security is not economically or technologically feasible. However, the sector envisions a resilient infrastructure in which threats can be quickly detected, consequences localized, and operational disruptions minimized. A key component of this vision is the United States Postal Inspection Service, one of the country's oldest Federal law enforcement agencies, which fights criminals who attack our Nation's postal system and misuse it to threaten the American public.

The Postal and Shipping Sector's collection, transportation, and distribution assets include complex intermodal networks linking millions of potential delivery points across the country and the globe.

The sector processes and distributes more than 170 billion pieces of mail domestically each year. However, the size and diversity of the Postal and Shipping Sector challenges efforts to protect its many different systems and assets.

The Postal and Shipping Sector shares dependencies and interdependencies with other CIKR sectors, including: Banking and Finance, Commercial Facilities, Communications, Critical Manufacturing, Energy, Healthcare and Public Health, Information Technology, and Transportation Systems.

Transportation Systems Sector

The Transportation Systems Sector is a vast, open network of interdependent systems that delivers food, water, medicines, fuel, and other commodities, making it a highly attractive target for terrorists.

What is unique about the Transportation Systems Sector is its part in the global transportation network. The Transportation Systems Sector relies on global partners to share critical information that can lead to more informed decisions by identifying and understanding threats, vulnerabilities, and consequences using global threat information and assessments.

The sector's goals are to prevent and deter acts of terrorism using transportation means or against elements of the transportation system, to enhance resilience of the transportation system, and to improve the cost-effective use of resources for transportation security.

The sector is organized into the following six subsectors or "modes":

- Aviation Mode: includes aircraft, air traffic control systems, and air cargo, as well as commercial, civil, and joint-use military airports, airfields, heliports, and seaplane bases.
- Maritime Mode: includes various maritime operations within the Maritime Transportation System (MTS) networks and have components that include vessels as well as approximately 95,000 miles of coastline, port facilities, waterways, and related infrastructure.
- Mass Transit and Passenger Rail Mode: comprised of multiple-occupancy vehicles designed to transport customers on local and regional routes, while the Highway Infrastructure and Motor Carriers mode encompasses more than 4 million miles of roadways and supporting infrastructure.
- Freight Rail Mode: includes hundreds of railroads, thousands of miles of track, and more than 1 million cars and locomotives.
- Pipeline Security Mode: focuses on the infrastructure that carries natural gas, hazardous liquids, and various chemicals.

The Transportation Systems Sector shares dependencies and interdependencies with all the other CIKR sectors, including: Agriculture and Food, Banking and Finance, Chemical, Commercial Facilities, Communications, Critical Manufacturing, Defense Industrial Base, Emergency Services, Energy, Government Facilities, Information Technology, and Postal and Shipping. In addition to cross-sector interdependencies, the Transportation Systems Sector must pay particular attention to interdependencies among the transportation modes.

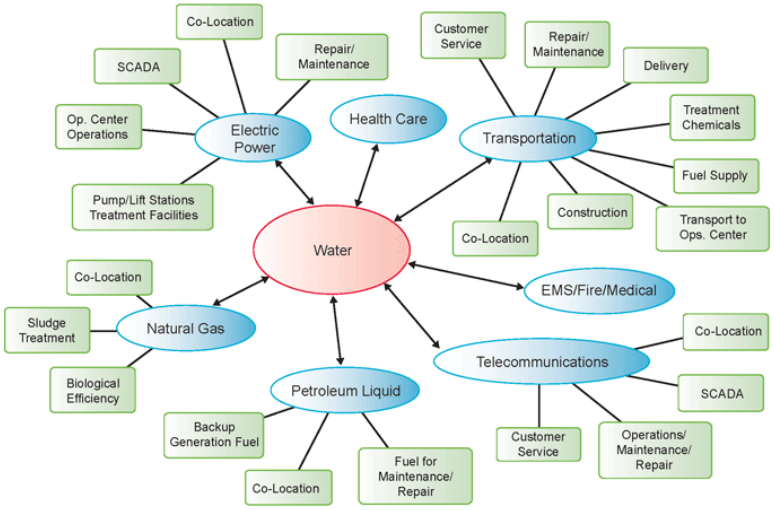
Water Sector

Safe drinking water and properly treated wastewater are critical to modern life. The former is a prerequisite for all human activity—physical, economic, and cultural. Wastewater treatment is important for preventing disease and protecting the environment. Therefore, from the standpoints of public health and economic impact, it is critical that we protect the Nation's drinking water and wastewater infrastructures, collectively known as the Water Sector.

The Water Sector is a partnership of public and private drinking water and wastewater utilities; national and State associations; State, local, and tribal governments; research foundations; and Federal agencies that together have been ensuring the protection and resilience of water services for decades. Water Sector partners collaborate to be better prepared to prevent, detect, respond to, and recover from terrorist attacks and other intentional acts, natural disasters, and other hazards (i.e., the "all-hazards" approach).

The Water Sector has interdependencies with all critical infrastructures. Further analysis of dependencies and interdependencies across all 18 CIKR sectors is needed to identify the true scope of cascading effects resulting from a manmade attack or a naturally occurring event.

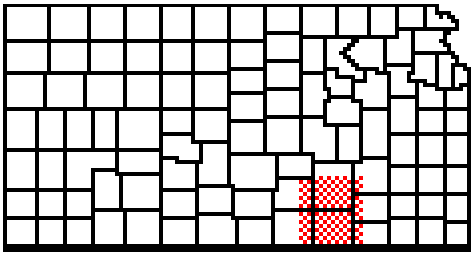
Water Sector Interdependencies With Other CIKR Sectors



3 OVERVIEW

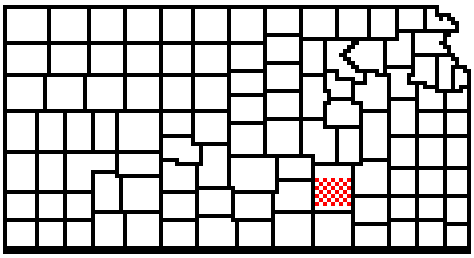
3.1 EARLY TERRITORY HISTORY[1]

Hunter County



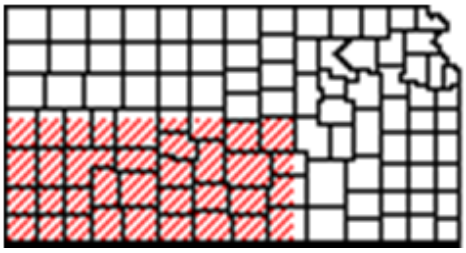
Probably named for Robert Mercer Taliaferro Hunter (1809-1887), a Virginia congressman and senator, who favored the admission of Kansas under the Lecompton Constitution. Hunter was one of the original 33 counties created by the first territorial legislature in 1855. In 1860, Irving County was created out of the northern part of Hunter. The county was never organized, and on February 24, 1864 it was annexed into Butler County. The greater portion of what was Hunter County is now included in Cowley County, with the remainder scattered among Sedgwick, Sumner, Butler, Elk, Chautauqua, and Greenwood counties. The county was dissolved on February 24, 1864.

Irving County



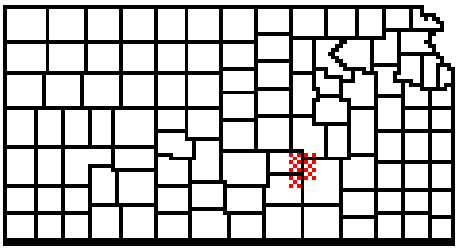
In honor of Washington Irving (1783-1859), author, essayist, biographer, and poet. Perhaps best known for "The Legend of Sleepy Hollow" and "Rip Van Winkle," Irving was the first American author to achieve international fame. Irving County was never organized, and it was annexed into Butler County in February 24, 1864. Its territory embraced the southern part of Butler, the northern tier of Cowley, part of the southwest corner of Greenwood, and the northwest corner of Elk County.

Washington County



In honor of George Washington (1732-1799), first president of the United States. The legislative Act of 1855 originally created this old Washington County and included all of the unorganized territory in the south and west of the territory. It included the area of the present counties of Barber, Barton, Clark, Comanche, Edwards, Ford, Grant, Gray, Greeley, Hamilton, Harper, Harvey, Haskell, Hodgeman, Kearney, Kingman, Kiowa, Lane, the southwest corner of Marion, the southern part of McPherson, Meade, Morton, Ness, Pawnee, Pratt, Reno, Rice, Russell, Scott, Sedgwick, Seward, Stafford, Stanton, Stevens, nearly all of Sumner, and Wichita. The name of Washington was given to a northeastern county in February 1857, leaving the original territory without a name until Peketon County was established in February 1860. Old Washington County was never organized, and there is no evidence that a county seat was ever established.

Otoe County

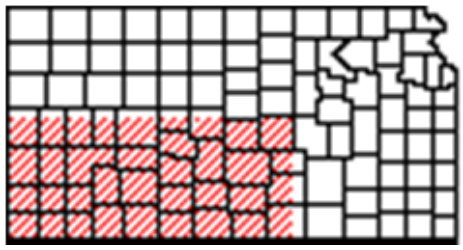


Established on February 17, 1860, the county was named for the Otoe [Oto] Indian tribe of Nebraska. The tribal name is derived from 'wat-ota,' meaning 'seekers of pleasure' or 'lechers,' a name given them when they separated from their kindred tribes, the Iowa and Missouri. Otoe County once embraced townships 21, 22, 23, and the northern 2/3 of 24 in ranges1 through 4 east of the sixth principal meridian. Apparently never organized. In 1864, the boundaries of Butler County were enlarged to include Otoe

[1] *Kansas State Historical Society*

County. Most of the territory once comprising Otoe is included in the present county of Butler, with the remainder in the eastern parts of Harvey and Sedgwick counties. The county was dissolved February 24, 1864.

Peketon County



Possibly from a Sac Indian word meaning flat land, Peketon was established February 21, 1860 and included all territory west of the 6th principal meridian, and south of township 16 south, more than one-quarter of the state. The northeast corner was at the southwest corner of Dickinson County; from which point the northern boundary of Peketon ran west past what is now the Kansas/Colorado state line into southeastern Colorado, and the eastern boundary went south to the border of Indian Territory (now the state of Oklahoma). The county was dissolved on February 26, 1867.

3.2 EARLY COUNTY HISTORY[2]

Barber County

Barber County was organized on April 14, 1874, amidst "bond fraud" issues and padded census returns. The county was named for Thomas Barber, a free-stater from Ohio who was killed on the road between Bloomington and Lawrence during the Wakarusa War in 1855 by pro slavery men. James Lane called Barber one of the first Kansas martyrs of freedom and it was his suggestion the county be named for Barber. The name was misspelled as Barbour until an act of the 1883 legislature corrected it. It contains the cities of Hardtner, Hazelton, Isabel, Kiowa, Medicine Lodge, Sharon and Sun City.

Barton County

Barton County, named for Clara Barton, contains the cities of Albert, Claflin, Ellinwood, Galatia, Great Bend, Hoisington, Olmitz, Pawnee Rock and Susank. John R. Reinecke; Henry Schultz; John H. Hubbard; George M. Berry; William J. O'dell; T. L. Morries; E. L. Murphy; D. N. Heizer; and George Moses organized the county on May 16, 1872. This is the only Kansas County named for a woman. Fort Zarah was established on Sept. 6, 1864, to guard the Santa Fe Trail. The Santa Fe Railroad arrived in 1872 and the county became a shipping point for Texas cattle. Great Bend was established as the county seat in 1872.

Butler County

Butler County was organized on February 11, 1859, by William Hildebrand; Jerry Conner; Captain J. Cracklin; Henry Martin; Martin Vaught; Samuel Stewart; William Beemis; Jacob Carey and William Crimble.It was named for Andrew Pickens Butler, Senator from South Carolina, and contains the cities of Andover, Augusta, Benton, Cassoday, Douglass, Elbing, El Dorado, Lastham, Leon, Potwin, Rose Hill, Towanda and Whitewater. The discovery of oil in 1915 made the county one of the largest oil producers in the state.

Comanche County

Comanche County was first politically organized in 1873; however, this was fraudulently done. Bogus records showed a population in the county when in fact none existed. The creation of a false population allowed the legislature to organize the county and float bonds. The Attorney General, however, investigated and declared there was no population. Even so, the legislature declared a legal government had issued the fraudulent bonds, and this held the county back from any funding for improvements. In the Legislature of 1874 the county was represented even though it had no population. On February 27, 1885, the county was reorganized and lawsuits were begun against those holding the original bonds. It was not until 1941 that the bonds were completely retired. The county contains the cities of Coldwater, Wilmore and Protection.

[2] *Kansas State Historical Society, Kansapedia - Counties*

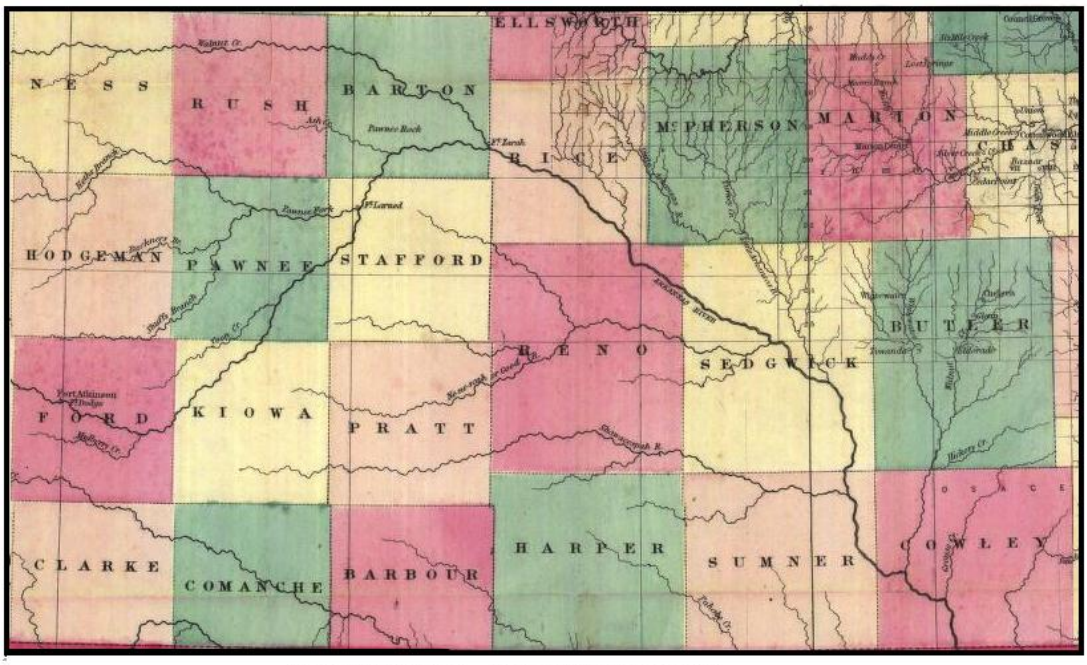
Cowley County

Cowley County was organized on February 28, 1870, by N. J. Thompson; William Quimby; James Renfro; T. B. Ross; John and Joseph Stanbury; F. W. Schwartz; S. B. Williams, and B. F. Murphy.Named for First Lieutenant Matthew Cowley, C. I, Ninth Kansas Cavalry, who was killed at Little Rock, Arkansas, in August, 1864, the county contains the cities of Udall, Arkansas City, Geuda Springs (part), Dexter, Atlanta, Burden, Cambridge and Winfield. Coronado is said to have camped near the site of Bliss Mill in his search for the cities of gold. An Indian supposedly placed a curse on the river that a whirlpool should claim one life per year.

Edwards County

On March 17, 1874, the Edwards County boundaries were defined by the Legislature and on August 1, 1874, the county was organized by Taylor Flick; Robert McCanse; Captain Peter H. Miles; and C. L. Hubbs. The county was named for W. C. Edwards of Hutchinson who promised that when the county was organized he would build a brick block of buildings in Kinsley if the county was named for him. He was the senior partner of the House of Edwards Brothers in Kinsley. It contains the cities of Belpre, Kinsley, Offerle and Lewis.
The Battle of Coon Creek was a major event in county history. Fought on June 18, 1848, between some 200 Comanche and Osage Indians and 140 soldiers on their way to fight in the Mexican War, this was the first battle to use breech-loading rifles. The story also tells of an Indian woman mounted on a horse, who seemed to be their queen, directing the handling of the wounded. On January 27, 1878, bandits attempting to loot the Santa Fe railroad station's safe, and also rob the westbound Pueblo Express, were foiled by a young telegraph operator named Andrew Kincaid. Four of the gang were later captured by Bat Masterson. In 1939 a "Half-Way" sign was erected two miles west of Kinsley denoting Kinsley's location as half-way between New York and San Francisco. The signing was done in commemoration of the 1939 World Fairs being held simultaneously in the two cities.

Colton's Township Map of Kansas - 1868



WSU Libraries - Special Collections

Harper County

Harper County was founded by H. E. Jessup; John Lamar; M. Devoure; J. B. Glenn; G. M.Goss; S. S. Gideon; and G. W. Francis, and contains the cities of Anthony, Attica, Waldron, Bluff City, Freeport, Danville and Harper. The county was first organized on August 20, 1873, but was determined fraudulent by the Attorney General as there was no population and the county was disorganized. It was reorganized on August 26, 1878. The story is told that during the fraudulent organization of the county, that early settlers near Bluff

Creek counted buffalo bones to represent families, and petitioned for Bluff City to be the temporary county seat on that basis. The county was named for Marion Harper, a sergeant in the Second Kansas Cavalry.

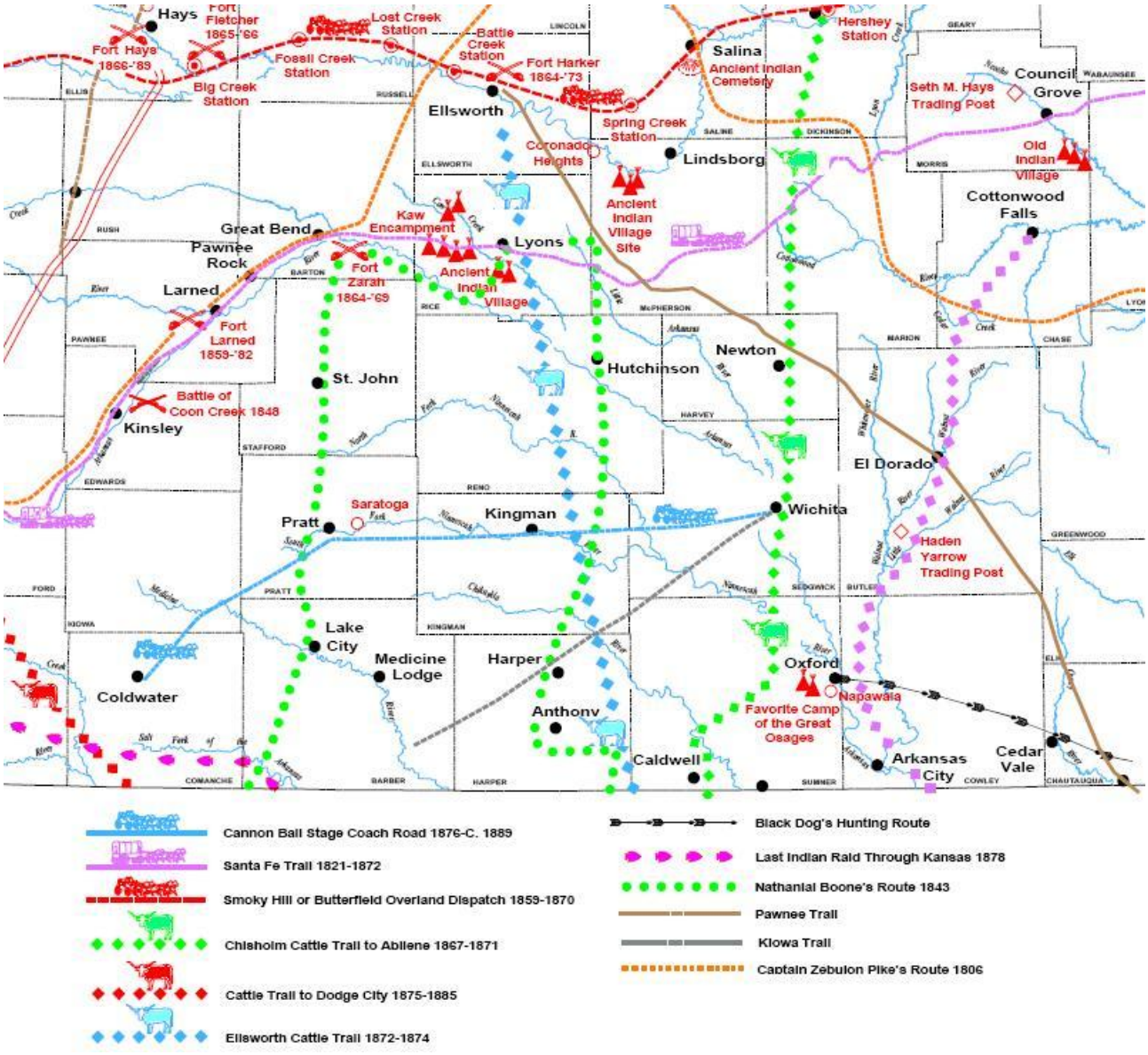
Harvey County

H. Neiman; Walter Munch; William Lawrence; Hubbard Wilcox; William McOwen; Charles Shafer; John Cogan; W. T. Wetherel; Joel T. Davis; R. M. Spivey; C. S. Bowneau; James Sprague; J. C. Johnston; D. Ainsworth; Judge R. W. P. Muse; and L. E. Steele organized Harvey County on February 29, 1872. Named for James Harvey, Governor of Kansas 1869-1873, the county contains the cities of Burrton, Hesston, Halstead, Newton, North Newton, Sedgwick (part) and Walton.

Kingman County

Kingman County was organized by J. F. Fical; J. W. Jordan; G. W. Lacey; H. L. Ball; J. Narmony; W. P. Brown; George Pitts; G. A. Whicher; and R. R. Wilson on February 27, 1874. Named for Judge Samuel B. Kingman of Topeka, it sontains the cities of Cunningham, Norwich, Spivey, Penalosa, Kingman, Nashville and Zenda.

HISTORIC TRAILS AND ROUTES



Source: Kansas Department of Transportation

Kiowa County

Kiowa County was founded on March 23, 1886, by J. W. Davis; C. F. Mingenbeck; C. P. Fullington; M. A. Nelson; and Cash Hopkins. The county was named for the Kiowa Indians and contains the cities of Greensburg, Mullinville and Havilan.

Marion County

Marion County was organized on July 6, 1865, by George Griffith; William H. Billins; William P. Shreve; Reuben Riggs; A. E. Case; and A. A. More. The county was named for General Francis Marion, Revolutionary War hero, and contains the cities of Peabody, Tampa, Lincolnville, Ramona, Durham, Florence, Hillsboro, Lehigh, Lost Springs, Marion, Burns and Goessel. Although based in fact, many stories of legendary proportions surround the area of land one section wide and eighteen sections long along the east boundary of the county. A murder had been committed in the area and Marion County did not want to have the trial so they gave those sections to Chase County to make certain the murder had occurred in that county. The immigration of Mennonites from Russia in 1874 and their purchase of vast acreages of government and railroad land; and the large purchases of land by William Scully, of Illinois, between 1870 and 1885 and his introduction of the Scully land system, which included tenant farming and drain tiling the fields, both helped the early settlement and development of the county. The Scully estate still owned 53,491 acres in as late as 1942.

McPherson County

McPherson County was organized on March 1, 1870, by A. G. Limm; Gustaf Johnson; Nicholas Sponberg; H. J. Nordlund; John F. Hughes; James M. Claypool; Robert Minns; and Harold Reese. It contains the cities of Canton, Windom, Galva, Lindsborg, McPherson, Marquette, Moundridge and Inman and was named for Civil War General James McPherson. A treaty with the Kaw Indians in 1825 that ceded all their land to the federal government opened the area to settlement. The arrival of the Chicago Swedish Company and founding of Lindsborg in 1868 prompted many Swedish settlers and the founding of Lindsborg College in the late 1860s and early 1870s. In 1881 Bethel College was founded.

Pawnee County

Pawnee County was organized on November 4, 1872, by A. H. Boyd; Henry Booth; Timothy McCarthy; and George J. Cox. Containing the cities of Garfield, Burdett, Rozel and Larned, the county was named for the Pawnee Indians. The establishment of Fort Larned in 1859 on the Santa Fe Trail was significant not only for defense of the Trail, but also to assist settlers in the area. The Hancock-Custer expedition of 1867 arrived at Fort Larned on April 7, 1867, and the two men conducted meetings with two Cheyenne chiefs, Tall Bull, and White Horse in an attempt to satisfy Indian displeasure at white settlement in the area. This meeting temporarily halted any problems along the Santa Fe Trail.

Pratt County

Pratt County was organized on July 25, 1879, by John Sillin; Thomas Goodwin; L. H. Naron; and L. C. Thompson. Containing the cities of Preston, Luka, Byers, Cullison, Coats, Sawyer and Pratt, the county was named for Caleb Pratt, who migrated from Massachusetts to Lawrence, became active in politics, served in the First Kansas Infantry in the Civil War and was killed during the War.

Reno County

Clinton Carter Hutchinson; Lewis M. Thomas; John Hart; J. H. D. Rosan; and Charles Street organized Reno County on January 1, 1872. Pretty Prairie, Arlington, Partridge, Willowbrook, Haven, Hutchinson, Langdon, Buhler, Turon, Nickerson, Plevna, South Hutchinson, Sylvia and Abbyville are all cities in the county. The county was named for Major General Jesse Lee Reno, Union army, killed at the Battle of Bull Run.

Rice County

Rice County was organized on August 18, 1871, by Earl Joslyn; J. Q. Adams; C. S. Lindell; John A. Carlson; and Andrew Johnson. Named for General Samuel A. Rice, killed at Jenkins Ferry, Arkansas, in the Civil War,

the county contains the cities of Frederick, Bushton, Chase, Lyons, Raymond, Sterkling, Little River, Alden and Geneseo.

Sedgwick County

Sedgwick County was organized on April 27, 1870, by Darius Munger; William Greiffenstein; Charles Whittaker; Eli Waterman; and John Lawton. It contains the cities of Haysville, Valley Center, Goddard, Bentley, Garden Plain, Mount Hope, Kechi, Eastborough, Cheney, Clearwater, Maize, Derby, Mulvane (part), Andale, Colwich, Sedgwick (part), Viola, Wichita, Park City and Bel Aire, the county was named for General John Sedgwick, U.S. Army, who was killed at the Battle of Spotsylvania, 1864. Sedgwick County was the northern terminus of the Chisholm Trail for a short time (1872-1876), and subsequently developed into an important cattle center. The Wichita and Southwestern Railroad Company (a branch of the Santa Fe) arrived in 1872, playing a crucial role in the development of the county's economic role in the state. The early development of the aircraft industry, beginning just prior to and during the 1920 saw the establishment of Cessna, Beech, Boeing, and other companies that made Wichita the center of the industry. Wichita is still a leader in military, commercial, and small aircraft production.

Stafford County

Stafford County was organized on July 2, 1879, by John Birkbeck; Martin Fitzpatrick; James O'Connor; Elisha, Edward and F. Williamson; Abraham Lash; H. Campbell; J. C. Stone; R. M. Blair; Jesse Vickers; E. D. Crawford; Edwin Hadlock; W. Z. Nutting; George C. Ardry, and W. R. Hoole. It was named for Captain Lewis Stafford, a Civil War soldier in the First Kansas Regiment, and contains the cities of Radium, St. John, Macksville, Hudson, Seward and Stafford. The establishment of a Mormon settlement northeast of St. John in 1875 brought a new population base to the county.

Sumner County

Sumner County was organized on February 7, 1871, by John J. Albert and John S. McMahon. Named for Senator Charles Sumner of Massachusetts, it contains the cities of Conway Springs, Belle Plaine, Caldwell, Argonia, Mulvane (part), Mayfield, Oxford, Milan, Hunnewell, South Haven, Geuda Springs (part), and Wellington.

3.3 TOPOGRAPHY[3]

Relief.--The region discussed in this report lies west of the Flint Hills and is included in the Great Bend Prairie physiographic province of Moore (1940). It is characterized by the extreme flatness of large areas and low topographic relief in parts of the area. The belt of sand dunes trending northwest-southeast along the northeast side of the Arkansas River valley, the scarps formed by Cretaceous sandstones in the northwestern and northeastern parts of the area, and the rough area underlain by Ninnescah shale along the Ninnescah River provide the only prominent relief to an otherwise nearly featureless plain.

The lowest points in the area, about 1,280 feet above sea level, occur along the Smoky Hill and Arkansas rivers where these streams flow out of the area. The highest points occur south of Sharps Creek about 3 miles north of Windom, McPherson County, and are about 1,700 feet above sea level.

The wide, flat, poorly drained valley plain of the Arkansas River, and the wide, flat to gently rolling surface of the ancient McPherson Valley comprise most of the area here discussed. Low terraces occur along the Arkansas and Smoky Hill rivers, but are not prominent topographic forms.

Drainage.--Most of the area covered by this report is drained by the Arkansas River and its tributaries. The northwestern part of the area is drained by the Smoky Hill River, a part of the Kansas River system, and the northeastern part is drained by the headwaters of Cottonwood River, a part of the Neosho River system. A few square miles southeast of Newton are drained by small tributaries of Walnut River, which joins the Arkansas River at Arkansas City. The central part of the area is drained by the Little Arkansas River which joins the Arkansas at Wichita. The southwestern part is drained by the north fork of the Ninnescah River

[3] *Geology and Ground-water Resources of a Part of South-central Kansas, KGS Bulletin 79*

which joins the Arkansas River near Oxford in Sumner County. The more important tributaries to the Little Arkansas River are Kisiwa, Emma, Turkey, and Black Kettle creeks; the tributaries to the Smoky Hill River are Sharps, Paint, Indian, and Gypsum creeks.

3.4 CLIMATE[4]

Kansas's continental climate is highly changeable. The average mean temperature is 55°F (13°C). The record high is 121°F (149°C), recorded near Alton on 24 July 1936, and the record low, –40°F (–40°C), was registered at Lebanon on 13 February 1905. The normal annual precipitation ranges from slightly more than 40 in (101.6 cm) in the southeast to as little as 16 in (40.6 cm) in the west; in Wichita, average annual precipitation (1971–2000) was 30.4 in (77.2 cm). The overall annual precipitation for the state averages 27 in (68.6 cm), although years of drought have not been uncommon. About 70–77% of the precipitation falls between 1 April and 30 September. The annual mean snowfall ranges from about 36 in (91.4 cm) in the extreme northwest to less than 11 in (27.9 cm) in the far southeast. Tornadoes are a regular fact of life in Kansas. Dodge City is said to be the windiest city in the US, with an average wind speed of 14 mph (23 kph).

3.5 DEMOGRAPHICS

Information presented in the following tables was obtained from the 2010 U.S. Census Bureau and shows a breakdown of race and ethnicity for the south central Kansas region.

RACIAL DEMOGRAPHICS

County	Total	White	African American	Asian	Other	2 or More Races
Barber	4,861	4,673	22	20	79	67
Barton	27,674	24,567	399	54	2,109	545
Butler	65,880	61,576	1,096	467	1,280	1,461
Comanche	1,891	1,825	6	5	31	24
Cowley	36,311	31,317	1,004	586	2,154	1,250
Edwards	3,037	2,758	21	12	214	32
Harper	6,034	5,711	22	5	210	86
Harvey	34,684	31,693	564	256	1,361	810
Kingman	7,858	7,611	14	36	98	99
Kiowa	2,553	2,441	17	16	53	26
Marion	12,660	12,154	104	27	168	207
McPherson	29,180	27,763	294	147	477	499
Pawnee	6,973	6,322	325	32	155	139
Pratt	9,656	9,083	114	27	246	186
Reno	64,511	58,469	1,930	309	2,094	1,709
Rice	10,083	9,213	128	37	437	268
Sedgwick	498,365	380,482	46,167	20,385	31,453	19,878
Stafford	4,437	4,110	13	17	242	55
Sumner	24,132	22,705	230	56	556	585
Totals	**850,780**	**704,473**	**52,470**	**22,494**	**43,417**	**27,926**

[4] *Kansas Climate, www.city-data.com*

ETHNIC DEMOGRAPHICS

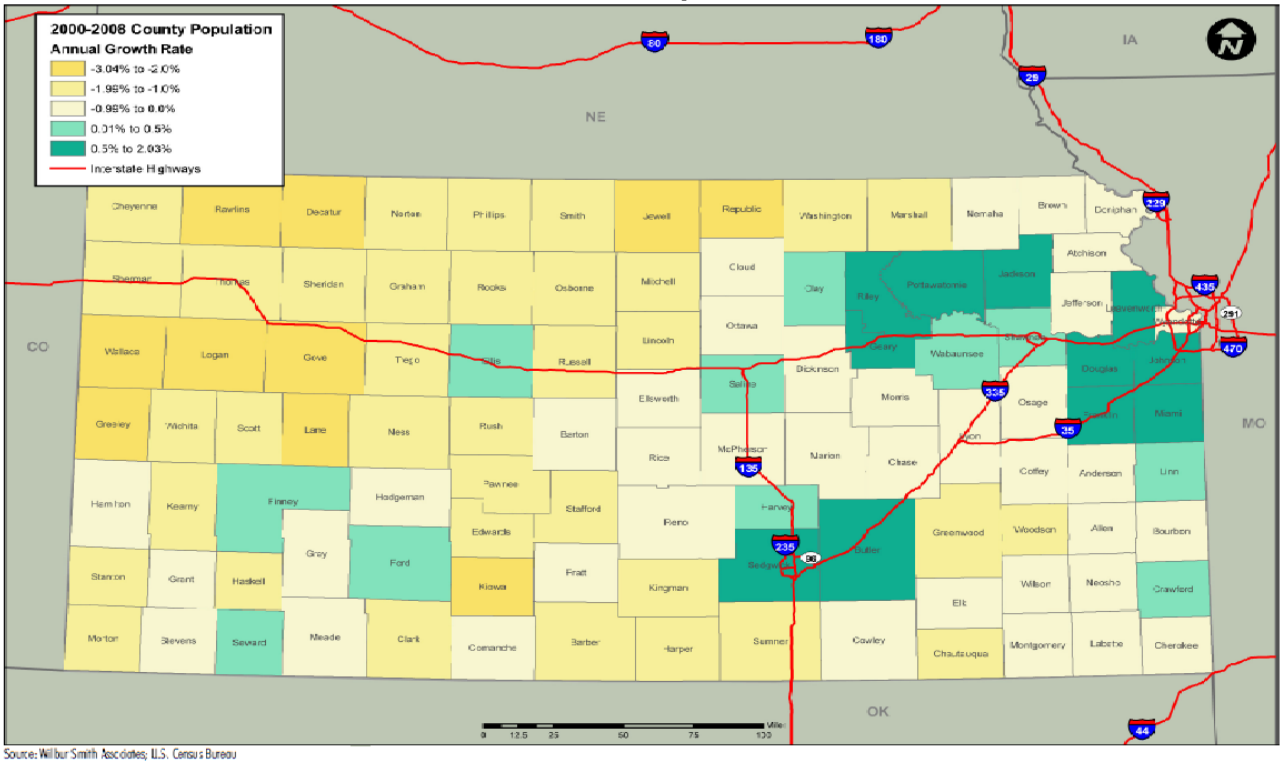
County	Hispanic or Latino	General
Barber	119	4,742
Barton	3,683	23,991
Butler	2,602	63,278
Comanche	73	1,818
Cowley	3,292	33,019
Edwards	534	2,503
Harper	298	5,736
Harvey	3,747	30,937
Kingman	199	7,659
Kiowa	99	2,454

County	Hispanic or Latino	General
Marion	296	12,364
McPherson	1,025	28,155
Pawnee	461	6,512
Pratt	525	9,131
Reno	5,209	59,302
Rice	1,018	9,065
Sedgwick	64,636	433,729
Stafford	529	3,908
Sumner	1,097	23,035
Totals	**89,442**	**761,338**

3.6 POPULATION

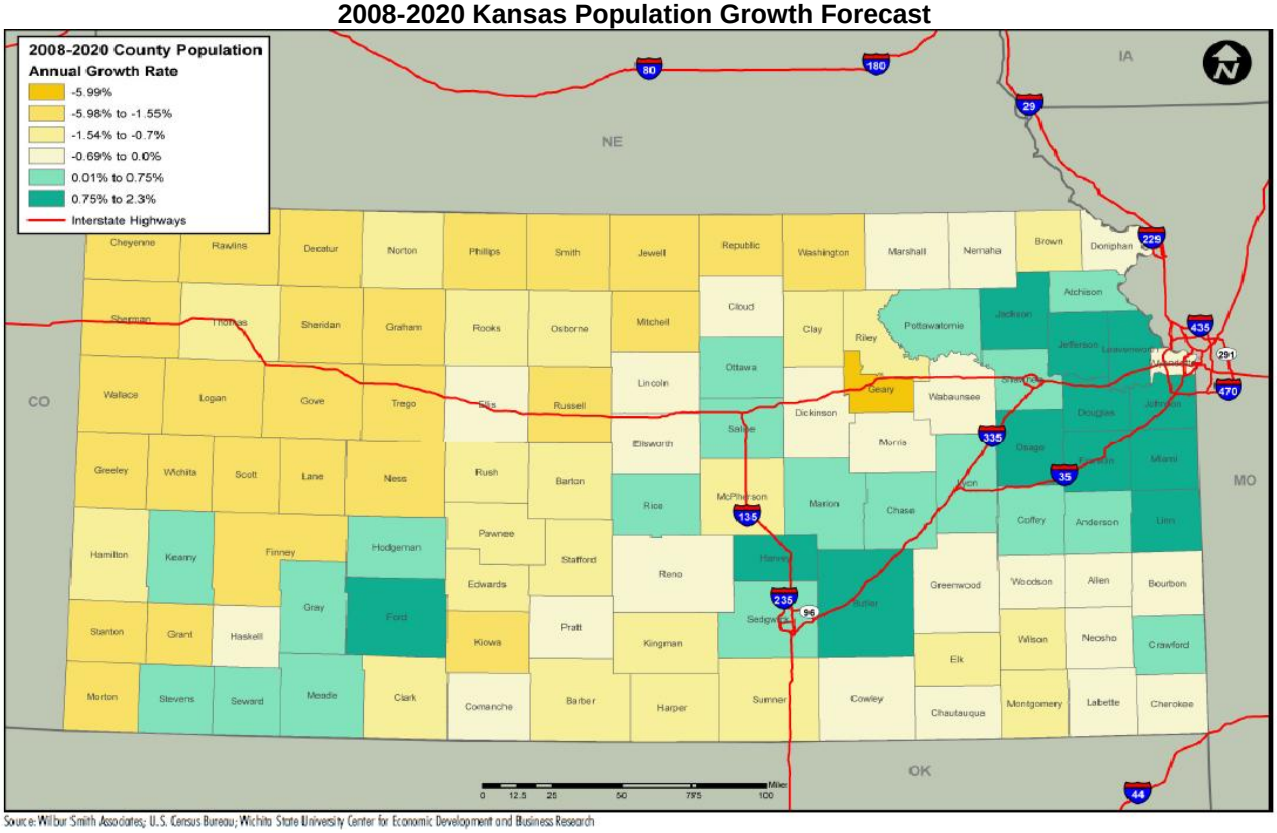
Historically, Kansas' population has been influenced by economic impact to include transportation (i.e. railroad) and industry (i.e. oil and gas exploration). Increases in population within the state are primarily around large urban areas and metropolitan/micropolitan statistical areas. The following maps show historical changes as well as projected changes of population to the year 2020. The chart shows the susceptible population distribution for each county of children and the elderly.

2000-2008 Kansas Population Growth



Source: Wilbur Smith Associates; U.S. Census Bureau

2008-2020 Kansas Population Growth Forecast



Source: Wilbur Smith Associates; U.S. Census Bureau; Wichita State University Center for Economic Development and Business Research

County	Persons Under 5 Years (%)	Persons 65 Years and Older (%)
Barber	5.7	19.1
Barton	7.0	16.4
Butler	6.8	12.8
Comanche	4.9	23.3
Cowley	6.7	14.2
Edwards	6.4	19.4
Harper	6.4	20.7
Harvey	6.6	16.8
Kingman	5.6	19.5
Kiowa	5.5	19.4
Marion	5.1	21.3
McPherson	6.1	17.1
Pawnee	5.6	14.2
Pratt	6.7	18.4
Reno	6.7	16.9
Rice	6.2	17.7
Sedgwick	8.2	11.5
Stafford	6.1	25.1
Sumner	6.4	15.0

3.7 HOUSING[5]

The census defines a housing unit as: a house, an apartment, a mobile home or trailer, a group of rooms, or a single room that is occupied, or, if vacant, is intended for occupancy as separate living quarters. According to the U.S. Census Bureau, the number of estimated housing units in Kansas increased 8.4% (95,469 units) between 2000 and 2009. When comparing the number of housing units, the State of Kansas ranks 33rd amongst the 50 states.

3.8 ECONOMY AND INDUSTRY

The following tables were obtained from the May 2010 Kansas Aviation Economic Impact Study technical report regarding employment by industry and gross state product for the State of Kansas:

Kansas Employment by Industry For 2008

Industry	*Employment*	*Percent*
Agriculture, Forestry, Fishing, and Hunting	72,956	3.9%
Mining	27,854	1.5%
Utilities	7,835	0.4%
Construction	100,466	5.4%
Durable Goods Manufacturing	125,113	6.7%
Non-durable Goods Manufacturing	68,645	3.7%
Wholesale Trade	68,537	3.7%
Retail Trade	190,110	10.1%
Transportation and Warehousing	59,567	3.2%
Information	43,074	2.3%
Finance and Insurance	89,158	4.8%
Real Estate, Rental, and Leasing	62,268	3.3%
Professional and Technical Services	96,210	5.1%
Management of Companies	14,541	0.8%
Administrative and Waste Service	99,595	5.3%
Educational Services	24,235	1.3%
Health Care and Social Assistance	188,997	10.1%
Arts, Entertainment, and Recreation	28,016	1.5%
Accommodation and Food Services	111,494	5.9%
Other Services	98,721	5.3%
Government	297,742	15.9%
Total	**1,875,134**	**100%**

Source: US Bureau of Economic Analysis

[5] *2010 Kansas Mitigation Plan*

Kansas Gross State Product by Industry For 2008

Industry	*Gross State Product (In Millions)*	*Percent*
Agriculture, Forestry, Fishing, and Hunting	$3,584	2.9%
Mining	$3,376	2.8%
Utilities	$2,767	2.3%
Construction	$4,364	3.6%
Durable Goods Manufacturing	$11,881	9.7%
Non-durable Goods Manufacturing	$6,718	5.5%
Wholesale Trade	$7,634	6.2%
Retail Trade	$8,102	6.6%
Transportation and Warehousing	$4,448	3.6%
Information	$7,220	5.9%
Finance and Insurance	$6,851	5.6%
Real Estate, Rental, and Leasing	$10,037	8.2%
Professional and Technical Services	$6,833	5.6%
Management of Companies	$2,002	1.6%
Administrative and Waste Service	$3,674	3.0%
Educational Services	$645	0.5%
Health Care and Social Assistance	$8,801	7.2%
Arts, Entertainment, and Recreation	$519	0.4%
Accommodation and Food Services	$2,927	2.4%
Other Services	$2,929	2.4%
Government	$17,418	14.2%
Total	**$122,730**	**100%**

Source: US Bureau of Economic Analysis

Historically, a major sector of Kansas' economy has been agriculture, driven by the global demand for grain and food exports. In 2008, agriculture made up only three percent of the gross state product. Government is the largest sector of Kansas' economy, as local, state, and federal governments constitute 14 percent of the gross state product. Durable goods manufacturing is the second largest sector at 10 percent gross state product, while real estate and health care are the next most productive industries at eight and seven percent, respectively. Aerospace plays a major role in the productivity of durable goods manufacturing, as several large aircraft corporations have manufacturing facilities in Kansas, including Spirit AeroSystems, Boeing, Cessna, Learjet, Hawker Beechcraft, and their respective suppliers. It is also important to note that the mining industry has significant presence in Kansas, as it is the eighth largest producer of oil and natural gas in the U.S.[6]

[6] *U.S. Energy Information Administration*

3.9 Population Characteristics

The following table shows a comparison of each of the counties in south central Kansas and compares the data between the regional average and state average. All figures were obtained from the 2010 U.S. Census and shown in percent with the exception of population.

County	Population	Under Age 5 (%)	65 and Over (%)	Language Other Than English (%)	Below Poverty (%)
Barber	4,861	5.7	19.1	2.4	11.9
Barton	27,674	7.0	16.4	10.8	14.0
Butler	65,880	6.8	12.8	3.2	9.3
Comanche	1,891	4.9	23.3	2.0	10.3
Cowley	36,311	6.7	14.2	6.0	15.7
Edwards	3.037	6.4	19.4	12.7	11.9
Harper	6,034	6.4	20.7	3.1	14.4
Harvey	34,684	6.6	16.8	7.8	10.5
Kingman	7,858	5.6	19.5	3.1	10.4
Kiowa	2,553	5.5	19.4	4.1	12.8
Marion	12,660	5.1	21.3	4.5	10.7
McPherson	29,180	6.1	17.1	3.2	9.0
Pawnee	6,973	5.6	14.2	3.1	14.4
Pratt	9,656	6.7	18.4	5.1	11.2
Reno	64,511	6.7	16.9	6.2	13.8
Rice	10,083	6.2	17.7	6.9	12.2
Sedgwick	498,365	8.2	11.5	11.8	13.5
Stafford	4,437	6.1	25.1	8.3	14.9
Sumner	24,132	6.4	15.0	2.2	11.4
SC Region	850,780	6.3	17.8	5.6	12.2
Kansas	2,853,118	7.3	13.0	9.9	13.2

3.10 Special Populations

3.10.1 Disability Status of the Aged

Census 2000 asked respondents about five types of disability: sensory, physical, mental, self-care, and mobility. The percent of persons reporting at least one disability was highest among persons 65 and older, with two out of every five aged Americans reporting at least one disability. Physical disability accounted for the majority of the reported disabilities in the 65 and older population. Mobility disability was the next most frequently reported disability.

Kansas - Disability Status of the Aged, 2000

	Number	Percent
Population Age 65 and over	**330,661**	**100.00%**
No disability	**193,573**	**58.54%**
One disability*	**70,665**	**21.37%**
Sensory disability only	14,375	4.35%
Physical disability only**	36,239	10.96%
Mental disability only	3,970	1.20%
Selfcare disability only	535	0.16%
Mobility disability only***	15,546	4.70%
Two or more disabilities	**66,423**	**20.09%**

Source: CensusScope

South Central Kansas - Disability Status of the Aged, 2000

	BA	BT	BU	CM	CL	ED	HP	HV	KM	KW
Population Age 65 and over	**1,073**	**4,651**	**6,772**	**455**	**5,419**	**700**	**1,357**	**5,053**	**1,522**	**663**
No disability	**670**	2,747	3,854	246	3,033	388	765	2,871	940	363
One disability*	**236**	**1,042**	**1,370**	**100**	**1,154**	**171**	**323**	**1,252**	**324**	**165**
Sensory disability only	51	280	282	20	227	32	86	312	44	35
Physical disability only**	121	490	674	61	633	94	151	635	170	76
Mental disability only	12	23	109	5	23	8	29	57	2	8
Selfcare disability only	0	0	3	0	29	0	7	10	0	2
Mobility disability only***	52	249	302	14	242	37	50	238	108	44
Two or more disabilities	**167**	**862**	**1,548**	**109**	**1,232**	**141**	**269**	**930**	**258**	**135**

	MN	MP	PN	PR	RN	RC	SG	SF	SU	Total
Population Age 65 and over	**2,561**	**4,459**	**1,165**	**1,699**	**9,725**	**1,826**	**49,457**	**941**	**3,686**	**103,184**
No disability	1,468	2,867	668	951	5,666	1,093	29,167	602	2,220	60,579
One disability*	**550**	**1,036**	**261**	**418**	**2,100**	**354**	**10,291**	**165**	**699**	**22,011**
Sensory disability only	94	200	37	70	497	94	1,936	30	198	4,525
Physical disability only**	282	419	170	216	1,062	177	5,255	75	352	11,113
Mental disability only	34	60	9	28	74	13	690	19	34	1,237
Selfcare disability only	13	2	0	0	7	0	79	0	0	152
Mobility disability only***	127	355	45	104	460	70	2,331	41	115	4,984
Two or more disabilities	**543**	**556**	**236**	**330**	**1,959**	**379**	**9,999**	**174**	**767**	**20,594**

* Disability: A long-lasting physical, mental, or emotional condition. This condition can make it difficult for a person to do activities such as walking, climbing stairs, dressing, bathing, learning, or remembering. This condition can also impede a person from being able to go outside the home alone or to work at a job or business.

** Physical Disability: A condition that substantially limits one or more basic physical activities such as walking, climbing stairs, reaching, lifting, or carrying.

*** Mobility Disability: The 2000 Census asks people if they have a "Go Outside The Home" disability. In previous years, the question has been labeled a "Mobility Disability." Both terms have the same meaning and include people who are limited from leaving their homes without assistance. The Census specifically asks if a person is unable to go outside the home for activities such as shopping and visiting the doctor.

3.10.2 Household Type of the Aged

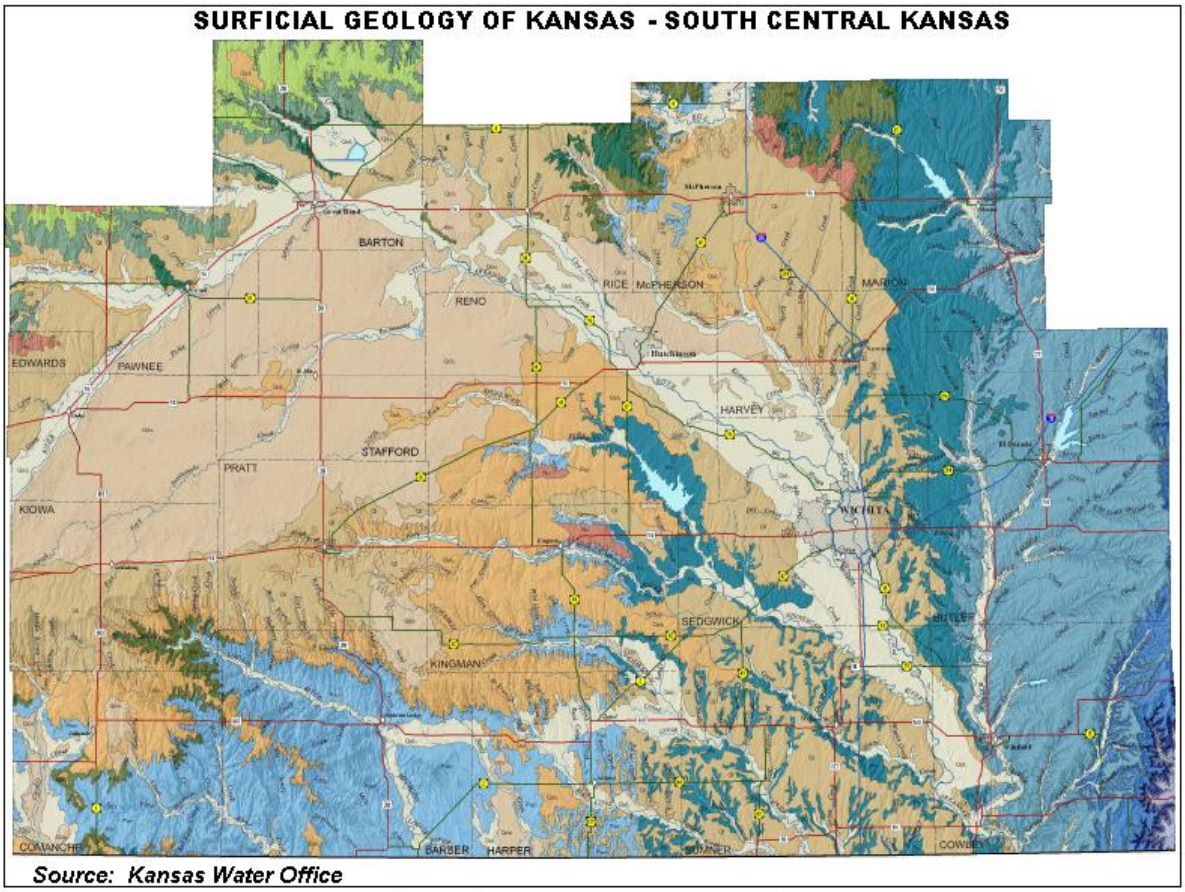
In 2000, 64 percent of Americans over 65 lived with one or more related family members. Of those not living in family households, most lived alone. In fact, 28.2 percent of Americans 65 and older lived alone in 2000. This may indicate a need for better social networks for the aged population.

About 4.7 percent of aged Americans lived in institutionalized group quarters, which include nursing homes, mental hospitals, and correctional facilities. The remaining 3.1 percent of aged Americans lived in non-family households or non-institutionalized group quarters, which include college dormitories, military barracks, group homes, missions, and shelters.

4 PHYSICAL CHARACTERISTICS

4.1 GEOLOGY

The subsurface formations within the Lower Arkansas basin include three major systems; from oldest to youngest: Permian, Cretaceous, and Quaternary.



Cenozoic Era
Quaternary System
- Qal3 Alluvium (late Pleist. and Holocene)
- Qds Dune sand
- Ql Loess
- Qal2 Alluvium (early Pleistocene)
- Qgd Glacial drift

Neogene System
- Ntd Terrace deposits
- No Ogallala Fm

Mesozoic Era
Cretaceous System
- Kp Pierre Sh
- Kn Niobrara Clk
- Kc Carlile Sh
- Kgg Greenhorn Ls Graneros Sh
- Kd Dakota Fm
- Kkc Kiowa Fm Cheyenne SS

Igneous rocks emplaced during Cretaceous
- K Kimberlite
- L Lamproite

Jurassic System
- JR

Paleozoic Era
Permian System
- Pbd Big Basin Fm Day Creek Dol
- Pwn Whitehorse Fm Nippewalla Gp
- Ps Sumner Gp
- Pc Chase Gp
- Pcg Council Grove Gp

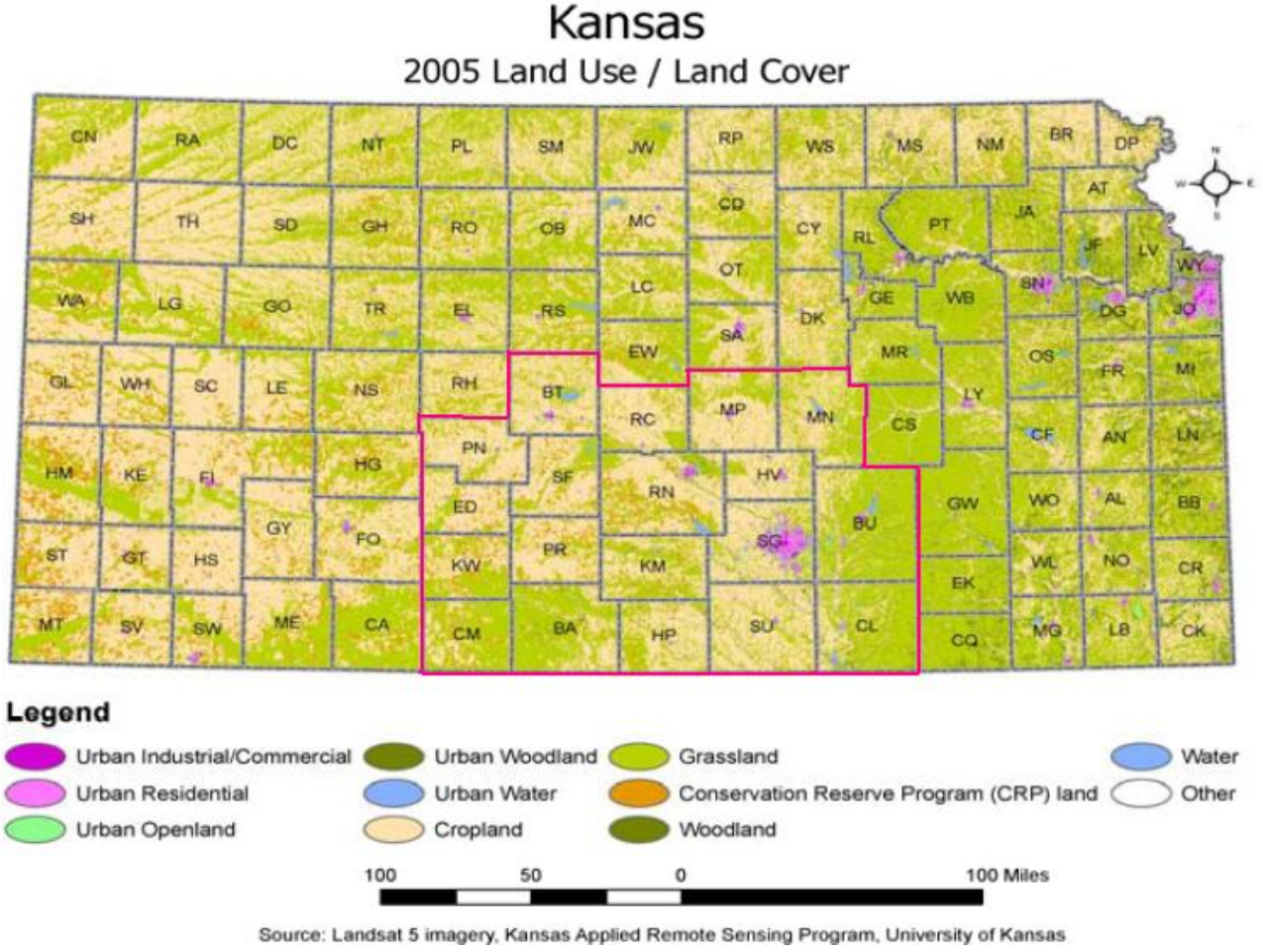
Carboniferous System
Pennsylvanian Subsystem
- IPcg Council Grove Gp
- IPa Admire Gp
- IPw Wabaunsee Gp
- IPs Shawnee Gp
- IPd Douglas Gp
- IPl Lansing Gp
- IPkc Kansas City Gp
- IPp Pleasanton Gp
- IPm Marmaton Gp
- IPc Cherokee Gp

Mississippian Subsystem
- M Warsaw Ls Burlington-Keokuk Ls

The formations in the Permian system are relatively poor sources of ground water in terms of quantity and quality. The same is true of the formations in the Cretaceous system, except in the northern part of the Lower Arkansas River valley where the Dakota Formation is a principal source of water supplies. The sands and gravels of the Quaternary system are a good source of ground water in the basin. The topography in the basin varies from flat, undulating plains of slight relief to rolling uplands and, in places, steep bluffs and hills. Elevation ranges from about 1,700 feet to about 1,100 feet. Sandy soils and sand dunes are prevalent, mostly in the river valleys, but fine textured soils, tight clays and many other soil types are also represented.

4.2 LAND USE

The following map shows the land use by thermal imaging for Kansas with the south central region outlined.



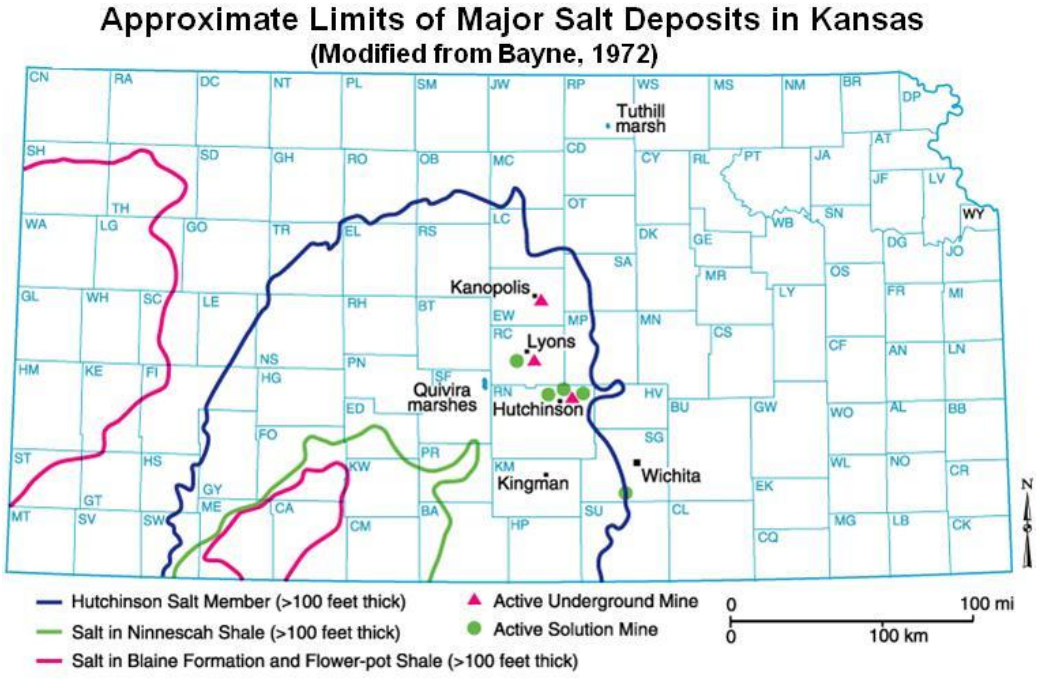
Source: Landsat 5 imagery, Kansas Applied Remote Sensing Program, University of Kansas

5 SALT DEPOSITS

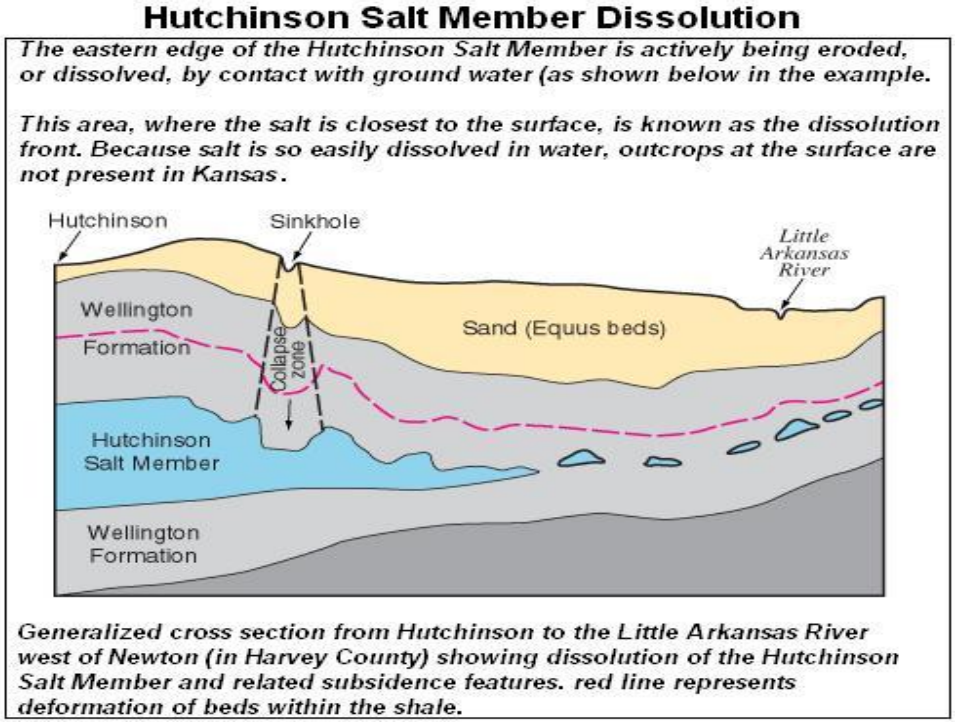
Salt--Salt deposits of the Wellington Formation of Permian age typically averages 450 feet thick (Gogel, 1980). The salt beds are interstratified with thin beds of shale, anhydrite, and limestone, but many beds of minable thickness are present. These deposits of salt underlie most of south-central Kansas and were laid down in Permian seas that were partly cut off from the ocean.

The Cimarron Salt (Lower Permian) is a relatively thin rock salt stratigraphically situated within the upper part of the Ninnescah Shale as shown on the4 next page. The Cimarron Salt is present only in the south-central and southwestern regions of Kansas. However, it extends southward into Oklahoma where it is much thicker and more expansive (Jordan and Vosburg, 1963). In Kansas, the salt attains maximum thicknesses of approximately 250 feet in Clark and Comanche Counties, and up to 200 feet in Barber County. Locally, the

Cimarron salt has been extensively leached and is believed to be a possible source for ground water contamination in portions of Kansas (Cobb, 1980; Cobb, 1983; Gillespie and Hargadine, 1992).[7]



Source: Kansas Geological Survey, Public Information Circular (PIC) 21

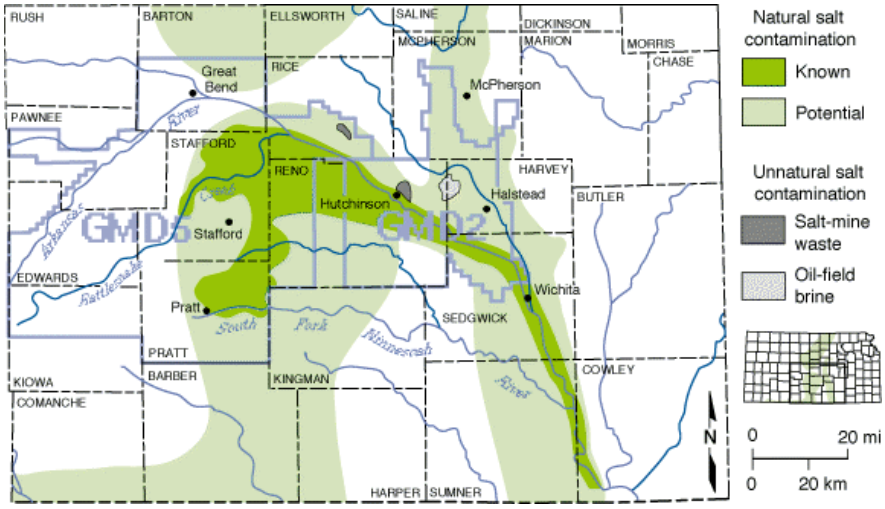


SALT CONTAMINATION

South-central Kansas contains unconsolidated (uncemented) sand and gravel aquifers of the Great Bend Prairie, the Equus Beds, and the Arkansas River valley. Areas with known or potential saltwater contamination in south-central Kansas are shown below. Areas identified as "known" natural salt

[7] *Kansas Geological Survey, Open-File Report 96-11*

contamination have saltwater within the freshwater aquifer. In the areas labeled "potential" natural salt contamination, subsurface bedrock formations containing salt or saltwater are in contact with the overlying freshwater aquifers.



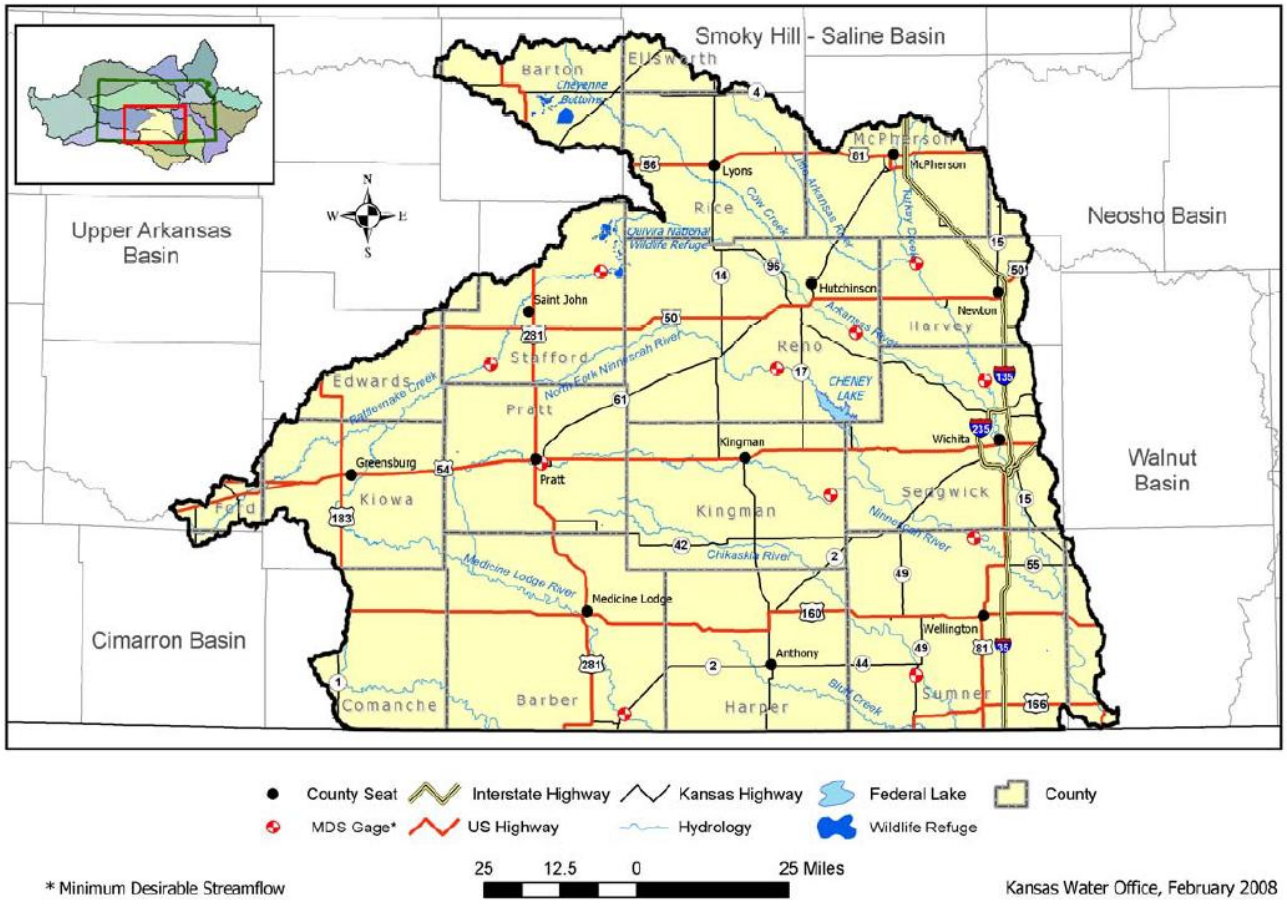
Possible sources of excess salinity in ground water include 1) recharge by irrigation water, 2) contamination of surface water or soil by waste water, road salt, and other sources, 3) contamination by oil-field brine and salt-mine waste, and 4) naturally occurring sources of salt. Recharge by irrigation water and contaminated surface-water typically causes modest salinity increases in ground water, while contamination by oil-field brines and salt mining can be highly concentrated. Salt contamination associated with oil or mining activities is typically localized.

Natural sources of salt contamination of freshwater aquifers include salt- and saltwater-bearing bedrock formations. Severe drought can lead to salt-contamination problems not observed during normal or excess precipitation. During periods of little or no recharge, ground water continues to discharge naturally from freshwater aquifers, decreasing the thickness of the freshwater zone overlying the saltwater. Regional pumping is likely to be greater during droughts and can further decrease the thickness of the freshwater aquifer.[8]

[8] *Salt in Kansas, Kansas Geological Survey, Bulletin 214*

6 RIVER BASINS

6.1 LOWER ARKANSAS RIVER BASIN[9]



General Description

The Lower Arkansas River Basin in Kansas is part of the Arkansas River basin. The Arkansas River originates in central Colorado, where it flows southeast into and across southern Kansas. The Arkansas River crosses the Kansas-Oklahoma border south of Arkansas City (Cowley County). The Arkansas basin in Kansas is divided into two basins, Upper and Lower, for planning purposes. The Lower Arkansas basin begins where Rattlesnake Creek confluences with the Arkansas River in southwestern Rice County. Major tributaries entering the river along its course through the basin are Rattlesnake Creek, Cow Creek, Little Arkansas River, Ninnescah River and Slate Creek. Other major streams in the basin that flow within Kansas and join the Arkansas River in Oklahoma are the Chikaskia River, Medicine Lodge River and Salt Fork. The only major federal reservoir in the basin is Cheney Reservoir. The Lower Arkansas basin covers 11,500 square miles of south central Kansas and includes all or part of 20 counties.

Population and Economy

The basin has the second largest population of the twelve major river basins, with an estimated 641,000 residents in the year 2000. According to projections conducted using Kansas Division of Budget population data, the population in the 20 counties included as a whole or in part in the basin, is projected to grow to nearly 887,450 in the year 2040. Nearly all of this growth will be in Sedgwick and the surrounding counties. Major population centers include Wichita, Newton, Hutchinson, Wellington and McPherson.

The general economy of the basin is diversified with farming throughout the area and industrial activity most heavily concentrated in the Wichita-Newton-Hutchinson vicinity. Corn, wheat and livestock are the principal

[9] *Kansas Water Office*

agricultural products (*USDA, Kansas 2006-2007 County Farm Facts, Agricultural Statistics and Ranking*). Many kinds of industries are represented in the basin, with the aircraft and oil and gas industries being of major importance. The salt mines of the state are located largely in this basin. There is a sizable gypsum production facility west of Medicine Lodge. There is one oil refinery located in the basin in McPherson.

The growing industrial contribution to the basin economy is primarily related to energy production, including ethanol. As of November 2008, three ethanol plants are located in the basin in Pratt (now idle), Sedgwick and Rice counties. An additional ethanol plant is under construction in Sedgwick County. Two biodiesel plants have been permitted for construction in Stafford and Kiowa Counties, and one is under construction in Sedgwick County.

Land Use/Land Cover

Land use in the basin typically is dominated by cropland (55.8%) or grassland (32.5%) and Conservation Reserve Program land (5.5%). The remaining land cover is forest or woody (2.4%) and industrial use, municipal use, open water and barren ground. The Lower Arkansas basin contains 49,108 stream bank miles. Within a 100-foot corridor along each bank, about 36% of the land is pasture/grassland followed by crop/tree mix (35%), cropland (34%), pasture/tree mix (13%) and forest land (11%). While comprising less than 1% of the bank miles, the Lower Arkansas basin has the most urban land stream bank area of the Kansas basins.

Wildlife and Habitat

The Lower Arkansas River basin is comprised primarily of four physiographic regions: High Plains, Red Hills, Arkansas River Lowlands and Wellington-McPherson Lowlands. Native vegetation in these regions ranges from mixed grass and sandsage prairie grasses to floodplain woodlands species such as cottonwood and black willow. Numerous threatened and endangered species occur in the Lower Arkansas basin. Of these, ten are birds, two are mammals, three are reptiles, one is an amphibian and six are fish.

Water Resources

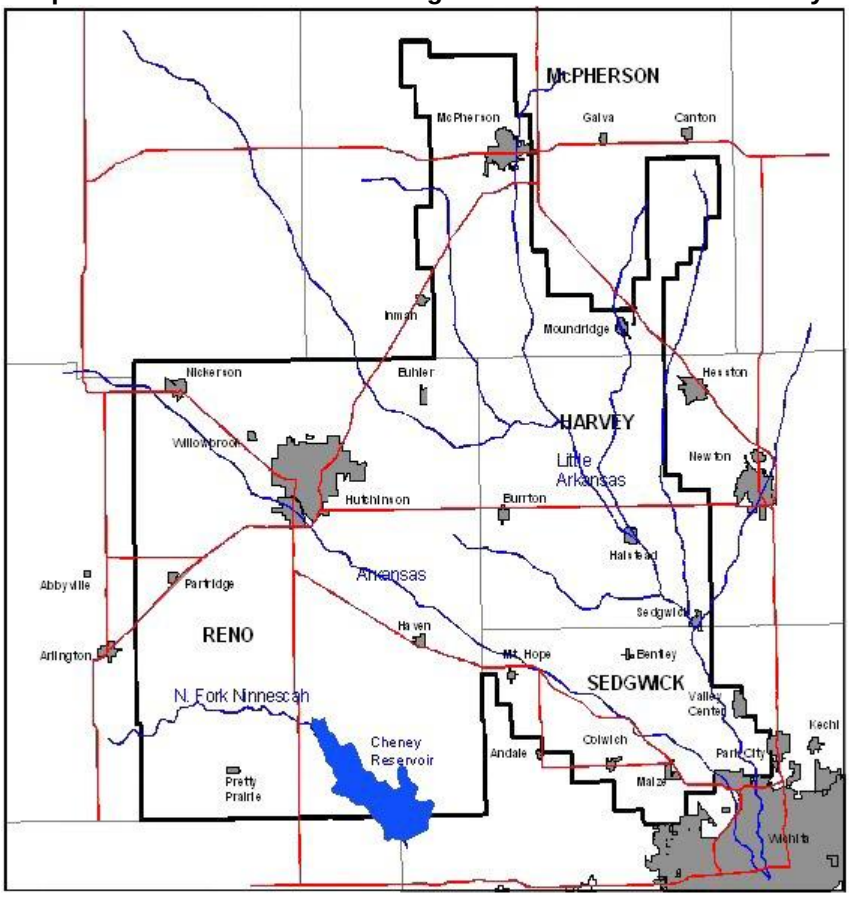
Ground water, which is very shallow in some places, i.e. the Equus Beds aquifer, is the source for 92 percent of supply for all reported uses in 2006. Irrigation accounted for nearly 75% of all reported water pumped or diverted. Municipal use accounted for 15% of water used in the basin; industry for five percent; and recreation, stock water and other uses combined equal about five percent (2006). The Lower Arkansas basin contains 20,974 miles of intermittent and 2,592 miles of perennial streams for a total of 23,566 stream miles. The basin has a density of 2.1 stream miles per square mile. Stream flows in the Lower Arkansas basin are highly variable within the year, and from one year to another. The major sources of surface water are Cheney Reservoir on the North Fork of the Ninnescah River in Reno County, and Wellington Lake in Sumner County, which drains into the Chikaskia River.

Water Management

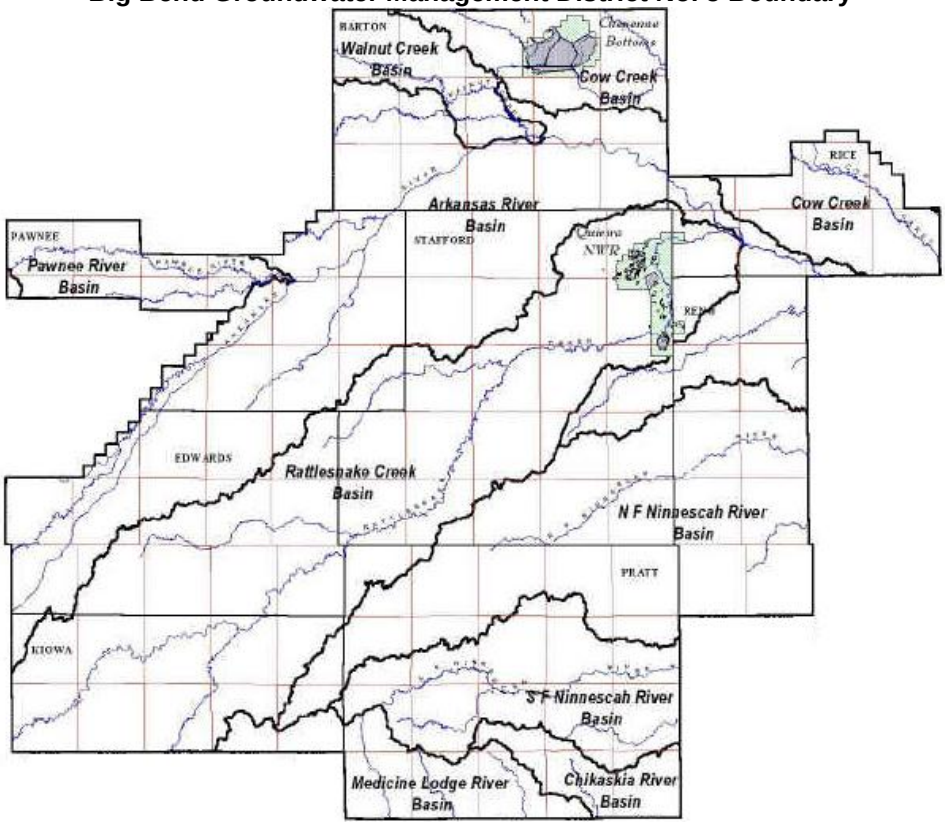
There are two Groundwater Management Districts (GMDs) in the Lower Arkansas basin which cover most of the area. The Equus Beds GMD2 was formed in 1975 and operates under a "safe yield concept" in which appropriations are managed so that the quantity of ground water withdrawn from a given area is approximately equal to the average annual recharge to the same area. Big Bend GMD #5, in the northwestern part of the basin, was formed in 1976 and also operates under a safe yield policy. There are two Intensive Ground Water Use Control Areas (IGUCAs) within GMD2: the McPherson Area IGUCA, and a 36 square mile area surrounding the town of Burrton in Harvey County. Each IGUCA is managed with programs and activities for the particular needs of that area. There are two IGUCAs in GMD5: the eastern portion of the Wet Walnut IGUCA, and the Pawnee IGUCA in Pawnee County.

Groundwater Management District Nos. 1, 3, and 5 are major local water management entities in the basin. Equus Beds Groundwater Management District No. 2 and the Big Bend Groundwater Management District No. 5 boundaries are shown on the next page.

Equss Beds Groundwater Management District No. 1 Boundary

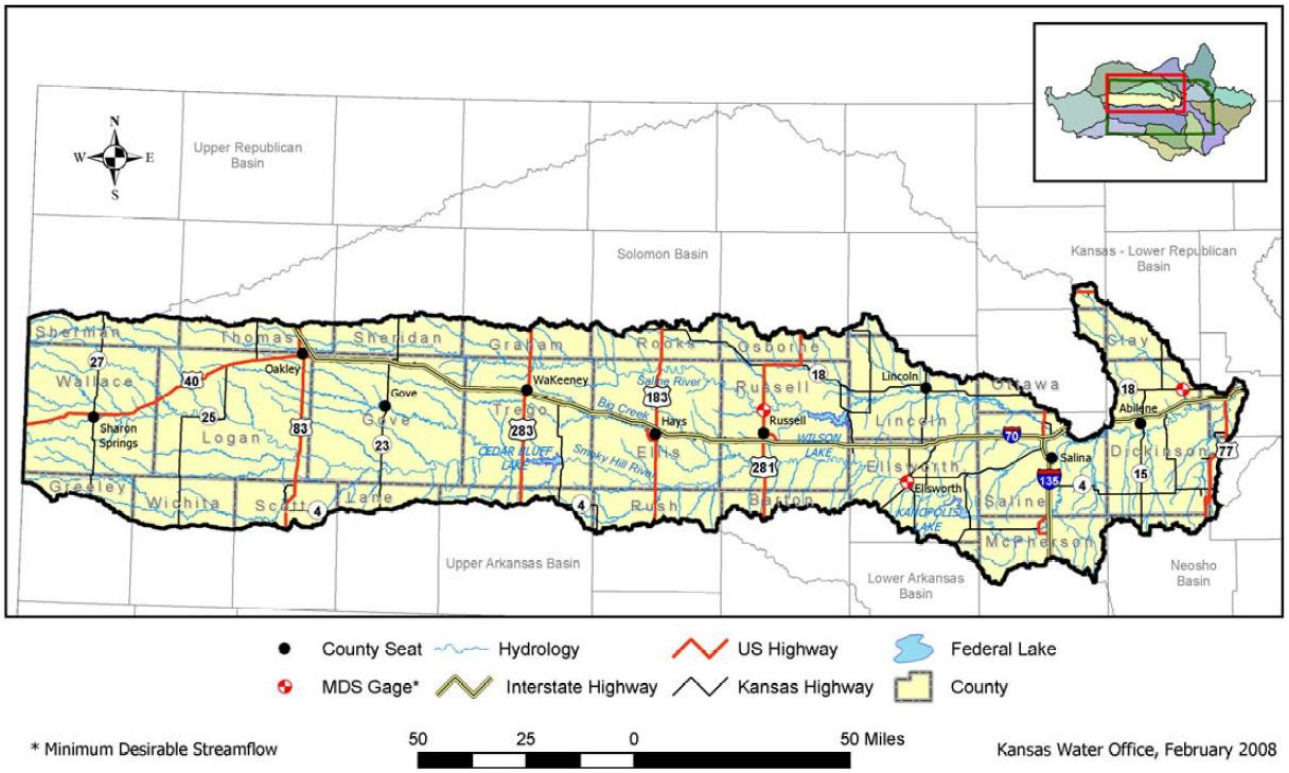


Big Bend Groundwater Management District No. 5 Boundary



Seven watershed districts are included in the Lower Arkansas basin: Upper Little Arkansas, Sand Creek, Mount Hope, Andale, Goose Creek, Spring Creek and Clear Creek. The county conservation district is the primary local unit of government responsible for the conservation of soil, water and related natural resources within the county boundary. Each county within the Lower Arkansas River basin has a county conservation district. Three Resource Conservation and Development (RC&D) districts serve the counties of the Lower Arkansas basin: the Sunflower RC&D, Flint Hills RC&D and Central Prairie RC&D. The RC&Ds are designed to help community leaders develop rural economies by improving and conserving local natural, human and economic resources.

6.2 SMOKY HILL-SALINE RIVER BASIN[10]



General Description

The Smoky Hill-Saline basin lies within the Great Plains and Central Lowland physiographic provinces. The Smoky Hill-Saline basin in Kansas is an elongated drainage area, which extends eastward from the Colorado border approximately 250 miles to the vicinity of Junction City, Kansas. The Smoky Hill-Saline Basin covers all or parts of Sherman, Thomas, Sheridan, Graham, Wallace, Logan, Gove, Trego, Greeley, Wichita, Scott, Lane, Ness, Rooks, Osborne, Mitchell, Cloud, Ellis, Russell, Lincoln, Ellsworth, Dickinson, Geary, Morris, Saline, Rush, Barton, Rice, McPherson and Marion counties. The basin includes sub-basins with hydrologic unit codes (HUCs) 10260001 thru 10260010. The Smoky Hill River headwaters are located in eastern Colorado where the North and South Forks rise. These forks join in Logan County, Kansas. The Smoky Hill River has a drainage area of about 8,810 square miles. The Smoky Hill River flows eastward to Junction City to the confluence with the Republican River. Below this point the river is known as the Kansas River. The drainage area of the Saline River is about 3,419 square miles. The Saline River, a tributary of the Smoky Hill, rises near the Sherman-Thomas County line in extreme western Kansas. The Saline River flows eastward to its confluence with the Smoky Hill River several miles east of Salina, Kansas. The entire Smoky Hill-Saline basin in Kansas has a drainage area of about 12,229 square miles. Topography within the basin is flat to gently rolling, with narrow, shallow valleys and low relief. The highest point in Kansas, Mount Sunflower at 4,039 feet above mean sea level (MSL), is located in northwestern Wallace County. From this point, elevations in the basin decrease to approximately 1,087 feet above MSL at the confluence of the Smoky Hill and Republican rivers.

[10] *Kansas Water Office*

Population and Economy

The basin had a population of 156,161 in 2000. The population of the 32 counties that are entirely or partially in the Smoky Hill-Saline basin was 330,631 in the year 2000 and is projected to be 288,939 in the year 2040. Rural counties have lost population, sometimes more than 10% in the last decade. The economy of the basin is based primarily on agriculture and manufacturing. The major crops are wheat, grain sorghum, corn and alfalfa with a sizable portion of this acreage being irrigated. In 2006 there were an estimated 17,060 farms with 15,966,000 acres in the 32 counties with all or parts in the basin. The average farm is about 936 acres. Recreation is an increasing part of the economics of the basin. The federal reservoirs and associated recreation and wildlife areas draw hunters, fishermen and boaters to the area. In addition, the state supports fishing at: Kanopolis State Park Pond (2 acres, 33 miles SW of Salina on Hwy K-149 & K-141); and Saline State Fishing Lake (Periodically Dry) (38 acres, 2-1/2 N 2 W of Salina). Logan State Fishing Lake (60 acres, 2 N 2 W of Russell Springs) is still listed by Kansas Department of Wildlife and Parks as a fishing opportunity; however it has been dry for many years. The growing industrial contribution to the basin economy is primarily related to energy production, including ethanol. As of December 2007, two ethanol plants were in operation in the basin.

Geology and Soils

Cretaceous bedrock underlying the basin consists of shale, limestone, and chalk. The most notable being the Niobrara Chalk and the Dakota Sandstone. The river and tributary valleys are comprised of unconsolidated deposits of gravel, sand, silt and clay. The bedrock has an east-to-southeast drainage trend. In the west, the rocks that outcrop are sedimentary in origin and range in age from Cretaceous to Recent. The Ogallala Formation of Late Tertiary (Pliocene) age uncomfortably overlies these older formations. Thin, dissected and isolated deposits of sand and gravel of Pleistocene age occur along the larger streams, chiefly the South Smoky Hill and North Smoky Hill Rivers. These deposits have been derived from the Ogallala Formation and lithologically are very similar to the Ogallala. The Smoky Hill River is completely incised into the Cretaceous Niobrara Formation throughout most of Kansas, so has little contact with the Ogallala-High Plains aquifer. However, two major tributaries, the Saline River and Ladder Creek, do have substantial connection. The terrace deposits and valley fill of the Smoky Hill valley become thicker and of greater areal extent to the east. The Smoky Hill-Saline basin soils vary widely in character. The soils are poor shallow soils in the west along streams with fertile loess soil in the uplands. Shallow, acidic and infertile soils occur through Trego, Ellis and Russell counties. Bottom land soils ranging from sand to clays and from permeable, friable soils to tight soils

Land Use/Land Cover

The basin covers approximately 7,726,235 acres. Over 48% is crop land, and more than 44% in grass. Crop land dominates in the west with grassland dominating through the central section of the basin. The major crops are wheat, sorghum, and corn. Approximately 249,596 acres were reported as irrigated in 2006. A major product is beef cattle. The Kansas Geological Survey (KGS) categorized riparian land use in 2003. Statewide pasture/grass land is the dominant riparian land use type in Kansas, accounting for over 142,000 bank miles or roughly 38% of all land use types. In this basin, the total of 56,730 bank miles vary in the riparian land use type, with 53% of the riparian cover being pasture/grass land.

Wildlife and Habitat

The Smoky Hill and Saline rivers landscape is comprised of rolling to nearly level tallgrass and mixed grass prairie vegetation. These contain some large tracts of high quality tallgrass and mixed grass prairie that are currently used primarily for grazing. These native prairie pastures provide important seasonal habitat for migrating birds as well as crucial nesting and brood rearing habitat for grassland nesting birds such as the greater prairie chicken. The Smoky Hill–Saline basin includes the range for numerous endangered or threatened species including the bald eagle, whooping crane, snowy plover, piping plover, peregrine falcon, black footed ferret, eastern spotted skunk, green toad and hornyhead chub. Eastern parts of the basin are also designated as critical habitat for the bald eagle. Wallace and Logan counties are designated critical habitat for the green toad. Cedar Bluff Wildlife Area varies in size with the fluctuating reservoir. At full pool the Reservoir is 6,800 surface acres and the surrounding Wildlife Area lands encompassing approximately 7,000 acres. The area lies in the mixed grass prairie and chalk bluff region. Cedar Bluff derives it's name from a 1/2 mile of 100 foot chalk bluffs located on the southwest portion of the property. Wilson Wildlife Area

is located on the upper end of 9,000 acre Wilson Reservoir. The 8,069 acre public hunting area is made up of 5,000 acres of rugged rolling hills of native prairie, approximately 2,000 acres of cropland, and 1,000 acres of riparian timber along the Saline River, Cedar Creek, Turkey Creek, and Elm Creek. Smoky Hill Wildlife Area at Kanopolis Lake offers 4,180 acres of land and 885 acres of water. The reservoir covers approximately 3,000 acres of water and the entire U.S. Army Corps of Engineers (Corps) property extends along the Smoky Hill River for over 15,000 acres.

Water Resources

The Smoky Hill River headwaters are located in eastern Colorado where the north and south forks rise. These forks join in Logan County, Kansas. The Smoky Hill flows eastward to Junction City to confluence with the Republican River. Below this point the river is known as the Kansas River. The Saline River, a tributary of the Smoky Hill, rises near the Sherman-Thomas County line in extreme western Kansas. The Saline River flows eastward to its confluence with the Smoky Hill River several miles east of Salina, Kansas. The streams include 50,951 intermittent stream miles and 3,832 perennial stream miles. Drainage density is 0.31 mile per square mile in the basin (perennial streams only). Three large federal irrigation and/or flood control projects are located in the Smoky Hill-Saline basin. Cedar Bluff Reservoir, a Bureau of Reclamation (Bureau) project, is located on the Smoky Hill River in Trego County. Wilson Lake on the Saline River and Kanopolis Lake on the Smoky Hill River are operated and maintained by the Corps.

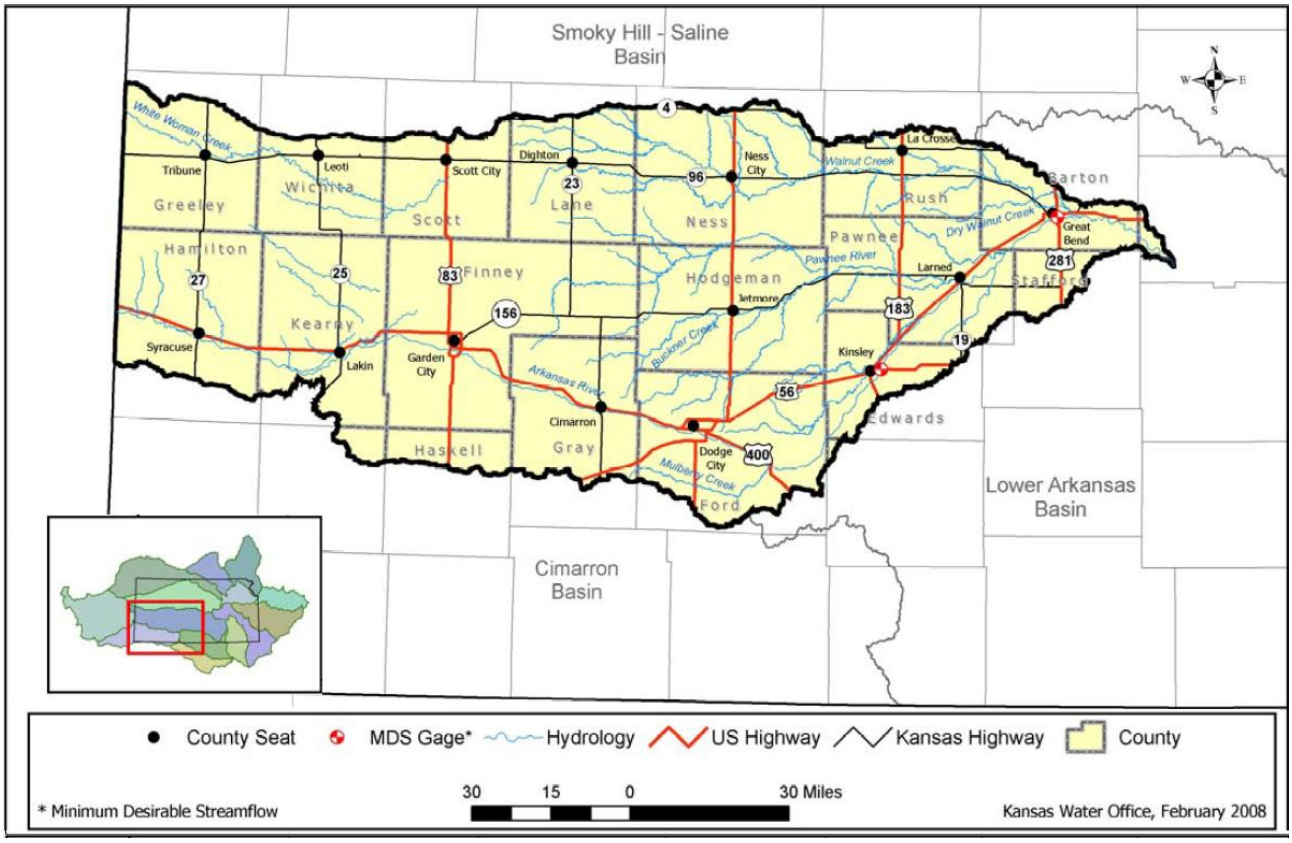
Much of the western half of this basin is underlain by the Ogallala-High Plains aquifer, deposits of saturated sands, gravels and silts of Tertiary and Quaternary age. The High Plains aquifer underlies most of western and south central Kansas. The High Plains aquifer consists of several hydraulically connected aquifers, the largest of which is the Ogallala. The Ogallala-High Plains aquifer is distinctive from other aquifers in Kansas because it has low annual recharge. The Ogallala-High Plains aquifer is found only in small parts of the western half of the Smoky Hill-Saline basin. It occurs in the southern portions of Sherman, Thomas, Sheridan, and Wallace counties and the northern parts of Logan, Gove, Trego, Ellis, Greeley, Wichita, Scott and Lane counties. Within the Smoky Hill-Saline basin the Ogallala-High Plains aquifer saturated thickness is generally less that 100 feet. In a few locations the saturated sediments are 150 or 200 feet thick when combined with the overlying alluvial sediments. Ground water resources also include the alluvial deposits along the rivers and tributaries and the Flint Hills aquifer in the eastern end of the basin. T

he USGS estimated drainable water in storage in the High Plains aquifer in 1992 to be about 3.25 billion acre feet; 10% of that in Kansas. There were 3,593 water rights reporting use in the basin in 2006. These rights reported a total of 282,453 acre feet used from surface and ground water sources. Ground water sources accounted for 268,145 acre feet with the remaining from surface water. The primary reported water use in the basin was irrigation, at 246,134 acre feet followed by municipal use at 23,820 acre feet. Municipal water use (public water supply) includes communities and rural water districts as well as those industries that obtain water through a public water supply. There were 99 public water suppliers in the basin in 2006. In 2006, 721 acre feet of water were marketed from Kanopolis Lake to one public water supplier who in turn supplied 11 other suppliers and rural customers.

Water Management

Water appropriations and use are overseen by the Kansas Department of Agriculture-Division of Water Resources. Most of the streams and alluvial corridors in the basin are closed or restricted for new water appropriations. This has eliminated the possibility of additional appropriations being approved in many areas of the basin. The exception is Ladder Creek and the Saline River which have not been closed to new appropriations. The Chief Engineer ordered Intensive Groundwater Use Control Areas (IGUCA) for two sections of the Smoky Hill River and for an area within the City of Hays. This closed the Smoky Hill River corridor in to further ground or surface water appropriations. An IGUCA can provide more comprehensive water management tools than provided under strict water right administration based on priority. States generally have the responsibility to determine the management of the water resources in that state. The exception to this is the management of federal reservoirs by a federal agency. In the Smoky Hill-Saline basin, Cedar Bluff is managed by the Bureau, Wilson and Kanopolis are managed and operated by the Corps. The State of Kansas has purchased water supply storage in the Kanopolis Lake that provides water to a significant area of the basin.

6.3 UPPER ARKANSAS RIVER BASIN[11]



General Description

The Upper Arkansas basin covers 10,300 square miles of west central Kansas. The basin includes all or parts of 20 counties. The Arkansas River is the dominant river. It receives water from snow and rain run off resulting in periodic high flows. There are no major tributaries to the Arkansas River until Mulberry Creek in Ford County; west of this, flows are highly dependent on flows entering from Colorado. The Pawnee River, Walnut Creek and Coon Creek are major tributaries of the Arkansas River in this basin. Declines in the alluvial aquifer have reduced or ceased baseflow contributions for most of the river west of Kinsley, with discharge from the alluvial aquifer only after high flow events have recharged bank storage. Some or all of the Arkansas River flow is lost as infiltration from the stateline to Dodge City. Whitewoman Creek and James Draw drain a portion of the basin but end in depressions. Remaining areas of the basin are drained by numerous small direct tributaries of the Arkansas River. Kansas Arkansas River basin overlies the High Plains
aquifer. The High Plains aquifer, of which the Ogallala is the dominant portion, has been identified as a national concern regarding water quantity.

Population and Economy

There were an estimated 128,500 residents in the basin in the year 2000.(1) According to the Kansas Division of Budget, the total population of the 19 counties that are contained in whole or in part by the Upper Arkansas basin had a population of 171,733 in 2000. By 2040, the county population is projected to decrease to 163,207. This basin illustrates major demographic changes that are taking place in Kansas. In the past 40 years, two trends have dominated the state and the basin: 1) Rural counties have lost population, sometimes more than 10 percent every decade; 2) Urban counties particularly in the greater Wichita area and Kansas City area are gaining population at an even greater rate. In the Upper Arkansas basin counties with meat packing plants in the immediate vicinity are gaining population. The economy of the basin is based primarily on agriculture and manufacturing. The major crops are wheat, grain sorghum, corn and alfalfa with a sizable portion of this acreage being irrigated. Irrigation has helped stabilize the agricultural

[11] *Kansas Water Office*

economy in this area of marginal precipitation. The total value of regional economic activity was about $10.3 billion in 2003. Manufacturing, where meat packing and other food processing is represented, is by far the largest economic sector. Regional employment totaled more than 83,000 jobs. This economic activity generated about $3.8 billion in value added income, the most important measure of regional household welfare associated with regional economic activity.

Geology and Soils

The Tertiary and Quaternary undifferentiated sediments deposits in the area are underlain by Cretaceous age bedrock deposits. The bedrock has an east-to-southeast drainage trend. Major structural controls are the Bear Creek fault in Hamilton and Kearny counties, and Crooked Creek-Fowler fault in Ford County. These faults created a vertical displacement up to 250 feet, and bound a subsidence that filled with the younger, unconsolidated sediments of the aquifer. West of Bear Creek fault, alluvial sediments overlie Cretaceous bedrock and the High Plains aquifer is not present. The impermeable nature of this bedrock allows for minimal to no infiltration beyond the alluvial deposits. East of the fault, the alluvial sediments overlie the Tertiary and Quaternary deposits in which the High Plains aquifer occurs. Land features are comprised predominantly of level to gently rolling tableland that is dissected with narrow drainage ways. Soils are deep on the ridge tops and moderately deep to shallow on the side slopes. Soil texture ranges from medium to fine. Several different soil associations are found in the basin. Along the Arkansas River floodplain and terraces, sandy, loamy and clay soils predominate. South of the river, there are also areas of sand hills, classified as duny soils.

Land Use/Land Cover

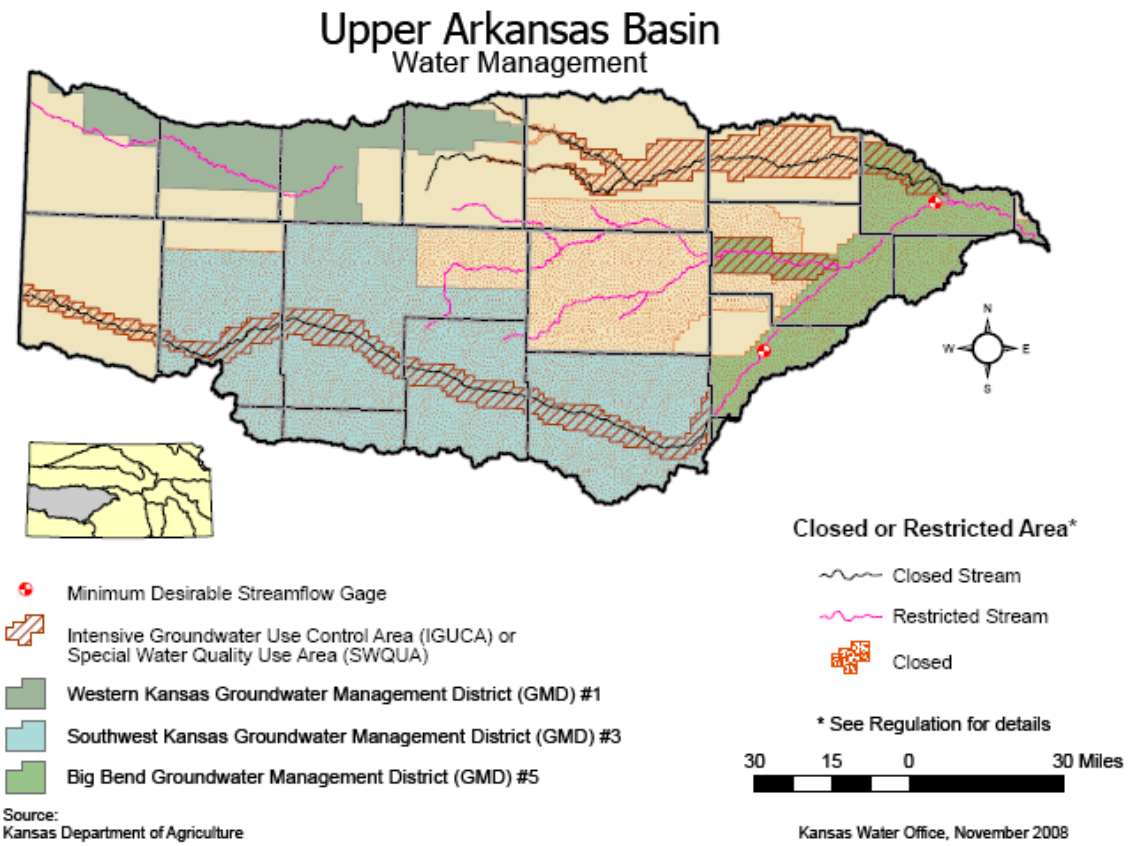
Land use in the basin typically is dominated by cropland (64.6%) or grassland (24.1%) or Conservation Reserve Program land (10.3%). Less than one percent of land within the basin is comprised of residential, commercial/industrial and municipal use, open water and barren ground. The Upper Arkansas basin has 28,531 stream bank miles. Within a 100-foot corridor along each bank, about 52% of the land is pasture/grassland followed by cropland (37%).

Wildlife and Habitat

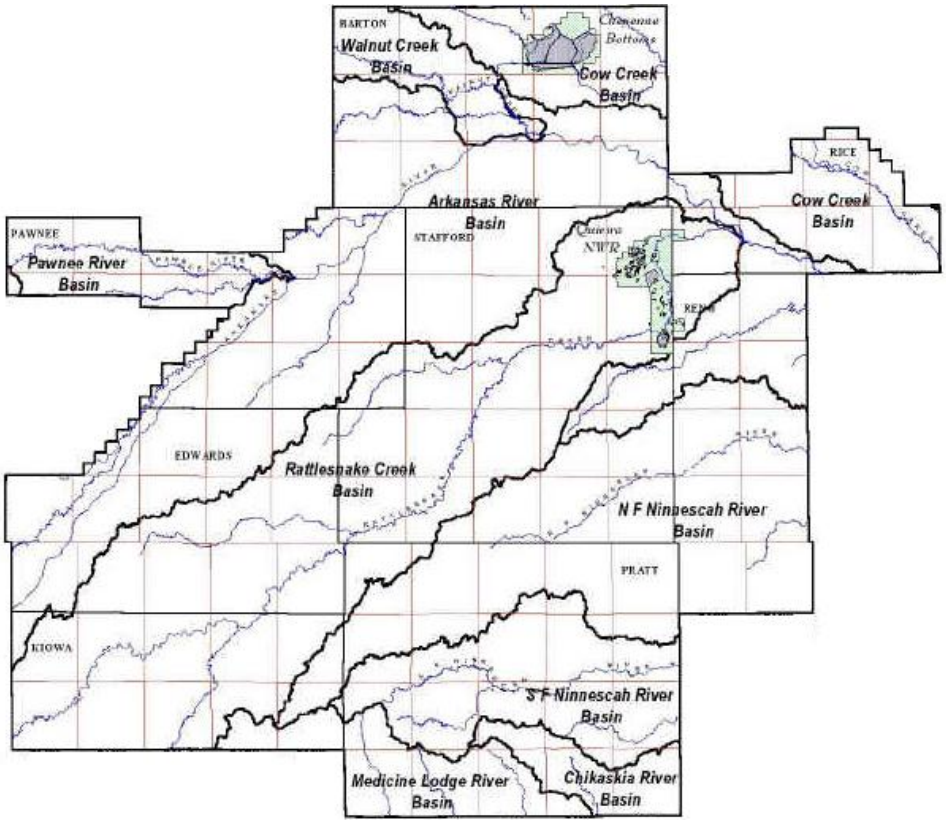
The Upper Arkansas River basin encompasses a wide array of habitat types that support rich and extremely diverse wildlife populations. The wildlife community includes 54 reptiles and amphibians, 48 fish, 54 mammals, and 283 bird species. Fifteen state or federally listed threatened or endangered species share a probable or historic range or critical habitat within the basin. In 1996, the U.S. Geological Survey (USGS) reported that Kansas has about 435,000 acres of wetlands, which include sandhill pools along the Arkansas River, playa lakes in western Kansas, freshwater marshes such as those in Cheyenne Bottoms, and salt marshes such as those in Quivira National Wildlife Refuge. Kansas has lost about one-half its wetlands during the last 200 years, mostly due to conversion to cropland, and depletion of surface and ground water by irrigation withdrawals.

Water Resources

The Arkansas River receives water from snow and rain run off resulting in periodic high flows associated with precipitation. Colorado Rocky Mountain snowmelt and runoff have a major impact on water flowing in the river as well as runoff in Kansas. There are no major tributaries to the Arkansas River in Kansas until Mulberry Creek in Ford County. The principal sources of ground water in the basin are the saturated sands, gravels and silts in the thick deposits of Tertiary and Quaternary age. This includes the alluvial deposits along the river and tributaries and the Ogallala Formation of the High Plains aquifer. The thickness of the Arkansas River alluvium ranges from about 10 feet to over 80 feet. Alluvial ground water levels are highly variable but a steady decline throughout the basin has occurred, with significant declines east of Garden City. The Upper Arkansas basin contains 13,165 miles of intermittent and 843 miles of perennial streams for a total of 14,008 stream miles. The density of 1.3 stream miles per square mile, places the basin second to last among the twelve major river basins. Ground water is the source for 96% of supply for all reported uses in 2006. Irrigation accounted for nearly 95% of all reported water pumped or diverted. Municipal use accounted for two percent of water used in the basin, industry for one percent and recreation, stockwater and other uses combined equal about two percent (2006).



Groundwater Management District Nos. 1, 3, and 5 are major local water management entities in the basin. Big Bend Groundwater Management District No. 5's boundaries are shown below.



Several townships in the Arkansas River basin are closed to new appropriations. The closures were proposed by the local GMDs, under authorities established in the Groundwater Management District Act. The adoption of these rules and regulations eliminated the possibility of additional appropriations being approved in many areas of the basin.

An Intensive Groundwater Use Control Area (IGUCA) can provide more comprehensive water management tools than provided under strict water right administration based on priority. Parts of five watershed districts are included in the basin: Cimarron Watershed District No. 3, James Draw Watershed Joint District No. 87, Lakin Watershed District No. 49, Pawnee Watershed Joint District No. 81 and Wet Walnut Creek Watershed Joint District No. 58.

Water Banking

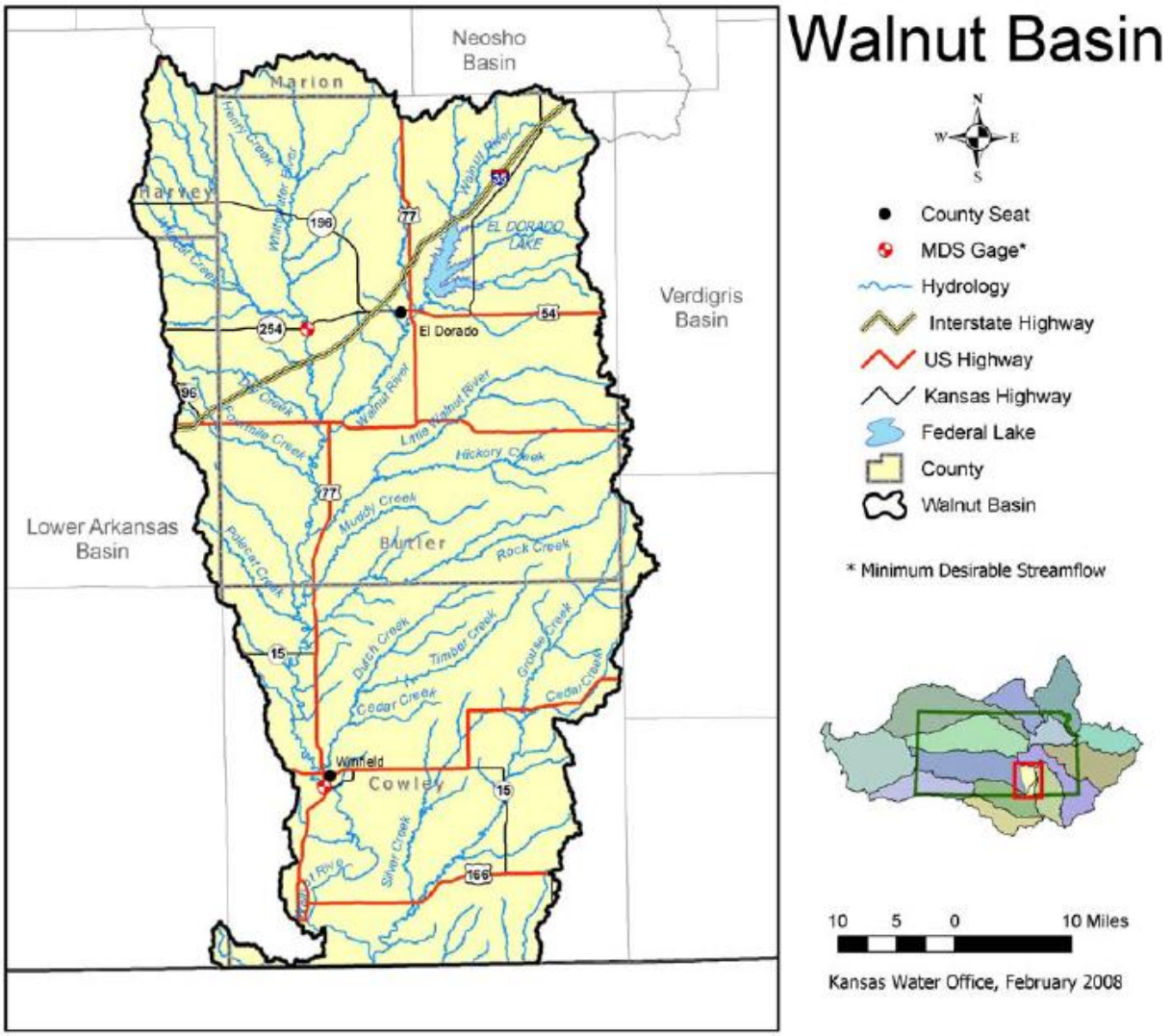
Water Banking originated out of the Quivira / Rattlesnake Creek Partnership Plan as part of a collective effort to reduce water use in that basin. A state task force studied the concept and the legislature passed the Water Banking Act in 2001. Rules and Regulations were adopted in 2004 and the Charter in June 2005. The water banking concept was also added to the Middle Arkansas Sub-basin Plan as a tool to address the water use issues in that basin. As the program developed, it became apparent that it could be applied in all the basins of GMD#5. The water bank is authorized by the Chief Engineer, to be chartered until Dec 31, 2011.

The objective of water banking is to allow water users who wish to sell (deposit) their water on an annual basis up to five years so others can lease it. The depositor sets a price for the water and it is then made available for lease by another user. Anyone wishing to sign up to deposit their water must do so on or before April 1 of the year in which the deposit will be made. A water right, or a portion of a water right, may be deposited only in increments of full calendar years. A water right shall not be eligible for deposit if water use occurred under the water right, or a portion of the water right, at any time from January 1 through March 31 of the year in which the deposit will be made. When the term for the deposit expires, the full annual amount of water is again available to the original water right holder.

Conservation District

The county conservation district is the primary local unit of government responsible for the conservation of soil, water and related natural resources within the county boundary. Each county within the Upper Arkansas River basin has a county conservation district. Four Resource Conservation and Development (RC&D) districts serve the counties of the Upper Arkansas basin: the Santa Fe Trail, Coronado Crossing, Central Prairie and Smoky Hill. The RC&Ds are designed to help community leaders develop rural economies by improving and conserving local natural, human and economic resources.

6.4 WALNUT RIVER BASIN[12]



General Description

The Walnut River basin covers approximately 2,380 square miles and encompasses most of Butler and Cowley counties, as well as small portions of five other counties in south central Kansas (HUCs 11030027 and 11030018). The Walnut River rises in the northeastern part of Butler County, joining the Arkansas River at Arkansas City in Cowley County, about 120 miles to the south, and just north of the Kansas-Oklahoma state line. Other major streams in the basin are the Whitewater River, Timber Creek, Little Walnut River, West Branch Walnut River (all tributaries to the Walnut River), and Grouse Creek. Both the Walnut River and Grouse Creek join the Arkansas River just before it leaves the State of Kansas. There are two major reservoirs on the river system: El Dorado Reservoir and Winfield City Lake. El Dorado Reservoir is formed by damming four headwater tributaries to the Walnut River in the northern part of the basin: Satchel Creek, Durechen Creek, Bemis Creek, and Cole Creek. Winfield City Lake is built on Timber Creek in the southern part of the basin, northeast of the City of Winfield. Elevations range from 1,625 ft. at the top of the basin to 1,148 ft. in the Walnut River valley. Major cities in the basin include county seat El Dorado in Butler County and county seat Winfield in Cowley County. Other communities in the basin include Augusta and Andover in eastern Butler County and Arkansas City in southern Cowley County.

[12] *Kansas Water Office*

Population and Economy

There were an estimated 95,925 residents in Butler and According to the Kansas Division of Budget, the total population in these two counties is projected to increase to 129,243 by the year 2040. This basin illustrates major demographic changes taking place in Kansas. In the past 40 years, two trends have dominated the state and the basin. Rural counties have lost population, sometimes more than 10 percent every decade. While the population of Butler County is projected to increase by 36,756 by 2040, the population of Cowley County is projected to decrease by 3,441 during the same period of time. The major crops are wheat, soybeans, cotton, hay, sorghum and corn. Crop value was estimated by the U.S. Department of Agriculture, (USDA) to be $83,149,500 in 2006. Livestock production is also an important part of the area's agriculture with beef cattle the predominant livestock raised in the basin. USDA estimates the value of this production to be $88,236,400. Farm related employment is a small part of total employment in the basin, even though the majority of the land use is for agricultural purposes. The northern part of the basin, generally in Butler County, is one of the fastest growing areas in the state, with Butler County as a whole ranked ninth in population growth between 2000 and 2005. While the rural farm based population is generally declining, there is continued growth in rural areas of non-farm residences outside of city limits in which residents generally commute to employment in either El Dorado, Wichita, or the surrounding suburban communities.

Although Sedgwick County and Wichita are in the Lower Arkansas River basin to the west, the western part of the Walnut basin is influenced by the Wichita metropolitan area economy and population. The influence of the Wichita Metropolitan area on population in the Walnut basin, especially in Butler County, has been apparent since the 1950s. Growth in the western parts of the counties can be attributed to an eastward expansion of the Wichita industrial and metropolitan area. This is enhanced by the well developed transportation system. Petroleum production and refining also supports the basin economy. Several pipelines run through the upper area of the basin. The state correctional facilities and light industry are growing segments of the economy. In addition, construction, wholesale trade, retail, finance, insurance, educational and health care services, arts, entertainment and recreation, and the accommodation and food service industries account for major economic growth sectors.

El Dorado Reservoir provides important water based economic resource in the upper part of the basin. El Dorado Reservoir was constructed by the U.S. Army Corps of Engineers (Corps) and was completed in June of 1981. The reservoir consists of approximately 8,000 surface acres of water, 4,500 acres of park lands and 3,500 acres of wildlife area. The Kansas Department of Wildlife and Parks (KDWP) manages these areas. Close to one million people visit El Dorado State Park each year. Recreation opportunities include: fishing, hunting, camping, boating and observing wildlife. Zebra mussels, *Dreissena polymorpha*an, an aquatic invasive species, have populated the reservoir in recent years. Zebra mussels have razor sharp shells and upset the ecological balance of the waters.

Geology and Soils

The topography of the Walnut basin features a series of east-facing escarpments or hills, including the southern section of the Flint Hills belt which bisects the state from the Nebraska to the Oklahoma borders. The limestone beds in the Flint Hills contain large amounts of flint or chert. Where these beds mantle the uplands, erosion of the underlying soft shales has been reduced. The streams in the Flint Hills upland area characteristically have deep and narrow valleys, lined with outcropping limestone ledges. The rocks that crop out at the surface in the basin belong to geologic formations of Permian age that were formed about 200 million years ago. The rocks consist of alternating beds of limestone, cherty limestone and shale. Unconsolidated deposits of more recent geologic age occur locally in the uplands and in the valleys of major streams. Chert gravels were deposited in the uplands by ancient streams that traversed the area before the present drainage pattern was established. The unconsolidated valley deposits consist of chert gravel, sand, silt, and clay. Thin, discontinuous deposits of loess or windblown silt also occur locally in the uplands and in the major stream valleys. In most areas, loess deposits are only a few feet thick, but along the Arkansas River in Cowley County east of Arkansas City, the loess is about 30 feet thick. Soils were developed from the underlying limestones and shales and in most parts of this predominantly hilly area the soils are relatively shallow, making them best suited for native pastures. Upland soils are subject to extensive sheet and gully erosion. This makes the already thin topsoils particularly vulnerable to being washed from the surface contributing to downstream sedimentation in streams and reservoirs. Conservation treatment of agricultural lands is a major strategy in reducing erosion. Before European settlement, the soils were held in place by deep rooted tall grasses and forbs. Grazing impacts were minimal as the native bison herds moved

throughout the expansive grasslands. As a result of more recent intensive cattle grazing, much of the prairie is overgrazed, exposing the soil to erosive forces.

Land Use/Land Cover

West of the Whitewater River, land use is predominately crop land; east of the Whitewater River the land use is predominately grassland except for along the floodplains of the Walnut River and its tributaries. Overall, grassland covers about 66% of the basin, crop land covers about 23% and woodlands cover 5 percent. Sub-basins dominated by grassland are the Little Walnut River (82%), Timber Creek (72%), and the Walnut River upstream from El Dorado Lake (81%). Cropland is dominant in the Whitewater River sub-basin (65%).(3) (USGS). Less than 3 percent of the basin is urban and less than 2 percent is water. In 2006 there were an estimated 2,310 farms, covering 1,382,000 acres in the two counties. The average farm size was 608 acres. According to the 2003 Assessment of Riparian Areas Inventory by the Kansas Geological Survey (KGS), of the 14,887 bank miles of riparian area within 100 ft. of the streams in the basin, the dominant riparian cover is pasture/grassland (41%). The second most common cover is forestland (20%), and third most common cover is crop land (16%). The remaining riparian cover types, in descending order of dominance, are pasture/tree mix, crop land/tree mix, shrub land, urban, urban/tree mix, and barren land.

Wildlife and Habitat

The basin is home to numerous species of fish and wildlife. Approximately 70 species of butterflies have been identified in Butler County alone. The El Dorado Reservoir watershed is located within the Central Flyway for migratory birds. The entire area is part of the Flint Hills Ecoregion. The Flint Hills Tall Grasslands is the smallest grassland ecoregion in North America and is distinguished from other grassland associations by the dominance of tallgrass species–and from the Central Tall Grasslands to the north by its more limited biota and a thin soil layer spread over distinct beds of limestone. These flinty beds of limestone, from which the name of this ecoregion is derived, rendered large areas unsuitable for corn or wheat farming. Today, the Flint Hills Tall Grasslands is an anomaly–an essentially unplowed (although heavily grazed) remnant of the tallgrass prairie. Historically, fire, drought and grazing by bison and other ungulates were the principle sources of habitat disturbance in this ecoregion. The dominant grass species in this ecoregion are big bluestem, switchgrass and Indian grass. Like other ecoregions of this section of North America, bison and elk once roamed these tallgrass prairies, where they were hunted by the prairie wolf. These species are now gone, although bison are being reestablished in this ecoregion. There are 14 threatened or endangered species in the basin. Seven are birds, five are fish, one is a mammal and one is a mussel. Butler County has critical habitat for the bald eagle and Topeka shiner, and Cowley County has critical habitat for the Arkansas darter, the Arkansas River shiner, the Arkansas River speckled chub, and the silver chub. Grouse Creek is considered a reference stream in Kansas meaning that it has geomorphologic, biologic, and chemical conditions characteristic of pre-settlement conditions.

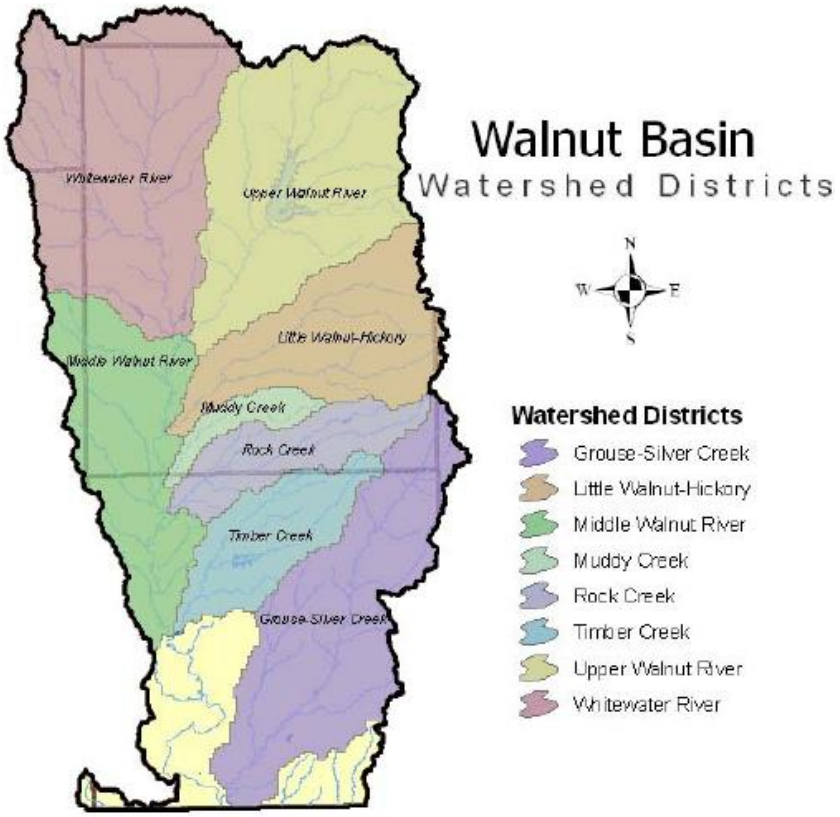
Water Resources

There are no natural lakes in the basin but numerous manmade surface water impoundments have been constructed. Reservoirs in the watershed include Augusta Lake, Winfield City Lake and El Dorado Reservoir. El Dorado Reservoir is operated by the Corps for the primary purpose of flood control. At the top of the conservation pool, the lake is approximately 8,000 acres and has 98 miles of shoreline. Community and other lakes include Fox Lake, Lake Clymer, Rogers Pond, Cowley County Lake, Harvey County East Lake, and Santa Fe Lake. All counties also have state fishing lakes. The Walnut basin contains 6,830 miles of streams; 5,729 miles of these are intermittent and 1,101 miles are perennial. Stream density in the basin is 2.8 stream miles/square mile area, making it the basin with the highest stream density in the state. The major streams in the basin are the Walnut River and its tributaries, the Whitewater River and Little Walnut Creek; and Grouse Creek. Grouse Creek is actually a direct tributary of the Arkansas River and is not hydrologically connected to the Walnut River; however, for planning purposes, the Kansas Water Office (KWO) includes the Grouse Creek drainage with the Walnut River basin. Both the Walnut River and Grouse Creek join the Arkansas River just before it leaves the State of Kansas. Ground water is present in alluvial deposits along major streams. Surface water makes up over 85% of the water used in the basin. The major use of water in the basin is for municipal purposes, at over 75% and 96% of this is from surface sources. Irrigation uses about 14% (77% from surface water) and recreation, industrial, stockwater and other uses account for the remaining 11%.

Water Management

Surface water management and conservation is a priority issue for this basin. The major streams in the basin are closed to new appropriations during the May to September timeframe. Significant water management entities in the basin include the conservation districts in Butler and Cowley counties and eight watershed districts, which cover approximately 95% of the land area of the basin. The Corps, responsible for the operation of El Dorado Reservoir, is an important water manager in the basin. The City of El Dorado contracts with the Corps for all of the public water supply storage space in El Dorado Reservoir, making the City another important water manager. Some communities and rural water districts (RWDs) in the Walnut basin get their public drinking water supply from Wichita. The cities of Winfield, El Dorado and Arkansas City are permitted, since 2004, under the Kansas Department of Health and Environment Stormwater Program. These municipalities are responsible for managing the quality and quantity of stormwater runoff within their boundaries.

The eight watershed districts in the basin have constructed 215 water retention structures on tributaries within the basin. Several levees have also been constructed in Butler and Cowley counties. In the Walnut basin, there are 23 high hazard dams of which 15 are in need of breach inundation mapping. There are 31 significant hazard dams.

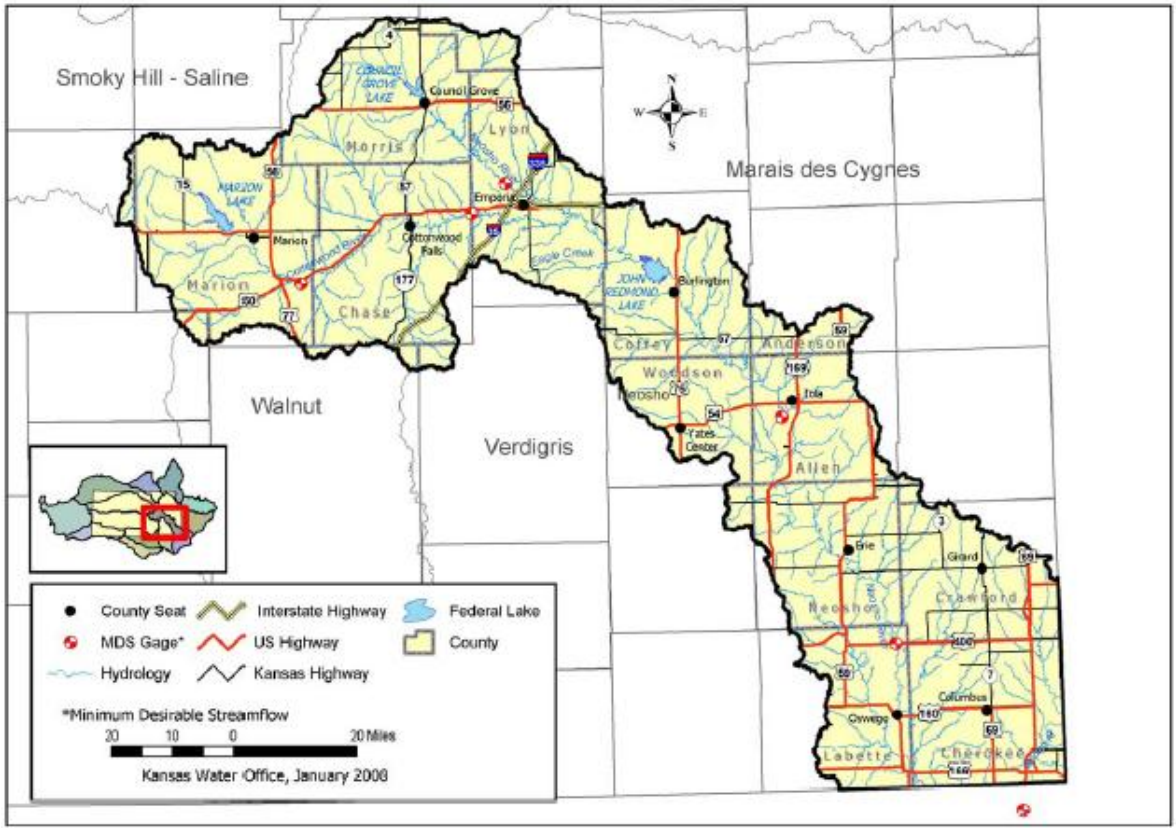


The western part of the Walnut and the eastern part of the Lower Arkansas basins have experienced population growth at an increasingly high rate over the last few years, resulting in increasing demands placed on existing water supplies. While surface water and ground water supplies are available to meet current and future (2050) demands in the area and are generally of good quality, supplies are not necessarily located in the immediate area of demand.

There are 33 public water suppliers in the Walnut basin, of which 16 are rural water districts (RWD). There is one public wholesale water supply district (PWWSD) in the basin. PWWSD #8 was established in 1982 and is operated by Butler County RWD #3 and El Dorado State Park. The district supplies water to members through a water purchase contract with the City of El Dorado. PWWSDs are considered to enhance the long-term availability of water supply in the areas of the basin they serve.

In 2007, KWO initiated an analysis of water supply and demand in five Kansas river basins. The analysis utilized historic climate and stream flow, along with current census information to predict the total water supply and demand in the basin over time. The preliminary finding in the Walnut basin was that in Butler County, which is primarily served by El Dorado Reservoir, demand could exceed supply during a 2 percent probability drought by the year 2025. If other sources of water in the basin are included, the projection for shortages in Butler County is in the year 2052. This evaluation did not include ground water availability from the Wellington formation, or sources from outside of the basin that are or could be used to supply water in the Walnut basin. The 2007 KWO analysis did not account for water that is used in the Walnut basin that originates in the Lower Arkansas basin and is distributed across basin boundaries by the City of Wichita and rural water districts (RWDs). Because the northern part of the Walnut basin is strongly influenced by regional growth patterns to the west, long-term water supply issues will be best addressed by planning with the cities and RWDs in the eastern part of the Lower Arkansas basin. The groundwork exists to build on the information in these studies to develop long-term water supply plans for the region.

6.5 NEOSHO RIVER BASIN[13]



General Description

The Neosho River basin covers approximately 6,300 square miles and encompasses all or parts of 18 counties in southeastern and east central Kansas. The area is drained by the Neosho River and its tributaries which also drain parts of Missouri, Arkansas, and Oklahoma. The Neosho Basin includes HUCs 11070201 through 11070207 in Kansas. The major streams in the basin are the Neosho River and two major tributaries: the Cottonwood River and the Spring River. The Neosho River rises in Morris County and flows southeast to join the Arkansas River near Muskogee, Oklahoma. The Cottonwood River rises in Marion County and joins the Neosho River in Lyon County east of Emporia. The Spring River in the southeast part of the state originates in Missouri and drains about 500 square miles in Kansas. It enters Cherokee County in the east, flows across the southeastern corner of that county, and joins the Neosho River in Oklahoma a short distance below the Kansas state line.

[13] *Kansas Water Office*

The larger tributaries of the Cottonwood River are South Cottonwood River, Mud Creek, Clear Creek, Doyle Creek, Cedar Creek, Middle Creek, Diamond Creek, and South Fork Cottonwood River. Tributaries to the Neosho with drainage areas greater than 70 square miles are Rock and Allen Creeks above Emporia, and Eagle Creek, Long Creek, Big Creek, Turkey Creek, Deer Creek, Elm Creek, Owl Creek, another Big Creek, Flat Rock Creek, Lightning Creek, Cherry Creek, and Labette Creek below Emporia. Elevations in the basin range from 1,320 feet in Marion County at the top of the basin to 826 feet in Cherokee County at the bottom of the basin in Kansas. There are three major federal reservoirs in the river system: Marion Reservoir is on the Cottonwood River and Council Grove and John Redmond Reservoirs are on the main stem of the Neosho River. Ground water is found in alluvial deposits along major streams.

Economy

The local economy is based primarily on agriculture, general manufacturing, and retail trades. The major crops grown in the basin include wheat, grain sorghum and soybeans. The value of crop production in 2006 was estimated to be $372,524,860. The production of beef cattle is another important part of the area's agricultural economy. The value of livestock production in 2006 was estimated to be $261,789,300. The Neosho basin has a greater variety of minerals than any other area in Kansas. The production of oil and gas is a relatively small but important component of the economy. A significant amount of coal, lead and zinc mining occurred historically in the southeastern portion of the basin. Strip mining of coal is the only one of these mining activities which continues today. Lead and zinc mining peaked in 1926 and by 1958, mining of these minerals had all but ceased. Legacy heavy metal pollution and dangerous underground mine shafts still plague southeast Kansas.

Natural resources of economic importance to area economies are oil, gas, cement, ceramic materials, coal, lead, zinc, stone, and sand and gravel. An additional component of the local economy is the only nuclear powered generating plant in Kansas, located near Burlington. The Wolf Creek Nuclear Power Plant is the largest single water user in the basin. Water based recreation is important to the economy of the basin with three federal reservoirs, a State Fishing Lake in every county, and nine community lakes attracting boaters, anglers, hunters and campers. State Parks and commercial marinas are located on and around the federal reservoirs in the basin.

Land Use/Land Cover

The predominant features in the basin are the grasslands of the Flint Hills in the northwestern part of the basin, crop land in the Neosho River and other flood plains, in the Marion Reservoir watershed, and in the Cherokee County area, and the urbanized areas described previously. Plant communities in the study area include Oak-Hickory Forest, Floodplain Forest, Cross Timbers, Cedar Glades, Bluestem Prairie, and Bluestem-Grama Prairie. Grassland (56%), and row crops, (38%) are the most widespread land cover classes covering about 3,738,540 acres of the basin.

In 2006, there were 8,530 farms covering 4,708,000 acres in the thirteen counties with significant area in the basin. The average farm size was 551 acres. The basin contains many important highway and rail transportation arteries. The basin map shows locations and coverage. According to the 2003 Assessment of Riparian Areas Inventory by the Kansas Geological Survey (KGS), of the 37,257 bank miles of riparian area, within a 100 ft corridor along each bank in the basin, the dominant riparian cover is pasture/grassland (31%). The second most common cover is forest land (25%), and third most common cover is a mixture of pasture and trees (20%). The remaining riparian cover types, in descending order of dominance, are crop land, crop land/tree mix, shrub land, urban, urban/tree mix, and barren land. Overall land use/land cover in the basin mirrors riparian land use/cover with grassland covering 56% of the area, crop land covering 32%, and woodlands covering about 7 percent. The balance is made up of urban uses and water.

Wildlife and Habitat

The Tallgrass Prairie National Preserve in the Flint Hills, covering 1,895 acres, was established in 1997. The preserve protects a nationally significant example of the once vast tallgrass ecosystem. Of the 400,000 acres once covered in the North American Continent, less than 4 percent remains, primarily in the Flint Hills of Kansas. The Flint Hills National Wildlife Refuge above John Redmond Reservoir is one of a system of over 500 refuges administered by the U.S. Fish and Wildlife Service (USFWS) dedicated to the preservation and conservation of wildlife. Named for the Flint Hills Region just to the west, the refuge consists of 18,500 acres located on the upstream portion of John Redmond Reservoir on land owned by the U.S. Army Corps of

Engineers (Corps). Schermerhorn Park, just south of Galena in the southeast corner of the basin, contains a small part of the Ozark oak-hickory forest ecosystem. Many of the threatened and endangered (T & E) species live in the “Kansas Ozarks”. The area is characterized by sinkholes, caves, swift streams, and steep cliffs.

Much of the original Ozark oak-hickory forestlands still remain in this region. Spring River and Shoal Creek are in this area and provide unique aquatic habitat for many species. There are 36 T&E species in the Neosho basin. Of these, one is an insect, three are mammals, 10 are mussels, seven are birds, and four are fish. For additional information on critical habitat for these species, please see the KDWP(13) website in the references. Because the basin covers a large geographic area with many ecosystem types and diverse land uses, the potential for habitat alteration is widespread resulting in pressures on populations of important species.

Water Resources

There are three federal reservoirs in the basin: Marion, Council Grove, and John Redmond. Coffey County State Fishing Lake provides cooling water for the Wolf Creek Nuclear Power Plant. All counties have state fishing lakes. Council Grove City Lake serves as a water supply for the city of Council Grove. Other localized resources that provide various services including water supply, recreation and habitat, include Jones Park Pond, Olpe City Lake, Gridley City Lake, Altamont City Lake, Bartlett City Lake, Lake Kahola, Mined Land Resources Area and Lake, Parsons Lake, Pittsburg College Lake, Marion County Lake, New Strawn City Lake, and Playter’s Lake.

Eighty percent of the streams in the basin are intermittent and 20% are perennial streams, for a total of 16,696 miles. Average stream density is 2.7 stream miles/square mile of area, the second highest density of all 12 basins in the state. The Ozark Plateau aquifer system and Spring River are water resources shared by Arkansas, Kansas, Missouri, and Oklahoma. Demand for water in the region is growing rapidly and concerns about water level declines and potential water quality degradation have prompted long-term management actions. Nearly 77% of water used in the basin is from surface sources (2006 water use). About 49% of water used is for industrial use, (54% of this from surface water and 45% from ground water), making it the highest use type in the basin, followed by 33% for municipal use, about 8 percent for recreational use and 8 percent for irrigation use.

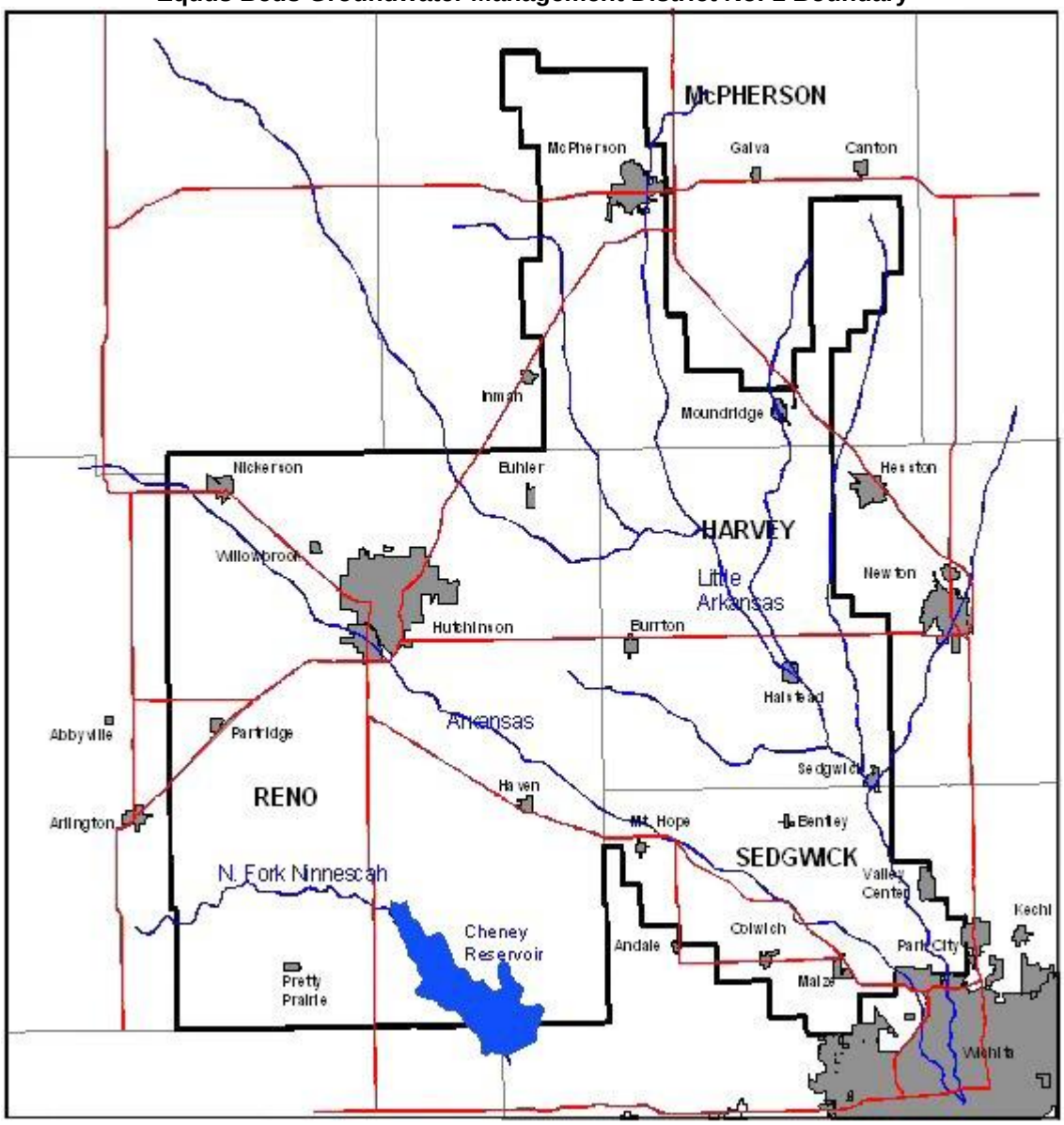
Water Management

Significant water management entities include conservation districts throughout the basin, the See-Kan, Flint Hills and Lake Region Resource Conservation and Development Councils RC&Ds and 15 active watershed districts. By virtue of its responsibility for three major reservoirs, the Corps is another important water manager in the basin. Watershed Restoration and Protection Strategy (WRAPS) groups are an emerging water management entity in the basin. These are coordinated by various entities including the See-Kan and Flint Hills RC&Ds, and local conservation districts.

6.6 EQUUS BEDS/GROUNDWATER MANAGEMENT DISTRICT #2

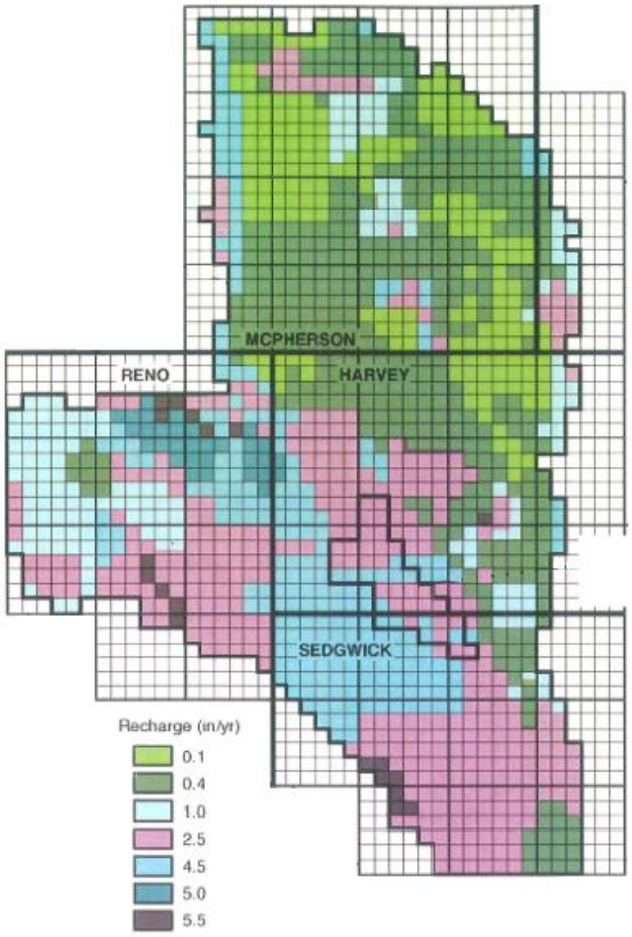
Established in 1975, the District is located in south central Kansas and underlies portions of McPherson, Harvey, Reno and Sedgwick counties. It is 878,720 acres in size and includes: 167,680 acres in western Harvey County; 140,160 acres in southern McPherson County; 460,800 acres in eastern Reno County; and 110,080 acres in northwestern Sedgwick County. The District lies exclusively within the eastern most region of the Great Bend Prairie physiographic province, except for its eastern edge which is in the Flint Hills Upland province. Total size is 1,406 square miles encompassing a population of approximately 550,000 people.

Equus Beds Groundwater Management District No. 1 Boundary



Groundwater is the principal source of fresh water for most uses in the District. The three leading uses are industrial, irrigation and municipal. Industrial usage accounted for about 15 percent of the average total; irrigation usage accounted for 50 percent; and municipal usage accounted for 34 percent. Other uses were one percent of the total average usage. The Little Arkansas River and its tributaries are the chief source of water for irrigation use. About 22 diversion points on the Little Arkansas River and its tributaries diverted 735 acre-feet for irrigation use in 1992.

Equus Beds Aquifer



The Equus Beds aquifer is part of a regional aquifer system known as the High Plains aquifer system. The regional aquifer extends into Colorado, Nebraska, New Mexico, Oklahoma, South Dakota, Texas and Wyoming. The Equus Beds aquifer forms the eastern most portion of the regional aquifer system in Kansas. It derives its name from Equine fossils found in unconsolidated deposits underlying the entire District.

The Equus Beds was formed during the Quaternary Period between 700,000 to 1,000,000 years ago. Depositional, erosion and structural processes were the main forces that formed it. The saturated thickness of the Equus Beds aquifer ranges from less than 50 feet to 300 feet. Areas of greatest thickness correspond to the McPherson and Ancestral Arkansas River bedrock channels. Areas of least thickness are associated with highs or ridges in the bedrock surface.

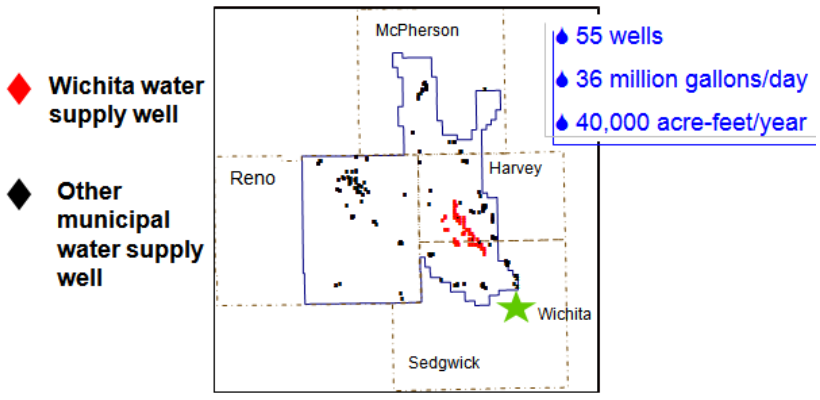
There are 1,620 water wells pumping from the Equus Beds aquifer. Of these wells, ten percent were industrial wells; 73 percent were irrigation wells; 13 percent were municipal wells; and the remaining four percent were hydraulic dredging, remediation, recreational and stockwater wells. Total usage for the period from 1981 to 1993 has remained fairly constant, except during periods of precipitation extremes.

Water usage ranged from a high of 197,651 acre-feet (64.4 billion gallons) in 1991 to a low of 111,690 acre-feet (36.4 billion gallons) in 1986. The average annual usage for the period of record was 157,350 acre-feet (51.3 billion gallons).

Water Overview

United States daily usage is 100 billion gallons per day, whereas in Kansas daily usage is 5.7 billion gallons. Within the Equus Beds Groundwater Management District Number 2, daily usage is 140.5 million gallons.

Geology and Hydrology of the Equus Beds Aquifer



Location Map of Municipal Water Supply Wells
Total Number of Wells ~ 275

The centralized geographic location of the area, good transportation routes, availability of substantial quantities of good quality water and reasonable prices for energy, labor and raw materials are factors that are conducive to development of industry.

Recharge is a continuous process that adds water directly to the aquifer. Several natural sources of water make up the total recharge supply for the Equus Beds aquifer. Of these sources, precipitation contributes the greatest amount to groundwater recharge. Annually, 30 inches of precipitation fall on the land surface overlying the Equus Beds aquifer. Due to geologic, hydrologic and climatic conditions, about 80 to 90 percent of annual precipitation will either drain into streams or rivers, evaporate back to the atmosphere or be used by plants or people.

7 TECHNOLOGICAL INCIDENT HISTORY

7.1 NATIONAL RESPONSE CENTER (NRC)

The primary function of the NRC is to serve as the sole national point of contact for reporting all oil, chemical, radiological, biological, and etiological discharges into the environment anywhere in the United States and its territories. The following information events that have been reported to the NRC since 1990 in each county:

BARBER COUNTY

Aircraft - 0
Continuous - 2
Fixed Facilities - 7
Mobile Sources - 9
Pipelines - 10
Railroad - 8
Railroad Non-Release - 3
Storage Tanks - 1
Unknown Sheen - 1

BARTON COUNTY

Aircraft - 0
Continuous - 2
Fixed Facilities - 21
Mobile Sources - 9
Pipelines - 32
Railroad - 1
Railroad Non-Release - 0
Storage Tanks - 6
Unknown Sheen - 0

BUTLER COUNTY

Aircraft - 0
Continuous - 4
Fixed Facilities - 302
Mobile Sources - 6
Pipelines - 79
Railroad - 30
Railroad Non-Release - 17
Storage Tanks - 22
Unknown Sheen - 2

COMANCHE COUNTY

Aircraft - 0
Continuous - 0
Fixed Facilities - 0
Mobile Sources - 1
Pipelines - 2
Railroad - 0
Railroad Non-Release - 0
Storage Tanks - 0
Unknown Sheen - 0

COWLEY COUNTY

Aircraft - 2
Continuous - 3
Fixed Facilities - 37
Mobile Sources - 5
Pipelines - 12
Railroad - 13
Railroad Non-Release - 6
Storage Tanks - 3
Unknown Sheen - 3

EDWARDS COUNTY

Aircraft - 0
Continuous - 1
Fixed Facilities - 0
Mobile Sources - 1
Pipelines - 2
Railroad - 5
Railroad Non-Release - 4
Storage Tanks - 3
Unknown Sheen - 0

HARPER COUNTY

Aircraft - 1
Continuous - 8
Fixed Facilities - 3
Mobile Sources - 24
Pipelines - 24
Railroad - 7
Railroad Non-Release - 4
Storage Tanks - 4
Unknown Sheen - 0

HARVEY COUNTY

Aircraft - 1
Continuous - 1
Fixed Facilities - 18
Mobile Sources - 6
Pipelines - 11
Railroad - 22
Railroad Non-Release - 13
Storage Tanks - 4
Unknown Sheen - 2

KINGMAN COUNTY

Aircraft - 0
Continuous - 0
Fixed Facilities - 18
Mobile Sources - 0
Pipelines - 21
Railroad - 0
Railroad Non-Release - 0
Storage Tanks - 1
Unknown Sheen - 1

KIOWA COUNTY

Aircraft - 0
Continuous - 5
Fixed Facilities - 29
Mobile Sources - 1
Pipelines - 30
Railroad - 6
Railroad Non-Release - 1
Storage Tanks - 3
Unknown Sheen - 0

MARION COUNTY

Aircraft - 0
Continuous - 3
Fixed Facilities - 10
Mobile Sources - 2
Pipelines - 7
Railroad - 13
Railroad Non-Release - 7
Storage Tanks - 4
Unknown Sheen - 1

MCPHERSON COUNTY

Aircraft - 0
Continuous - 12
Fixed Facilities - 110
Mobile Sources - 9
Pipelines - 52
Railroad - 10
Railroad Non-Release - 4
Storage Tanks - 17
Unknown Sheen - 3

PAWNEE COUNTY

Aircraft - 0
Continuous - 1
Fixed Facilities - 0
Mobile Sources - 2
Pipelines - 5
Railroad - 0
Railroad Non-Release - 0
Storage Tanks - 0
Unknown Sheen - 0

PRATT COUNTY

Aircraft - 0
Continuous - 6
Fixed Facilities - 9
Mobile Sources - 18
Pipelines - 7
Railroad - 14
Railroad Non-Release - 9
Storage Tanks - 3
Unknown Sheen - 0

RENO COUNTY

Aircraft - 0
Continuous - 13
Fixed Facilities - 61
Mobile Sources - 8
Pipelines - 51
Railroad - 38
Railroad Non-Release - 26
Storage Tanks - 13
Unknown Sheen - 2

RICE COUNTY

Aircraft - 0
Continuous - 0
Fixed Facilities - 18
Mobile Sources - 1
Pipelines - 26
Railroad - 1
Railroad Non-Release - 0
Storage Tanks - 5
Unknown Sheen - 1

SEDGWICK COUNTY

Aircraft - 22
Continuous - 13
Fixed Facilities - 849
Mobile Sources - 102
Pipelines - 62
Railroad - 62
Railroad Non-Release - 22
Storage Tanks - 56
Unknown Sheen - 18

STAFFORD COUNTY

Aircraft - 0
Continuous - 0
Fixed Facilities - 4
Mobile Sources - 7
Pipelines - 13
Railroad - 3
Railroad Non-Release - 3
Storage Tanks – 1
Unknown Sheen - 0

SUMNER COUNTY

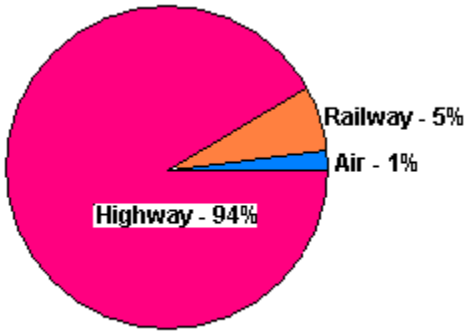
Aircraft - 1
Continuous - 1
Fixed Facilities - 11
Mobile Sources - 11
Pipelines - 9
Railroad - 25
Railroad Non-Release - 13
Storage Tanks - 5
Unknown Sheen - 2

SOUTH CENTRAL REGION

Aircraft - 27
Continuous - 75
Fixed Facilities – 1,507
Mobile Sources - 222
Pipelines - 455
Railroad - 258
Railroad Non-Release - 132
Storage Tanks - 151
Unknown Sheen - 37

7.2 U.S. DEPARTMENT OF TRANSPORTATION (USDOT)

The following hazardous materials incident information was extracted from the U.S. DOT's Hazardous Materials Information System containing Incident Report Form 5800.1 data submitted under the requirements of Title 49 CFR 171.15 and 171.16 for the years 1998 through 2008:



According to U.S. DOT information, there were a total of 4,010 hazardous materials incidents in the State of Kansas during the period between 1998 and 2008 and are broken down as follows:

Air: 50 (average of 5/year)
Highway: 3,761 (average of 376/year)
Rail: 199 (average of 2/year)

There were no fatalities reported during that period; however, three hospital injuries and 49 non-hospital injuries were reported. The total amount of damages from these incidents was reported to be over $9.3 million.

7.3 National Transportation Safety Board (NTSB)

The National Transportation Safety Board (NTSB) Aviation Accident Database shows the following aircraft accidents between 1962 through December 2010:

NTSB Aviation Accident Database 1962-2010

County	Non-Fatal Events	Fatal Events	Total Events
Barber	10	4	14
Barton	20	6	26
Butler	91	13	104
Comanche	8	1	9
Cowley	28	4	32
Edwards	7	1	8
Harper	10	7	17
Harvey	38	6	44
Kingman	16	4	20
Kiowa	3	3	6
Marion	5	5	10
McPherson	23	1	24
Pawnee	11	1	12
Pratt	17	4	21
Reno	39	1	40
Rice	8	4	12
Sedgwick	258	15	273
Stafford	3	1	4
Sumner	9	36	45

7.4 TOXIC RELEASE INVENTORY (TRI)

The U.S. EPA's Toxics Release Inventory (TRI) is a publicly available database that contains information on specific toxic chemical releases and other waste management activities reported annually by certain covered industry groups as well as federal facilities. This inventory was established under the Emergency Planning and Community Right-to-Know Act of 1986 (EPCRA), which requires facilities to use their best readily available data to calculate their releases and waste management estimates.

2010 TOXIC RELEASE INVENTORY

County	Total On-site Disposal or Other Releases	Total Off-site Disposal or Other Releases	Total On- and Off-site Disposal or Other Releases
Barber	1	3	4
Barton	34,123	0	34,123
Butler	197,061	98,620	295,681
Comanche	0	0	0
Cowley	16,347	84	16,431
Edwards	0	0	0
Harper	0	0	0
Harvey	63,667	542	64,210
Kingman	17	0	17
Kiowa	0	0	0
Marion	0	0	0
McPherson	239,037	113,956	352,992
Pawnee	0	0	0
Pratt	0	0	0
Reno	17,123	957	18,080
Rice	26,471	0	26,471
Sedgwick	1,461,384	183,546	1,644,930
Stafford	0	0	0
Sumner	0	0	0

TRI On-site and Off-site Reported Disposed of or Otherwise Released (in pounds), for All industries, for All chemicals, Barton County, Kansas, 2010

7.5 RADIOLOGICAL

According to Wolf Creek nuclear generation station information, uranium fuel pellets and rods are not transported through the south-central Kansas area and is not considered to be a concern. The covert usage of radiological materials by terrorist groups as a weapon of mass destruction (WMD) is a concern. The weapon could be detonated using conventional means and spread radioactivity over a large area. It is anticipated that one pound of radioactive material could affect an area greater than one mile depending on atmospheric conditions. Inhalation hazards and general contamination of persons, buildings and equipment are the primary concern.

7.6 METHAMPHETAMINE/CLANDESTINE LABS

Methamphetamine is a synthetic amphetamine or stimulant that is produced and sold illegally in pill form, capsules, powder, or chunks and produced in illegal clandestine drug laboratories that are commonly found in motels; rural areas away from the general public; and residential areas, including houses, apartments, and garages. Mobile labs have also been found in vehicles and discarded along roadsides or parking lots.

Methamphetamine is produced from 19 chemicals regulated under the Chemical Control Act with specific reported requirements from chemical industry manufacturers and retailers. Anhydrous ammonia is one of the primary chemicals of concern because of its commonality and can affect persons living near ammonia storage facilities. Explosions from chemical mixes and chemical vapors from the mixing are also of concern for persons in close proximity to the illegal laboratories. As shown in the following table, seizures have been steadily decreasing in both the State of Kansas and south central region.

METHAMPHETAMINE/CLANDESTINE LAB SEIZURES

County	2010	2009	2008	2007	2006	2005	2004	2003	2002	2001	2000
Barber	0	0	1	0	0	2	1	1	1	0	1
Barton	1	3	3	5	3	5	11	15	18	17	17
Butler	1	4	2	2	2	11	9	22	48	25	19
Comanche	9	0	2	3	0	0	0	0	0	0	0
Cowley	0	5	0	0	13	53	53	48	56	61	56
Edwards	0	0	0	0	0	0	0	0	1	0	0
Harper	0	0	0	1	0	3	1	2	1	0	1
Harvey	1	0	0	1	3	6	2	14	4	9	8
Kingman	0	0	0	2	0	0	2	0	4	1	0
Kiowa	0	0	0	0	0	0	0	4	1	0	2
Marion	0	0	0	0	3	0	0	3	9	4	3
McPherson	1	0	0	0	1	10	2	0	23	25	3
Pawnee	1	0	7	3	1	4	7	6	5	9	6
Pratt	0	0	0	0	2	2	0	1	14	7	10
Reno	9	0	22	17	31	37	0	36	32	54	6
Rice	0	0	1	0	5	7	12	10	9	8	5
Sedgwick	1	3	1	1	2	30	20	22	32	43	40
Stafford	1	2	2	1	2	0	0	3	4	5	2
Sumner	2	0	0	0	0	4	7	4	4	8	4
Region	**27**	**17**	**41**	**36**	**68**	**174**	**127**	**191**	**266**	**276**	**183**
State	**143**	**121**	**153**	**97**	**168**	**390**	**583**	**649**	**728**	**847**	**619**

Source: Kansas Bureau of Investigation

HAZARDS IDENTIFICATION

8 TRANSPORTATION

8.1 RAIL TRANSPORTATION

The Kansas rail system consists of 21 railroads of which five are identified in the South-Central Kansas region. Kansas is served by a comprehensive rail network comprising a total of 4,721 route miles of trackage. The Class I railroad network is a 2,790 mile spine which provides long haul service for both in- and out-bound products. The major Class I railroads currently operating in Kansas are Burlington Northern Santa Fe (BNSF) Railway and the Union Pacific (UP) Railroad. BNSF operates 1,237 miles of track in Kansas and UP operates 1,535 miles. The Kansas City Southern Railway (KCS) operates 18 miles in Kansas. The Norfolk Southern Railway (NS) also operates track in Kansas via three miles of trackage rights in the Kansas City area, but on a much smaller scale. Short line, or Class III railroad, own or operated over an additional 1,931 miles of track. **Error! Reference source not found.** displays a map of the Kansas railroad network. The state also has 41 miles of rail lines for tourist/excursion railroads.[14]

Kansas Rail Traffic Directional Flows

Traffic Type	Tons (million)	Percent	Carloads/Units	Percent
Interstate Inbound	29.1	8.5%	459,603	7.9%
Interstate Outbound	20.7	6.0%	377,604	6.5%
Intrastate	1.2	0.3%	12,679	0.2%
Through Freight	293.4	85.2%	4,983,097	85.4%
Total=	344.5	100.0%	5,832,983	100.0%

Most of the Class I rail traffic is through traffic progressing from the west coast to the Midwest or from the coal fields in Wyoming to the South and Southeast. Grain is the major commodity originated in Kansas by the Class I railroads and coal is the major commodity destined to Kansas. Connected to the Class I network are 1,666 miles of short line or Class III rail lines. The Kansas Freight tonnage transported by railroads in Kansas totaled approximately 342 million tons in 2008, a decrease of 9.4 percent from 2005 tonnage levels due to the downturn in the economy. Freight tons include originating, terminating and through traffic. The total 2008 rail carload tonnage would require more than 15 million truckloads to move the equivalent bulk weight over Kansas highways.[15] Coal is the principal commodity hauled by railroads in Kansas with approximately 193 million tons or 56 percent of the total rail tonnage.

A total of about 420,000 carloads totaling about 24 million tons of freight originated in Kansas in 2008. Farm products comprised 52 percent of originated freight tonnage. Food products and chemicals accounted for 12 percent and 11 percent of the 2008 tonnage, respectively.

8.1.1 FREIGHT RAIL TRAFFIC DENSITIES

The 2007 freight density map shows all rail lines in Kansas, measured in million net tons per mile. The map represents combined tonnage for freight moving outbound, inbound, intrastate and overhead. Rail lines with the heaviest density in Kansas are concentrated in the eastern portion of the State. The four busiest rail lines, each carrying over 40 million tons per mile per year are indicated by purple or red lines:

- UP “coal route” connecting Kansas City – Topeka – Marysville, including the Marysville and Kansas Subdivisions (purple line);
- BNSF “Transcon” connecting Kansas City – Emporia – Wellington, including a portion of the Panhandle and the Emporia Subdivisions (red line);
- UP line connecting Kansas City – Paola – Chetopa, including the Coffeyville and Parsons Subdivisions (red line);
- BNSF line connecting Kansas City and Ft. Scott, including the Fort Scott Subdivision (red line).

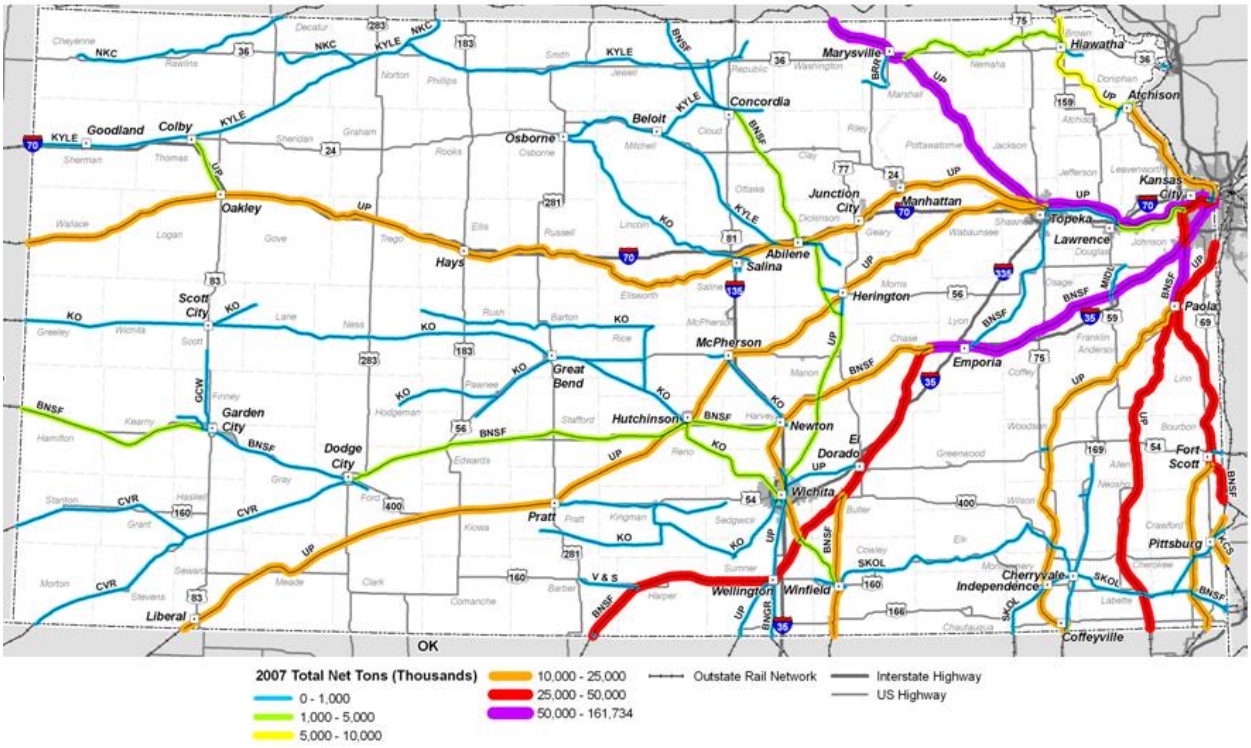
The heavy densities on these corridors are mainly attributed to coal, intermodal and agricultural freight. The heaviest tonnage is for coal shipments that enter Kansas on UP’s Marysville Subdivision heading toward

[14] *2011 Kansas Statewide Rail Plan*
[15] *Assumed weight capacity of a truckload to be 45,000 pounds*

Kansas City and markets beyond. At 110 to 160 million tons per mile, UP's Marysville to Kansas City rail line is among the heaviest density rail lines in the nation. Kansas is also a major conduit for import and export traffic traveling between Los Angeles and Chicago on either the BNSF or UP rail lines.

For outbound traffic, grain is the major commodity transported by rail from Kansas. The Class I railroads haul 110 car grain unit trains to cattle feed lots or to ports for export. The unit trains are loaded at large silos along the main rail lines. Smaller grain trains are loaded in rural areas, shuttled by short line railroads to interchange locations and then assembled into longer unit trains for transport by the Class I railroads. The short line railroads play an important role in the Kansas economy as the connector of rural agricultural areas to the main rail distribution lines. On the rail density map, the blue and green lines indicate how the short line networks connect the rural agricultural areas and serve as a vital link in getting Kansas' grain competitively to market and helping to sustain the State's rural economy.

Kansas Rail Traffic Density (2007)



A total of about 417,000 carloads totaling about 24 million tons of freight terminated in Kansas in 2008. Coal was the primary commodity delivered with 52 percent of the tonnage. Intermodal shipments accounted for an additional 10 percent of the total in 2008.[16]

Forecasted Rail Traffic for Kansas by Traffic Type

Traffic Type	2007 Tonnage (millions)	2030 Tonnage (millions)	Change (%)	CAGR* (%)
Interstate Inbound	29	35	20.60%	0.80%
Interstate Outbound	21	30	44.50%	1.60%
Intrastate	1	2	25.60%	1.00%
Overhead	293	404	37.50%	1.40%
Total=	345	470	36.50%	1.40%

*compound annual growth rate (CAGR)

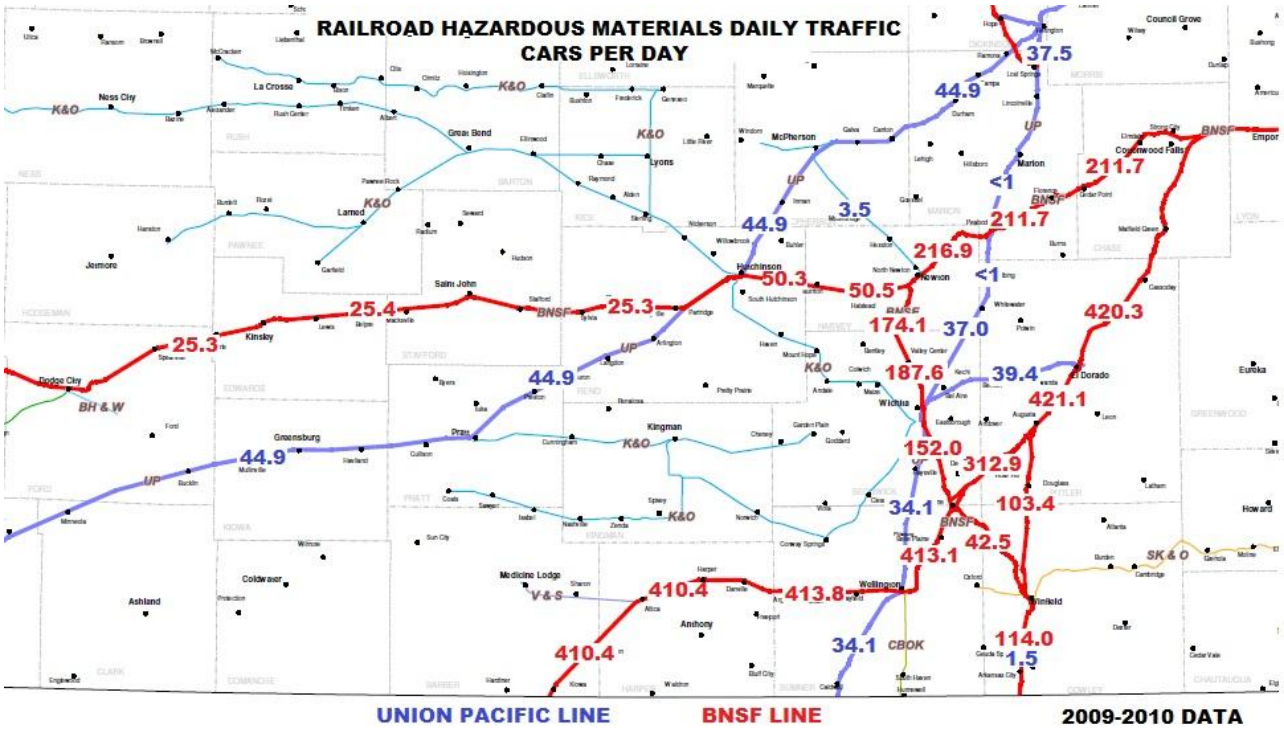
[16] *U.S. Freight Railroad Industry Snapshot from Association of American Railroads website at www.aar.org*

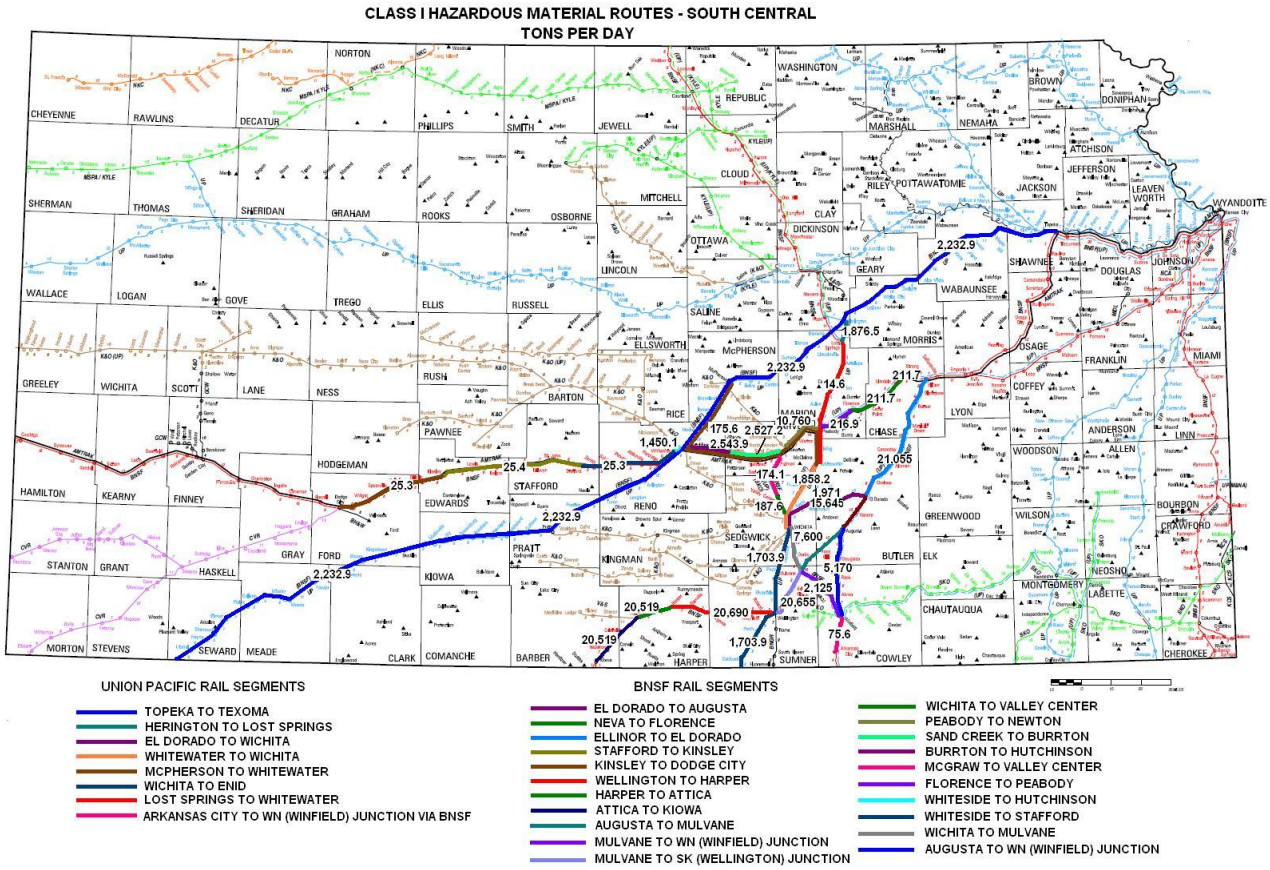
Forecasted Rail Traffic by Commodity

Commodity	2007 Tons	2007 Share	2030 Tons	2030 Share	CAGR* (2007-2030)
Coal	192,683,655	55.9%	257,243,760	54.7%	1.3%
Farm products	38,042,129	11.0%	50,178,894	10.7%	1.2%
Food and kindred products	28,582,309	8.3%	33,535,770	7.1%	0.7%
Intermodal	27,261,168	7.9%	56,644,084	12.0%	3.2%
Flammable liquids	11,619,387	3.4%	16,416,025	3.5%	1.5%
Chemicals or allied products	11,297,371	3.3%	11,850,378	2.5%	0.2%
Transportation equipment	7,405,786	2.1%	9,874,296	2.1%	1.3%
Primary metal products	4,892,776	1.4%	6,349,709	1.4%	1.1%
Clay, concrete, glass, or stone products	4,044,630	1.2%	6,050,997	1.3%	1.8%
Nonmetallic ores, minerals, excluding fuels	3,988,374	1.2%	6,833,387	1.5%	2.4%
Lumber or wood products, excluding furniture	3,354,440	1.0%	3,264,107	0.7%	-0.1%
Pulp, paper, or allied products	2,952,260	0.9%	3,266,204	0.7%	0.4%
Petroleum or coal products	2,336,722	0.7%	2,864,313	0.6%	0.9%
Waste or scrap materials not identified by producing industry	2,288,104	0.7%	3,422,851	0.7%	1.8%
Other	3,768,158	1.1%	2,409,205	0.5%	2.0%
Total=	344,517,268	100.0%	470,203,980	100.0%	1.4%

*compound annual growth rate (CAGR)

Information developed from Class I carrier manifests shows the following number of railcars carrying hazardous materials through the south central Kansas region:





Information was not readily available for Class III carriers to determine the number of hazardous materials railcars; however, based on 2004 manifest information, less than 5% of tonnage is classified as hazardous.

Kansas Rail Miles Owned and Operated

Class I Carriers	Main Line Owned	Lines Leased to Class III	Miles Operated	Trackage Rights
BNSF Railway	1,237		1,237	449
Kansas City Southern	18		18	
Norfolk Southern				3
Union Pacific System	1,800	265	1,535	837
Class I Total	3,055	265	2,790	1,289

Source: Class I's = Annual Reports R-1

CLASS I AND CLASS III RAILROADS IN SOUTH CENTRAL KANSAS

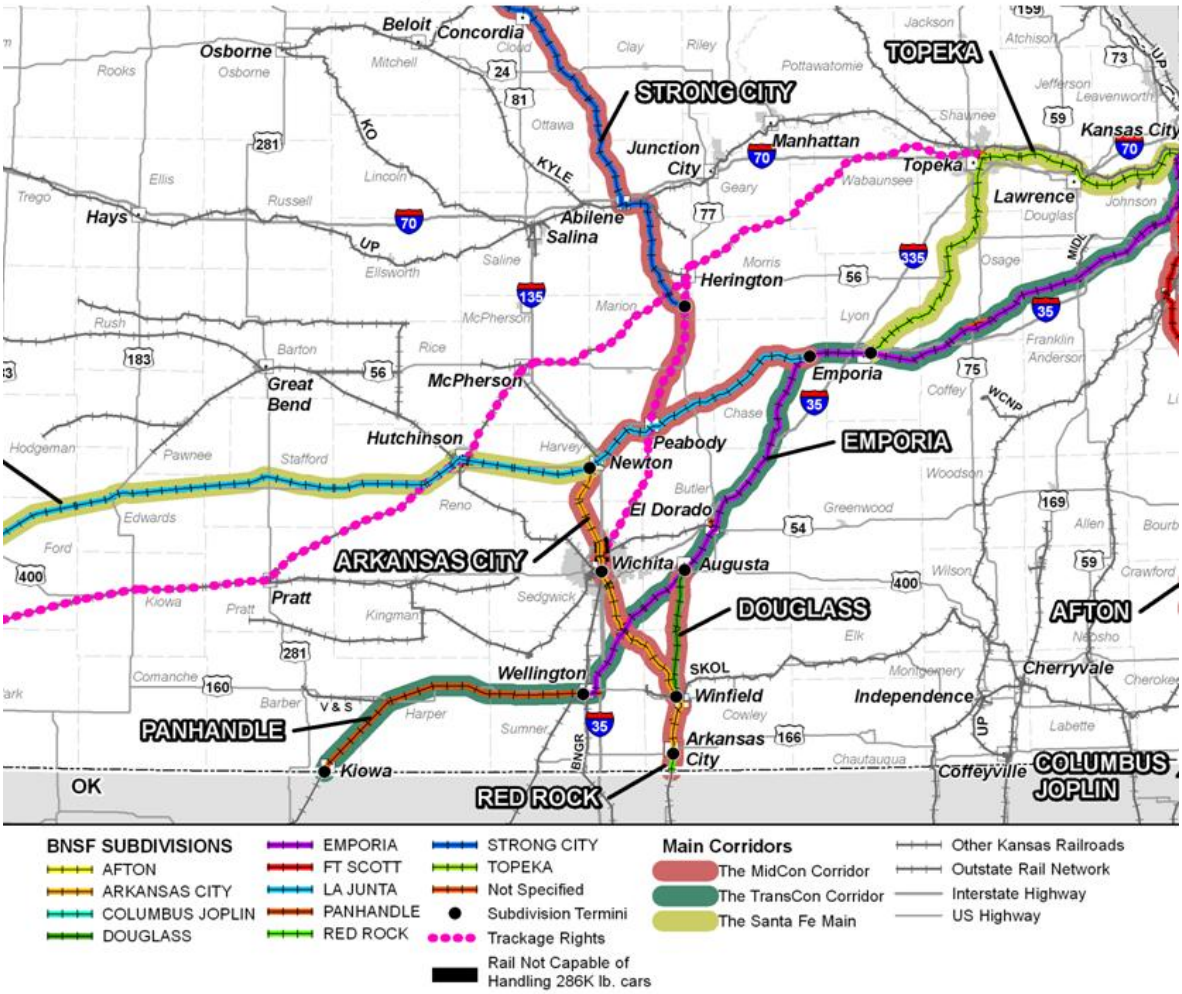
8.1.1.1 BNSF RAILWAY

BNSF Railway operates one of the largest railroad networks in North America with a total of approximately 32,000 operated miles of track in 28 states and two Canadian provinces. Approximately 23,000 route miles are owned by BNSF with the remainder operated by the railroad pursuant to trackage rights or leases. Approximately 9,000 route miles of BNSF Railway's system consist of trackage rights that permit BNSF Railway to operate its trains with its crews over other railroads' tracks.

BNSF's Main Corridors in Kansas

BNSF Railway has five principal corridors in and through Kansas. Each corridor carries substantial through freight as well as origin and termination service for shippers and receivers in Kansas.

The MidCon Corridor, The MidCon is a north-south corridor extending from the Canadian province of Manitoba to the Texas Gulf Coast and the Mexican State of Coahuila de Zaragoza. This corridor primarily handles coal, agricultural products, industrial products and petroleum products. The MidCon also hosts Amtrak's Southwest Chief between Newton and Ellinor. In Kansas, the MidCon is comprised of all or a portion of the following BNSF subdivisions: Afton, Arkansas City, Douglas, Fort Scott, La Junta, Red Rock, Strong City, and St. Joseph. The Strong City Subdivision has the potential to serve as a bypass allowing north-south traffic to avoid the Kansas City complex. Between 2000 and 2009, over 696 million tons of freight moved over the MidCon in Kansas. Forty eight million tons originated in Kansas and 48 million tons were destined for points within Kansas. During this period BNSF invested over $220 million in the MidCon Corridor's infrastructure.

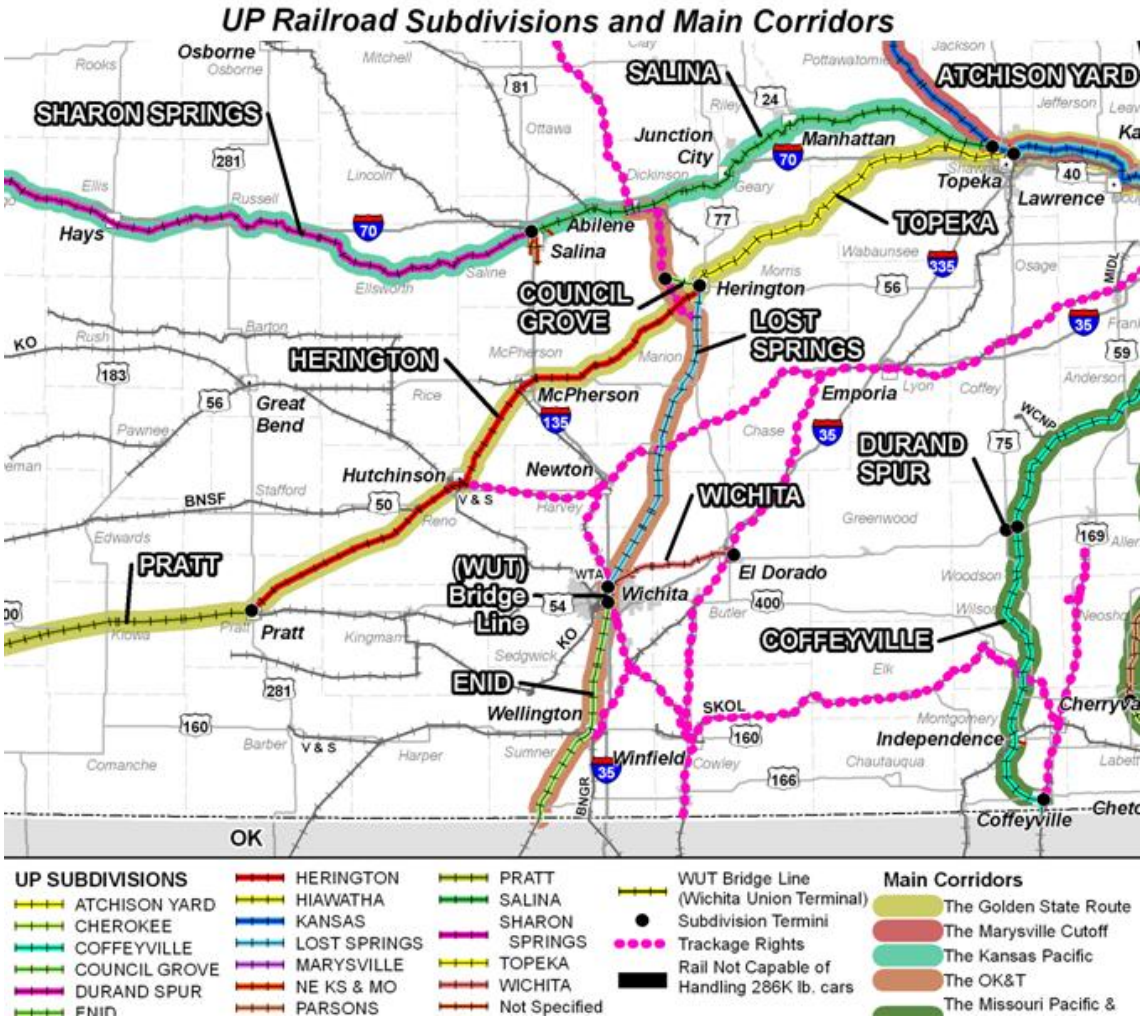


The Transcon, The TransCon is an east-west corridor extending from the California coast to Chicago, St. Louis, Memphis, Birmingham, and the Dallas-Fort Worth metroplex. The corridor primarily handles consumer, industrial, and agricultural products. In addition, the TransCon hosts Amtrak's Southwest Chief between Ellinor and Kansas City. In Kansas, the TransCon is comprised of the Emporia Subdivision and a portion of the Panhandle Subdivision. Between 2000 and 2009, over 968 million tons of freight moved over the TransCon in Kansas. Sixty six million tons originated in Kansas and 38 million tons were destined for points within Kansas. During this period BNSF invested over $1.8 billion in the TransCon Corridor's infrastructure.

The Santa Fe Main, comprised of portions of the Topeka, and La Junta subdivisions, originates at Kansas City, and passes through Topeka, Newton, and Dodge City, exiting Kansas at its western border en route to Pueblo, Colorado, and Albuquerque, New Mexico. It is a primary route for originating grain trains that move eastward off of this line to other BNSF lines, and the route of Amtrak's Southwest Chief. Carload traffic moves between Colorado and Kansas City in modest volumes. It is single track and is mostly equipped with Automatic Block Signals (ABS). The line is about 471 miles in Kansas. West of Newton, approximate train traffic is less than 10 trains per day. East of Newton, train traffic is increased by traffic diverted to this line from BNSF's Transcon line.

8.1.1.2 UNION PACIFIC RAILROAD

The Union Pacific Railroad (UP) has a total of 50,766 track miles which includes 32,012 route miles, 6,510 other main line miles, 3,037 passing lines and turnouts, and 9,207 switching and classification yard miles. UP's rail network, encompassing 23 states, links the Pacific Coast and Gulf Coast ports with the Midwest and Eastern U.S. gateways. UP also provides several corridors to key Mexican gateways. UP owns 26,171 route miles and operates on the remainder pursuant to trackage rights or leases.



UP'S MAIN CORRIDORS IN KANSAS

Union Pacific Railroad has six principal corridors in and through Kansas. Each corridor carries substantial through freight as well as origin and termination service for shippers and receivers in Kansas. Minor portions of these various routes merge with other routes in and around the Kansas City area.

The Golden State Route, comprised of the Pratt, Herington, Topeka, and Kansas subdivisions, enters Kansas near Liberal, in the State's southwestern corner, and terminates at Kansas City, passing through Hutchinson and Topeka en route. It serves as a primary route between Southern California and the Ports of Los Angeles and Long Beach and Kansas City. At Kansas City, it connects to UP routes to St. Louis and Chicago. Traffic on the Golden State is primarily domestic and international intermodal freight, finished domestic and imported autos and light trucks, and general manifest freight moving in individual carloads. Significant local traffic is generated at Hutchinson and Topeka. Most of the Golden State is single-track and it is equipped with Centralized Traffic Control (CTC). It is about 455 miles in Kansas. Approximate rail traffic per day is 25 trains.

The Marysville Cutoff, comprised of the Marysville and Kansas subdivisions, begins at Gibbon, Nebraska, where it leaves UP's principal east-west main line, the Overland Route, enters Kansas along its northern border and terminates at Kansas City. It is about 173 miles in Kansas. The line serves as a primary outlet route for unit coal trains from the Gillette Field of the Powder River Basin in Wyoming to utilities in Kansas, Missouri, Oklahoma, Louisiana, Arkansas, Texas, and the Southeast. It also serves as a return route for empty coal trains. Empty return coal trains are also carried on UP's Falls City Subdivision and the former St. Joseph & Grand Island Railroad between Hiawatha and Upland, near Marysville. This route serves in effect as a third track. The Marysville Cutoff is mostly double-track and equipped with CTC. Approximate rail traffic per day is 60 trains.

The Kansas Pacific, consisting of the Kansas, Salina and Sharon Springs subdivisions, begins at Kansas City and leaves Kansas at its western border near Sharon Springs en route to its terminus at Denver. Primary traffic is unit coal trains that originate in the Yampa and North Fork Coal Fields in Colorado en route to utilities in Kansas and the Midwest, empty return coal trains, and locally originating unit grain trains and grain moving in blocks of 26 or 52 cars. The Kansas Pacific is mostly single-track and equipped with CTC. It is about 445 miles in Kansas. Approximate rail traffic per day is 15 trains.

The Falls City Subdivision begins at Omaha, Nebraska, and terminates at Kansas City. Primary traffic is general carload freight and empty unit coal trains returning to Wyoming, moving northward from Kansas City on the Falls City Subdivision as far as Hiawatha. The Falls City Subdivision is mostly single-track and equipped with CTC. It is about 96 miles in Kansas. Approximate rail traffic per day is 40 trains.

The OK&T, so named because it was at one time called the Oklahoma, Kansas & Texas Railroad, was formed out of the bankruptcy of the Chicago, Rock Island & Pacific Railroad. Consisting primarily of the Lost Springs and Enid subdivisions, it originates at Herrington and runs southward, exiting Kansas near Wellington en route to Oklahoma City and Fort Worth, Texas. Its primary traffic is unit grain trains originating on the Kansas Pacific, en route, and through short-line connections, and general carload freight, as well as finished automobiles from the General Motors assembly plant at Oklahoma City. The OK&T is single-track and is mostly not signaled. It is about 125 miles in Kansas. Approximate rail traffic per day is less than 10 trains.

The Missouri Pacific and Katy lines, comprised of the Coffeyville, Parsons, and Cherokee subdivisions, are single-track main lines that run southward from Kansas City leaving the state near Coffeyville and Chetopa. These lines carry coal trains forwarded from the Marysville Cutoff and the Kansas Pacific, unit grain trains destined to poultry feeders in Arkansas, Oklahoma, and Texas, unit grain trains destined to export at Galveston or to Mexico, and substantial carload, chemical, and finished automobile traffic between Texas, Mexico, and the Southeast, and Kansas City, Chicago, and the northeastern U.S. Both lines are mostly single-track and are equipped with CTC. Approximate rail traffic on each line is 25 trains per day. The Missouri Pacific line runs about 142 miles south from Paola to the Oklahoma border, while the Katy line is about 160 miles between the Kansas/Oklahoma border and Paola. Between the Paola and the Kansas/Missouri border in Kansas City is about 42 miles. The Missouri Pacific line primarily carries traffic into Arkansas and the Southeast, whereas the Katy line primarily carries Texas and Mexico traffic.

Class III Railroad Service in Kansas

There are currently 14 Class III railroads, including 11 local and regional carriers and three switching railroads in the State of Kansas. A primary goal of the Class III railroad operations is to forward and terminate local traffic, connecting it with the Class I railroads.

Class III Rail Lines in South Central Kansas

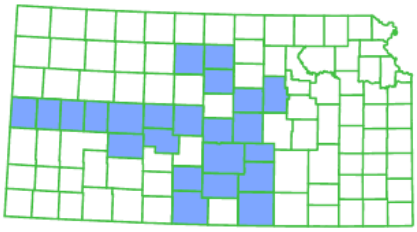
Class III Carriers	Main Line Owned	Lines Leased from Class I	Miles Operated	Trackage Rights
Local and Regional Carriers				
Blackwell Northern Gateway Railroad	18		18	
Kansas & Oklahoma Railroad	642	111	753	36
South Kansas & Oklahoma	305		305	36
V & S Railway	25		25	2
Mileage Totals				
Class III Total	990	111	1,101	74

Short Lines = Data provided by each Short Line Company
Note: The Class II and III miles operated do not include the miles of trackage rights

The Kansas short line rail system is critical to providing local markets a transportation link to national and international markets via their interconnection with the Class I rail system. The short line rail system is truly a collector system and, as such, provides local rail access and customer service. Train traffic on the short lines will vary from seasonal to four trains per day. This is in contrast to the Class I railroads that on selected lines can see as many as 89 trains per day.

Train speeds on the short lines vary from a low of 5 to 10 mph to a high of 40 mph. This speed is a function of the track conditions, rail age, rail weight (measured in pounds for three foot section), tie condition, and ballast condition. Virtually all short lines were operated by Class I railroads prior to de-regulation of the rail industry in the early 1980s. As the Class I revenues decreased on these lines, so did the maintenance and infrastructure investments, leading to most short line systems being started in a deferred maintenance condition. The short lines have been able to replace ties and ballast through their own capital investments, previous federal freight rail programs, and the State Rail Service Improvement Fund. However, the majority of the rail has not been replaced or upgraded, with the age of some rail being over 100 years old. The 2008 rail car load statistics show that Kansas short lines originated and terminated over 177,000 car loads. The significance of the short line car loadings is that for every car load there are 3 to 4 semi-trucks (548,000 to 685,000) removed from the state highway system.

8.1.1.3 KANSAS AND OKLAHOMA RAILROAD

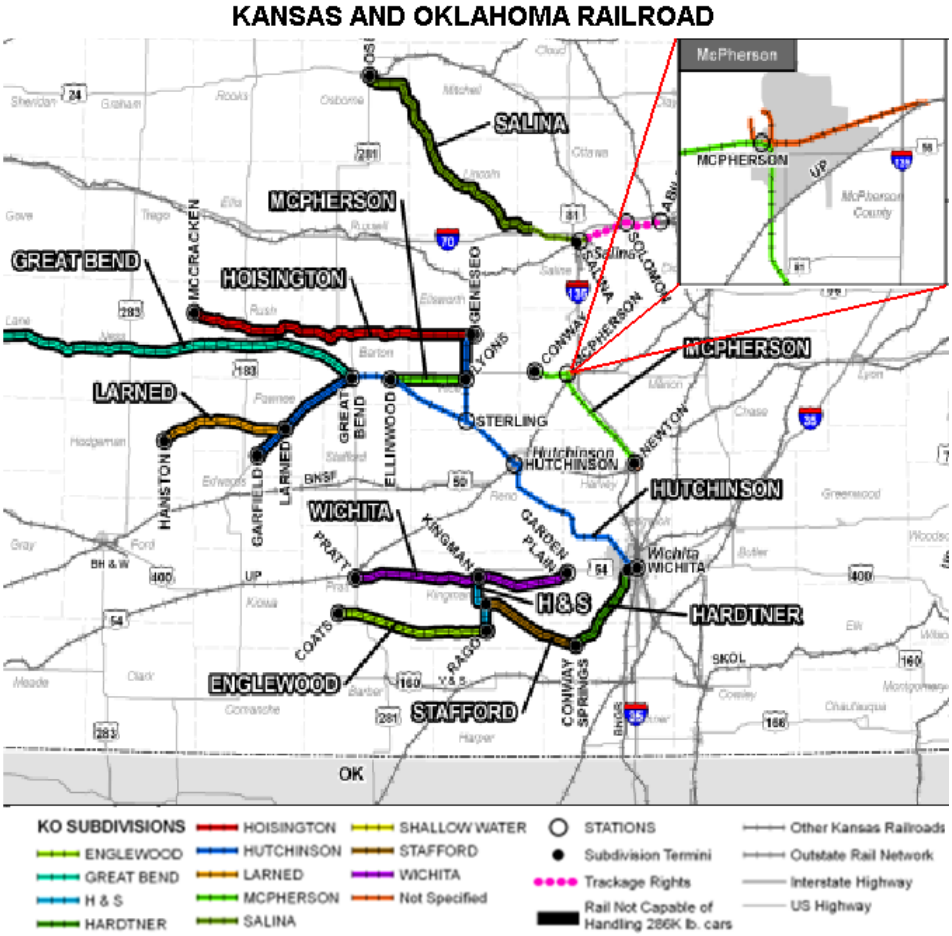


The Kansas and Oklahoma Railroad (KO) is a subsidiary of WATCO Companies, Inc. (WATCO), a Pittsburg, KS, based company. As of 2009, WATCO owned and operated 22 railroads nationwide, including the KO, South Kansas and Oklahoma Railroad (SKOL), and Kaw River Railroad (KAW) in Kansas. More than 1,200 people are employed by WATCO and its subsidiaries nationwide.

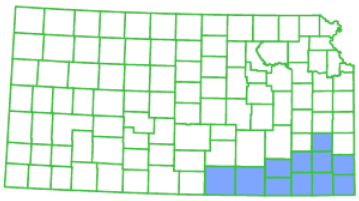
WATCO purchased the KO on June 29, 2001. The KO operates over 840 track miles in three directions, making it one of the largest short lines in the industry. It originates in Wichita and extends to the Colorado state line. It owns 642 miles of track in Kansas, leases 111 miles of track to operate, and has 36 miles of trackage rights on UP lines. In Kansas, the KO has 31 locomotives; 27 are owned and 4 are leased. It has access to 981 freight cars; 252 owned and 729 leased. More than 55,000 carloads of agricultural and industrial products, such as corn, wheat, fertilizers, lumber, cement, sand, and rock are transported annually on the KO.

Kansas and Oklahoma Railroad Statistics

Location	Employees	Locomotives	Freight Cars	Passenger Cars
KS	N/A	27 owned 4 leased	252 owned 729 leased	0
National	1,200			
Location	**Operated Miles**	**Owned Miles**	**Leased Miles**	**Miles Trackage Rights**
KS	753	642	111	36-UP
Connections to other railroads:				
BNSF: Abilene, Hutchinson, Newton and Wichita, KS UP: Hutchinson, McPherson, Salina and Wichita, KS KYLE: Osborne, KS SKOL: Wichita, KS WTA: Wichita, KS				



8.1.1.4 SOUTH KANSAS AND OKLAHOMA RAILROAD



The South Kansas and Oklahoma Railroad (SKOL) is a subsidiary of WATCO Companies, Inc. (WATCO), a Pittsburg, Kansas based company.

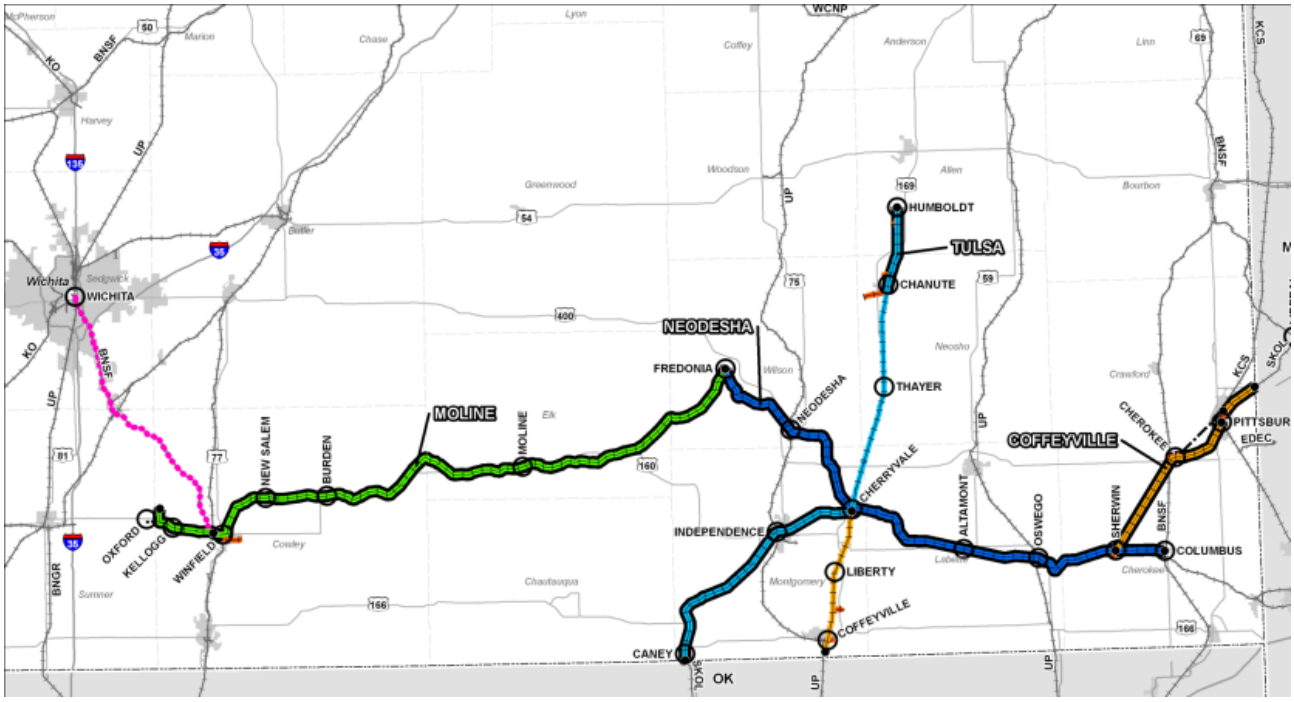
The SKOL, purchased in 1987, was the first short line railroad operated by WATCO. The SKOL operates 305 track miles in Kansas, originating from Cherryvale, Kansas and serves customers primarily in southeastern Kansas and northeastern Oklahoma. More than 48,000 carloads of agricultural and industrial products such as corn, wheat, fertilizers, lumber, cement and sand are transported annually.

South Kansas and Oklahoma Railroad Statistics

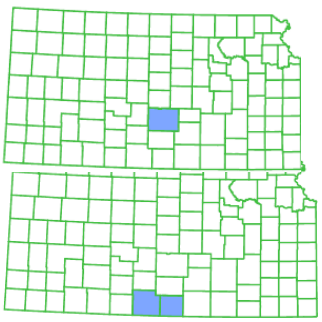
Location	Employees	Locomotives	Freight Cars	Passenger Cars
KS	N/A	31 owned 3 leased	331 owned, 611 leased	0
Location	**Operated Miles**	**Owned Miles**	**Leased Miles**	**Miles Trackage Rights**
KS	305	305	0	44- BNSF
KS, OK, MO	380	380	0	44-BNSF
Connections to other railroads:				
BNSF: Columbus and Winfield, KS Kansas City Southern: Pittsburg, KS Union Pacific: Coffeyville and Winfield, KS Kansas and Oklahoma: Wichita, KS				

Source: Prepared by Olsson Associates, online source: www.watcocompanies.com

SOUTH KANSAS AND OKLAHOMA RAILROAD



8.1.1.5 V&S RAILWAY LLC



V&S Railway operates on two separate rail lines. It has a 21.5 mile line that is located in Barber and Harper Counties between the cities of Attica and Medicine Lodge. The second line is 3.5 miles long and is located in the City of Hutchinson.

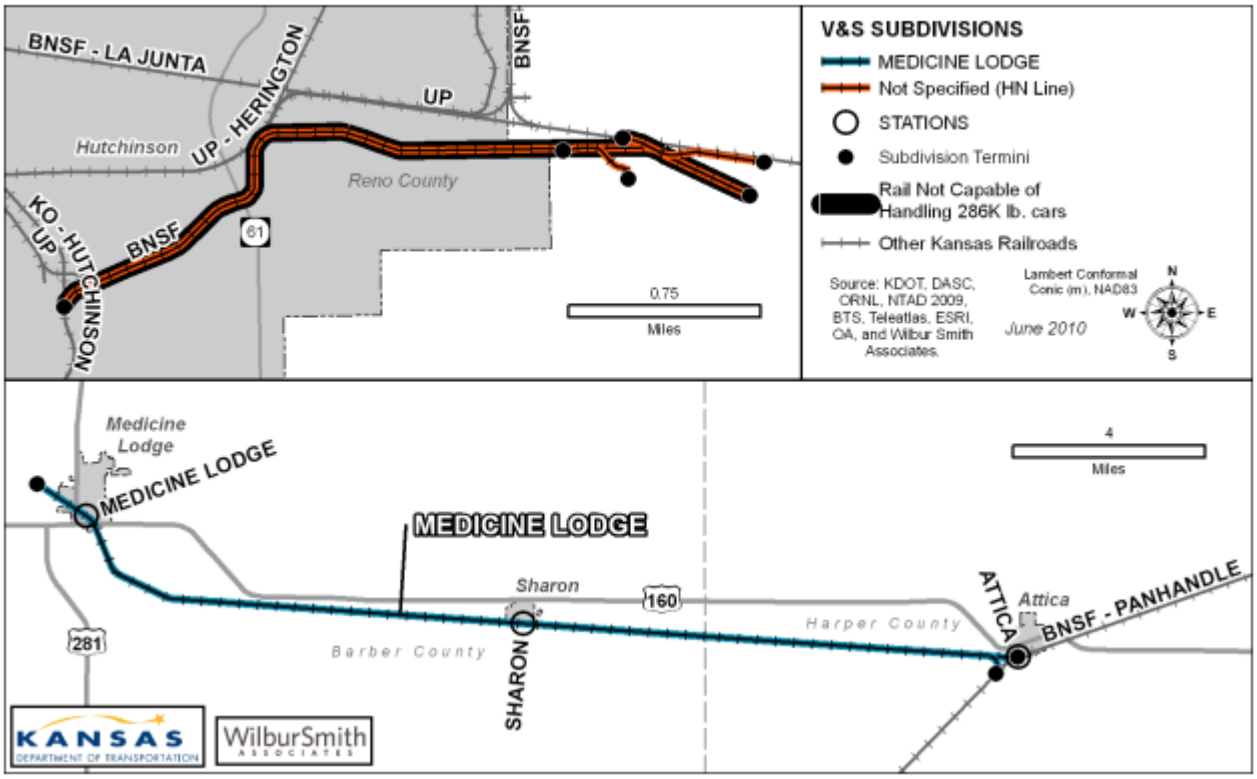
Commodities transported include sheet rock and bagged plaster. In 2009, the V&S hauled 1,250 carloads. Currently the railway has three employees and two locomotives; one in Medicine Lodge and one in Hutchinson. The V & S Railway connects with the BNSF Railway at Attica, Kansas in Harper County.

In November 2005 the Hutchinson and Northern Railroad was purchased by Pacific Western Railway. In January 2006 V & S Railway LLC began operating the railroad on behalf of Pacific Western Railway. In May 2006, V&S acquired the 3.5 mile line in Hutchinson, and currently operates the line in conjunction with its operations in Medicine Lodge. Major commodities shipped on the line include salt and scrap iron. A freight car repair facility is also located on the line.

V&S Railway Railroad Statistics

Location	Employees	Locomotives	Freight Cars	Passenger Cars
KS	3	2	0	0
Location	Operated Miles	Owned Miles	Leased Miles	Miles Trackage Rights
KS	25	25	0	2-BNSF
Connections to other railroads:				
BNSF: Attica and Hutchinson, KS Union Pacific: Hutchinson, KS Kansas and Oklahoma: Hutchinson, KS				

V&S Railway Rail Network in Kansas



8.1.2 COMMUNITY IMPACTS

Community and quality of life impacts related to rail transportation include safety, noise and air pollution, energy and highway congestion relief. Safety, environmental and energy contributions have been discussed earlier in this chapter. One additional community impact which has been the subject of recent attention is congestion relief related to rail operations.

According to *2008 Kansas Long Range Transportation Plan*[17], with increasing population and freight movement, urban and rural areas have seen heavier traffic volumes and worsening congestion. There were 105 miles of congested highways in the State's urban areas, and it is expected the congested highway mileage will reach 265 miles by 2030. Rural congestion is also rising. In 2008, KDOT indentified 535 miles of

[17] *Kansas DOT, Long Range Transportation Plan 2008, available online at* http://www.ksdot.org:9080/lrtp2008/

congested rural highways, and this number could be 1,725 miles in 2030 if no improvements are made on these congested segments. Truck traffic contributes significantly to the rural congestion, with trucks accounting for 20 to 25 percent of traffic.

8.1.3 RAIL SAFETY

Rail safety requirements are provided through a combination of federal and state laws. Most safety-related rules and regulations fall under the jurisdiction of the Federal Railroad Administration, as outlined in the Rail Safety Act of 1970 and other legislation, such as the most recent Rail Safety Improvement Act of 2008. Rail safety issues are generally comprised of highway/rail grade crossing safety, rail safety inspection, rail trespass, and other requirements regarding the movement of hazardous materials and implementation of new technology. Although these issues fall under FRA's jurisdiction, state agencies are heavily involved in efforts to improve the safety of the rail system. Overall rail safety trends in Kansas are shown below:

Total Train Accidents/Incidents in Kansas (2001-2009)

	2001	2002	2003	2004	2005	2006	2007	2008	2009
Total Accidents/Incidents	100	83	92	104	108	99	87	88	59
Total Fatalities	6	6	6	6	3	9	5	5	6
Total Non-fatal Conditions	157	86	90	109	117	104	146	122	89

Source: FRA Office of Safety Analysis

Grade crossing incident statistics over the past decade are shown below:

Kansas Grade Crossing Incident Statistics

	2001	2002	2003	2004	2005	2006	2007	2008	2009
Total Incidents	63	71	58	72	64	59	57	43	46
Fatalities	5	9	3	7	7	15	9	9	2
Injuries	20	26	28	16	31	27	18	16	15

Source: FRA Office of Safety Analysis

The number of grade crossing incidents and fatalities/injuries has decreased steadily over the past five years. This decrease is at least partly attributed to the State's emphasis on addressing the over 4,000 crossings without active warning systems, as well as the grade crossing safety educational programs provided by the State's Operation Lifesaver chapter. Additional information regarding county specific accident data is shown below and on the next page.

TEN-YEAR ACCIDENT/INCIDENT OVERVIEW FOR KANSAS

KANSAS

SUMMARY BY CALENDAR YEAR (JAN Through JAN)

ALL RAILROADS SELECTED

Category	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	% Change From Last Year	% Change From 2002	Total For Period
TOTAL ACCIDENTS/INCIDENTS	23	16	24	20	23	21	28	15	22	14	-36.36	-39.13	206
---Total fatalities	1	1	3	.	1	1	.	1	.	3	.	200.00	11
---Total nonfatal conditions	13	5	9	13	14	14	13	6	17	9	-47.06	-30.77	113
Employee on duty deaths	.	.	.	.	.	.	.	.	.	.	.	.	.
Nonfatal EOD injuries	10	4	8	9	6	11	11	5	11	5	-54.55	-50.00	80
Nonfatal EOD illnesses	.	.	.	.	.	.	.	.	.	.	.	.	.
Total employee on duty cases	10	4	8	9	6	11	11	5	11	5	-54.55	-50.00	80
Cases with days absent from work	6	3	3	6	4	7	7	4	10	3	-70.00	-50.00	53
Trespasser deaths, not at HRC	.	1	.	.	.	1	.	.	.	.	.	.	2
Trespasser injuries, not at HRC	.	.	.	1	1	.	.	.	.	2	.	.	4
TRAIN ACCIDENTS	4	6	8	6	5	5	12	4	5	1	-80.00	-75.00	56
--- Train accident deaths	.	.	.	.	.	.	.	.	.	.	.	.	.
--- Train accident injuries	.	.	.	.	.	.	2	.	.	.	.	.	2
> Human factor caused	2	1	2	.	1	2	4	2	1	1	0.00	-50.00	16
> Track caused	1	4	4	5	3	1	5	1	.	.	.	.	24
> Motive power/equipment caused	.	1	2	.	1	1	2	.	.	.	.	.	7
> Signal caused, all track types	.	.	.	.	.	.	.	.	1	.	.	.	1
> Signal caused, main line track	.	.	.	.	.	.	.	.	.	.	.	.	.
> Miscellaneous caused	1	.	.	1	.	1	1	1	3	.	.	.	8
> Collisions	.	.	.	.	1	.	1	1	.	.	.	.	3
> *** Collisions on main line track	.	.	.	.	.	.	1	.	.	.	.	.	1
> Derailments	3	5	8	6	4	5	7	3	5	.	.	.	46
> Other types, e.g., obstructions	1	1	.	.	.	.	4	.	.	1	.	0.00	7
Accidents with reportable damage > $100K	1	2	1	.	2	2	4	1	.	.	.	.	13
*** Percent of total	25	33	13	.	40	40	33	25	.	.	.	.	.
> $500K	.	1	.	.	.	.	1	.	.	.	.	.	2
*** Percent of total	.	17	.	.	.	.	8	.	.	.	.	.	.
> $1,000,000	.	1	.	.	.	.	1	.	.	.	.	.	2
*** Percent of total	.	17	.	.	.	.	8	.	.	.	.	.	.
Train accidents on main line	1	4	3	2	2	3	4	1	1	.	.	.	21
Accidents on yard track	3	2	5	2	3	1	7	1	4	.	.	.	28
HAZMAT RELEASES	.	.	.	.	.	.	2	.	.	.	.	.	2
--- Cars carrying hazmat	11	5	30	.	25	23	41	.	2	.	.	.	137
--- Hazmat cars damaged/derailed	5	4	1	.	.	4	10	.	2	.	.	.	26
--- Cars releasing	.	.	.	.	.	.	2	.	.	.	.	.	2
HIGHWAY-RAIL INCIDENTS	6	4	8	1	6	1	6	7	5	5	0.00	-16.67	49
--- Highway-rail incidents deaths	1	.	3	.	1	.	.	1	.	3	.	200.00	9
--- Highway-rail incidents injuries	.	.	1	.	2	.	1	2	5	.	.	.	11
Incidents at public xings	6	3	6	1	6	1	6	6	5	4	-20.00	-33.33	44
*** Percent of total	100	75	75	100	100	100	100	86	100	80	-20.00	-20.00	.
OTHER ACCIDENTS/INCIDENTS 2/	13	6	8	13	12	15	10	4	12	8	-33.33	-38.46	101
--- Other incidents deaths	.	1	.	.	.	1	.	.	.	.	.	.	2
--- Other incidents injuries	13	5	8	13	12	14	10	4	12	9	-25.00	-30.77	100
Passengers kld in train accs or crossing incs	.	.	.	.	.	.	.	.	.	.	.	.	.
Passengers inj in train accs or crossing incs	.	.	.	.	.	.	.	.	.	.	.	.	.
Passengers kld in other incidents	.	.	.	.	.	.	.	.	.	.	.	.	.
Passengers inj in other incidents	.	.	.	.	.	.	.	.	.	.	.	.	.

Other accidents/incidents are events other than train accidents or crossing incidents that cause physical harm to persons

TOTAL ACCIDENTS IS THE SUM OF TRAIN ACCIDENTS, CROSSING INCIDENTS, AND OTHER ACCIDENTS/INCIDENTS

Other accidents/incidents are events other than train accidents or crossing incidents that cause physical harm to persons

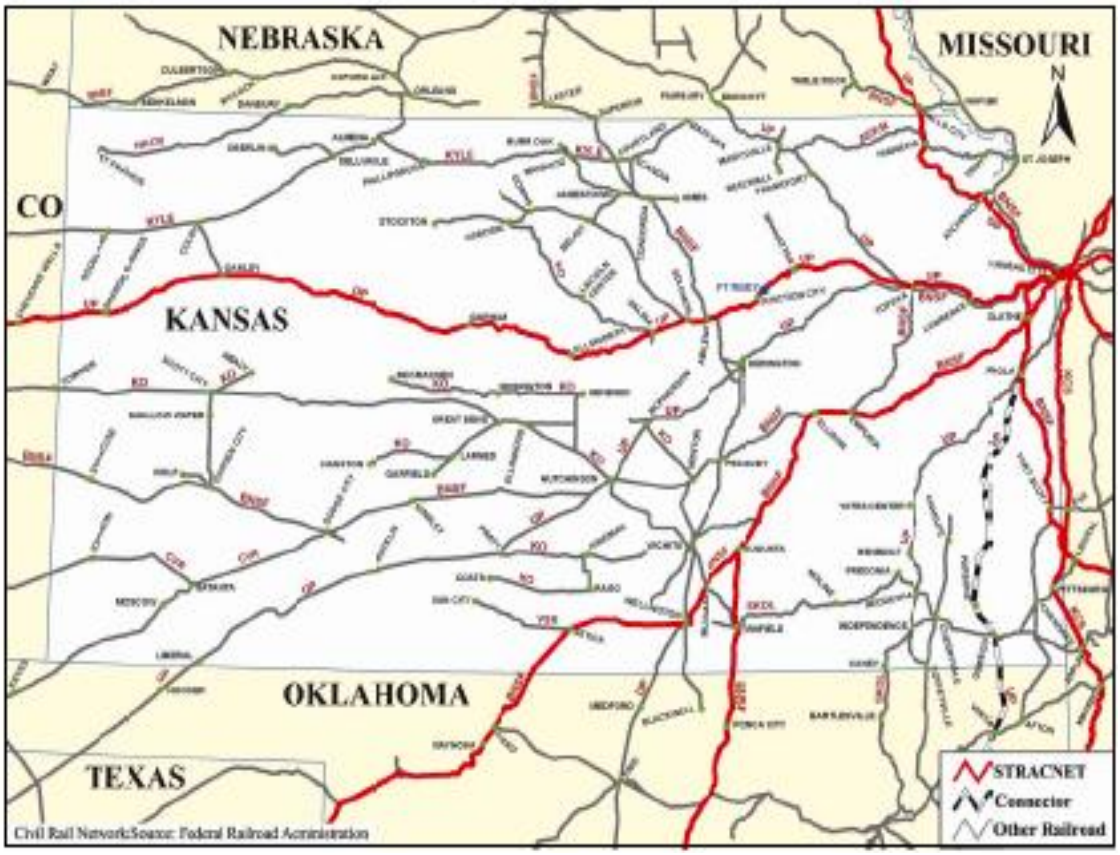
SOURCE: FEDERAL RAILROAD ADMINISTRATION – OFFICE OF SAFETY ANALYSIS

According to Federal Railroad Administration data, approximately three percent of railroad accidents reported nationwide have occurred in the state of Kansas. Statistically, approximately four railroad accidents have resulted for every one million-train miles.

8.1.4 STRATEGIC RAIL CORRIDOR NETWORK (STRACNET)

The U.S. Military Surface Deployment and Distribution Command's Transportation Engineering Agency has identified the national Strategic Rail Corridor Network (STRACNET). STRACNET is comprised of a 32,000 mile interconnected network of rail corridors and associated connector lines most important to national defense. Kansas' STRACNET system is shown below:

Kansas STRACNET Map



Source: U.S. Military Surface Deployment and Distribution Command

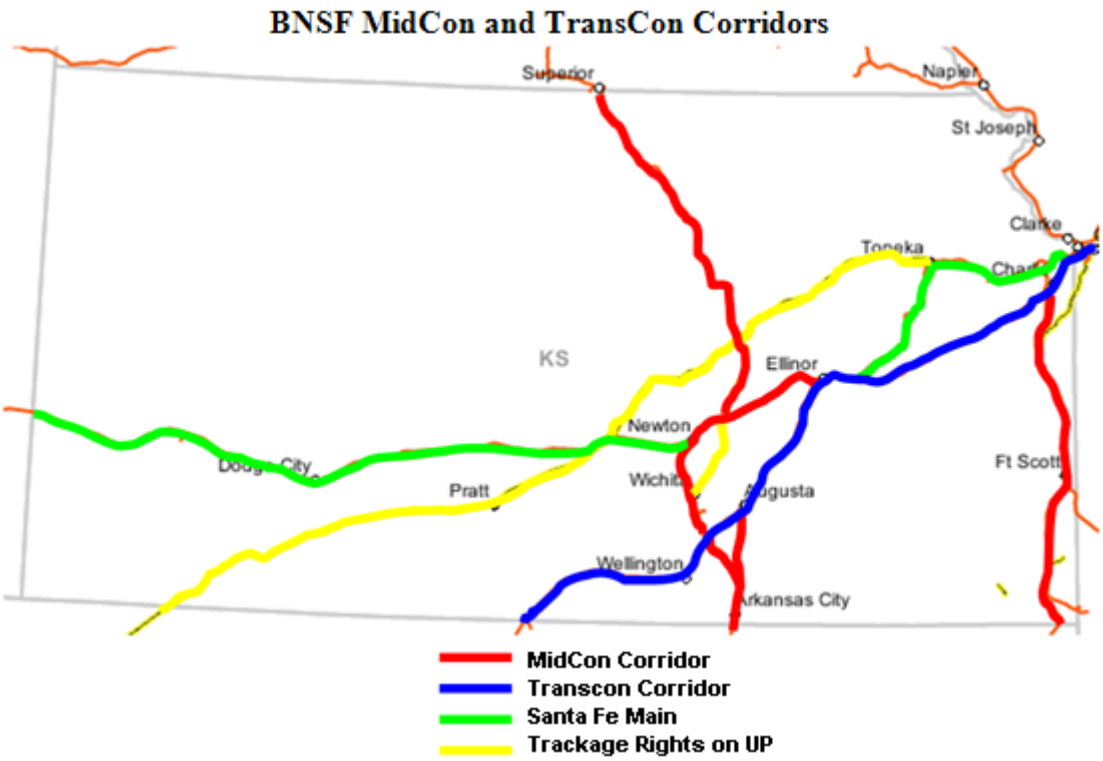
KDOT works with the Military Surface Deployment and Distribution Command to ensure the strategic nature of these corridors and connecting lines are considered in their planning process.

8.1.5 PROPOSED CLASS I RAILROAD PROJECTS

The major Class I railroads operating in Kansas recognize the strategic value of rail corridors in Kansas, not only with regard to operations within the state but within the larger region and for long-haul intermodal movements. To increase capacity and system velocity as well as mitigate choke points, Class I railroads have identified the following future projects in Kansas:

<u>BNSF Projects</u>

- ***Emporia Subdivision Capacity Projects*** - A series of track projects would be implemented on the Emporia Subdivision in Kansas between Holliday and Rose Hill. The results would expand capacity on BNSF's Transcon corridor to accommodate future volumes and improve service reliability. The projects consist of double tracking and triple tracking sections through siding connections and installation of powered crossovers.
- ***Arkansas City Subdivision Capacity Projects*** - A series of track projects would be conducted on the Arkansas Subdivision in Kansas to expand capacity to accommodate future volumes and improve service reliability. The projects consist of double tracking through connecting sidings and siding extensions.
- ***Corridors of Commerce*** – Two of BNSF's three Corridors of Commerce are located in Kansas: the MidCon and the TransCon. These corridors are uniquely positioned to enhance livability and economic development opportunities in Kansas while making freight transportation more productive and more environmentally sustainable. BNSF's Corridors initiative consists of a series of rail infrastructure projects in Kansas and other states to expand the capacity of the Corridors to meet the future freight transportation needs of North America.



Union Pacific Projects

OK&T Route Siding Upgrades – This project consists of multiple elements, including extending sidings at Caldwell and Riverdale and constructing new sidings at Aulne, Butler, and Peck. These siding projects will increase the railroad's ability to run long, fuel-efficient trains, with accompanying reduction in delays and emissions.

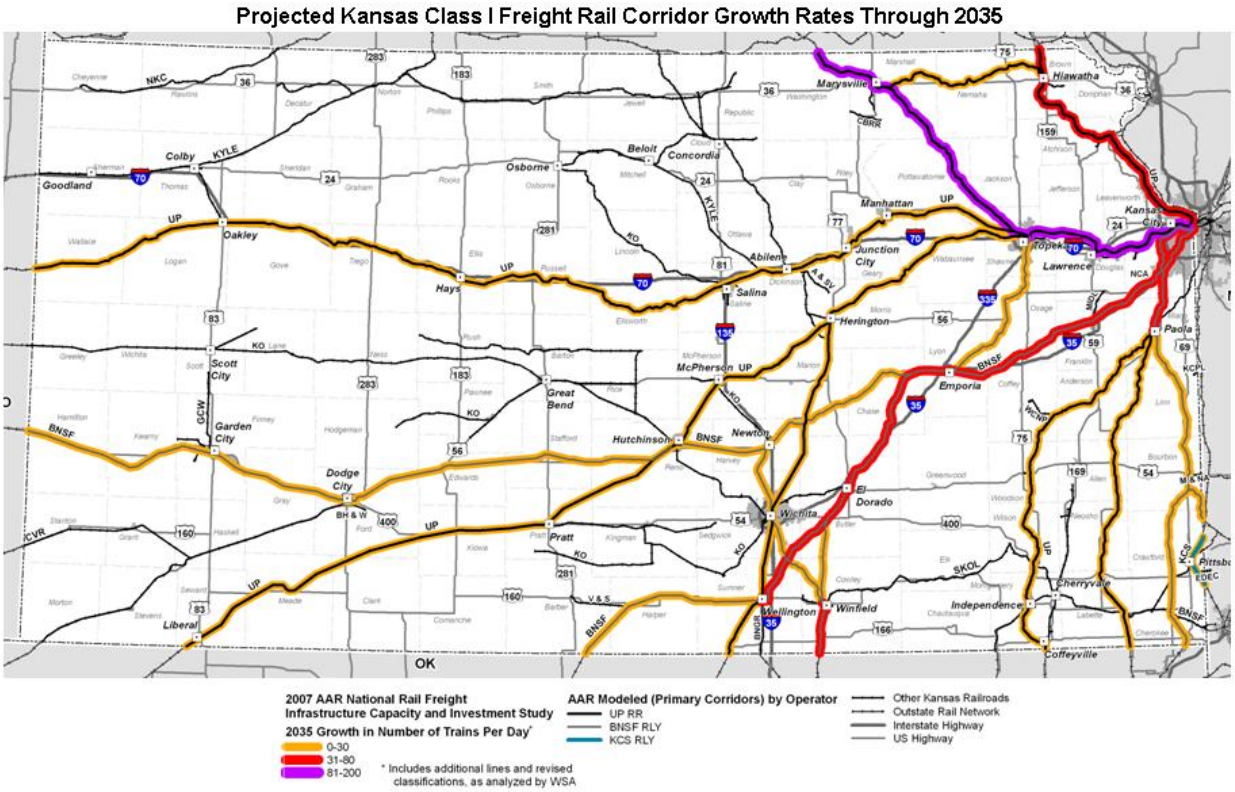
8.1.6 PROJECTED CLASS I RAILROAD CONSTRAINTS

In response to the projected increases in rail demand, the Class I railroads have worked together to identify rail corridors and corridor segments which they estimate will see the greatest increase in volume and where existing and projected capacity constraints will affect the fluidity and reliability required for the rail network to remain competitive. To determine rail mainline system capacity needs for the country, the "National Rail Freight Infrastructure Capacity and Investment Study", published by the Association of American Railroads in September 2007 was developed.

The Class I railroads designated Primary Rail Corridors. These corridors were evaluated on the basis of both current rail volumes compared to current capacity and future (2035) volumes compared to current capacity. From this, current and future levels of service from Level A to Level F, similar to that used for the highway system, were assigned to each of the corridors.[18]

The following map shows the projected growth rates on Kansas' primary rail corridors. Future growth rates in terms of trains per day for most primary rail freight corridors in Kansas are relatively moderate with projected increases of 0 to 30 daily trains through 2035. A number of north-south corridors across the state, however, are projected to have increases of 30 to 60 trains per day and the UP Kansas Subdivision north of Topeka is projected to experience more than 60 additional trains per day.

[18] *Several additional segments associated with the BNSF Midcon Corridors have been evaluated using a similar methodology and volume/capacity data presented elsewhere in this rail plan.*



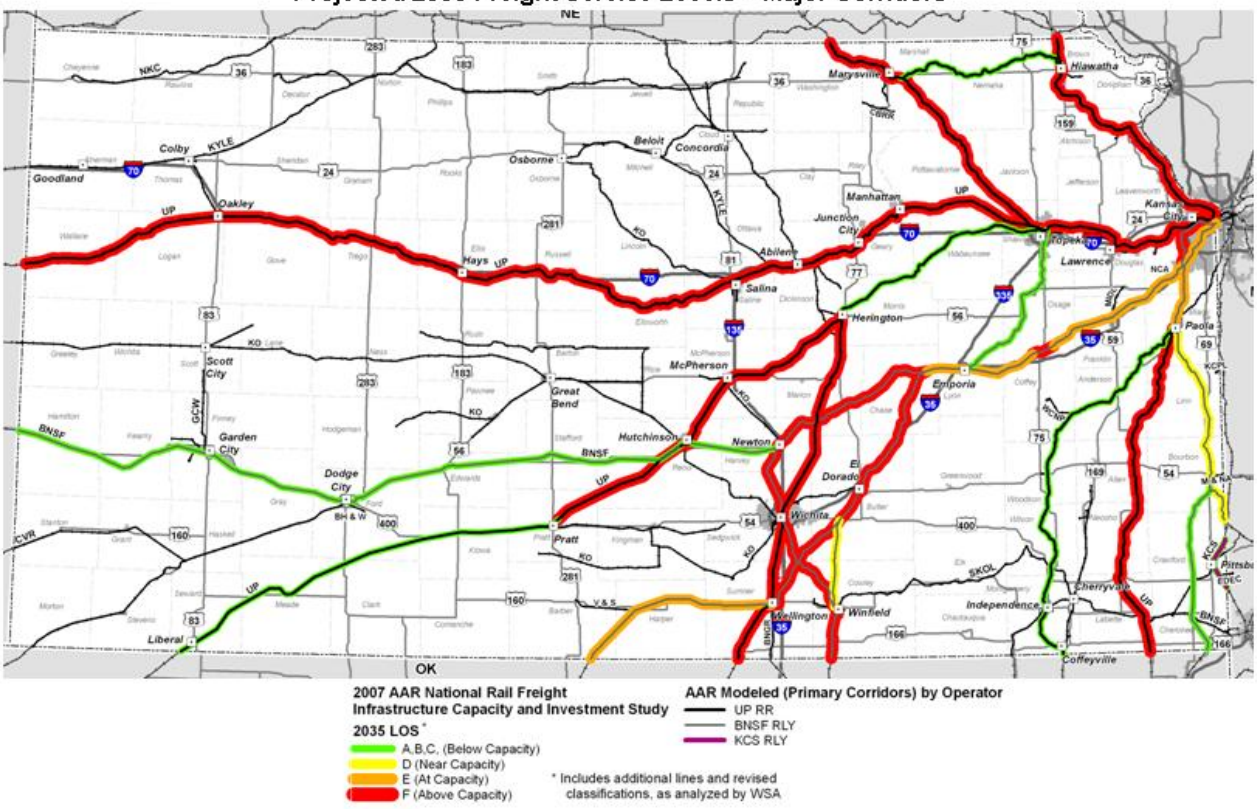
The National Rail Freight Infrastructure Capacity and Investment Study assessed current corridor capacity to determine congestion levels. This was done by calculating a volume-to-capacity ratio expressed as a level of service (LOS) grade.

LOS grades were generally described as follows:

- LOS Grades A, B, C – Rail volumes are generally below current capacity. Train flows are low to moderate with capacity to accommodate maintenance and recover from accidents.
- LOS Grade D – Rail volumes are near capacity. Train flows are heavy with moderate capacity to accommodate maintenance and recover from accidents.
- LOS Grade E – Rail volumes are at capacity. Train flows are heavy with very limited capacity to accommodate maintenance and recover from accidents.
- LOS Grade F – Rail volumes are above capacity. Train flows are unstable and service breakdown conditions exist.

The following map shows the projected level of service on Kansas rail lines in 2035 without significant investment in capacity.

Projected 2035 Freight Service Levels – Major Corridors



As noted on the map, the projected levels of service on most major rail corridors in Kansas are projected to deteriorate to Levels D, E or F without a significant level of investment such as adding track, building or lengthening passing sidings, improving signal systems, and upgrading track to support increased traffic and heavier loads.

8.1.7 Short Line Railroad Infrastructure Needs

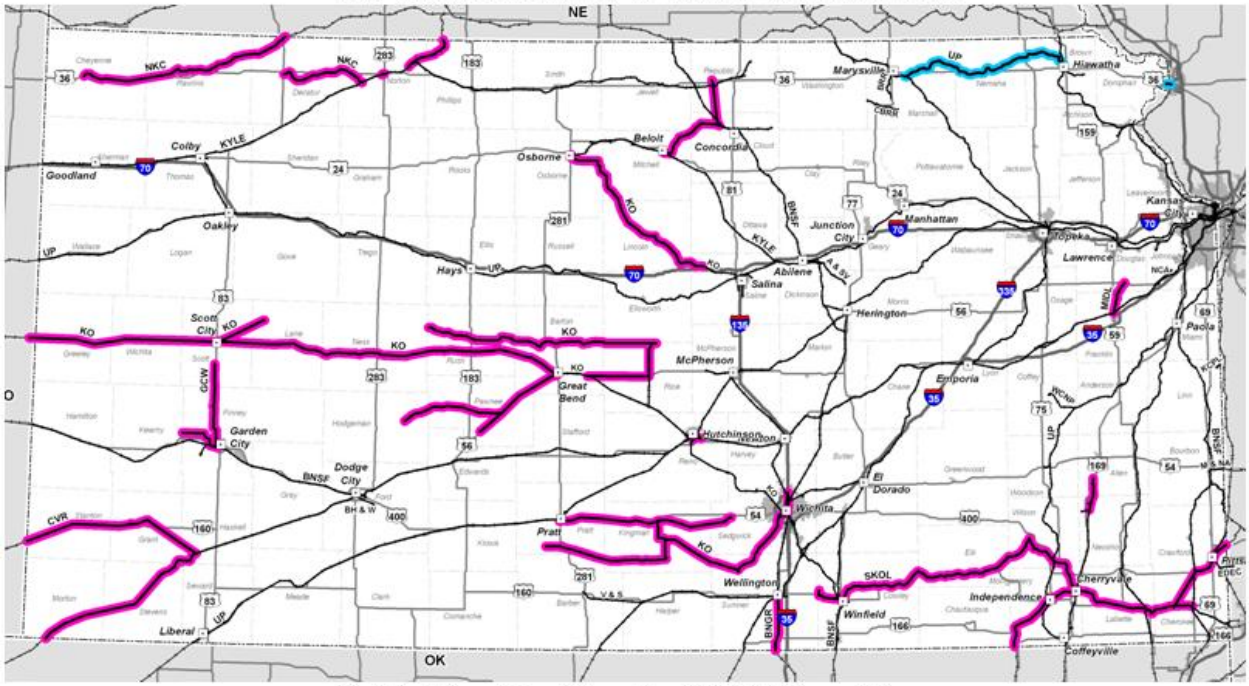
The short line railroad industry in Kansas has identified the number one priority and largest need to be the capability to handle 286,000 pound (286K) rail cars, which are the current standard for Class I rail systems. Over half of the Kansas short line system is limited to 263,000 pound (263K) car loadings. This requires the use an outdated fleet of 263K rail cars or loading the 286K rail cars 23,000 pounds light. Both scenarios increase the freight rate for Kansas shippers, predominately those shipping grain to national and international markets.

The main limiting factor to accommodate 286K is the weight of rail (pounds per three foot section). For some sections of the short line system upgrading rail weights to 90 pound rail will be sufficient while other higher volume portions will require 115 pound rail.

Other factors, such as the condition of the ties and ballast and the number of substandard open span bridge structures, will affect the total cost of upgrade. In 2007, the Kansas T-LINK Task Force estimated that a public investment of $200 million would be required to address the state's short line industry needs. A large portion of this would be required to upgrade lines to the 286K standard.

Information collected from short line railroads during the development of this Plan resulted in an estimated need for 748 miles of short line railroad track requiring rail replacement and 105 bridges needing upgrading to handle 286K rail car loadings. Short line railroad mileage in Kansas which cannot accommodate 286K carload weights are shown below:

Rail Weight Capacity of Short Line Railroads

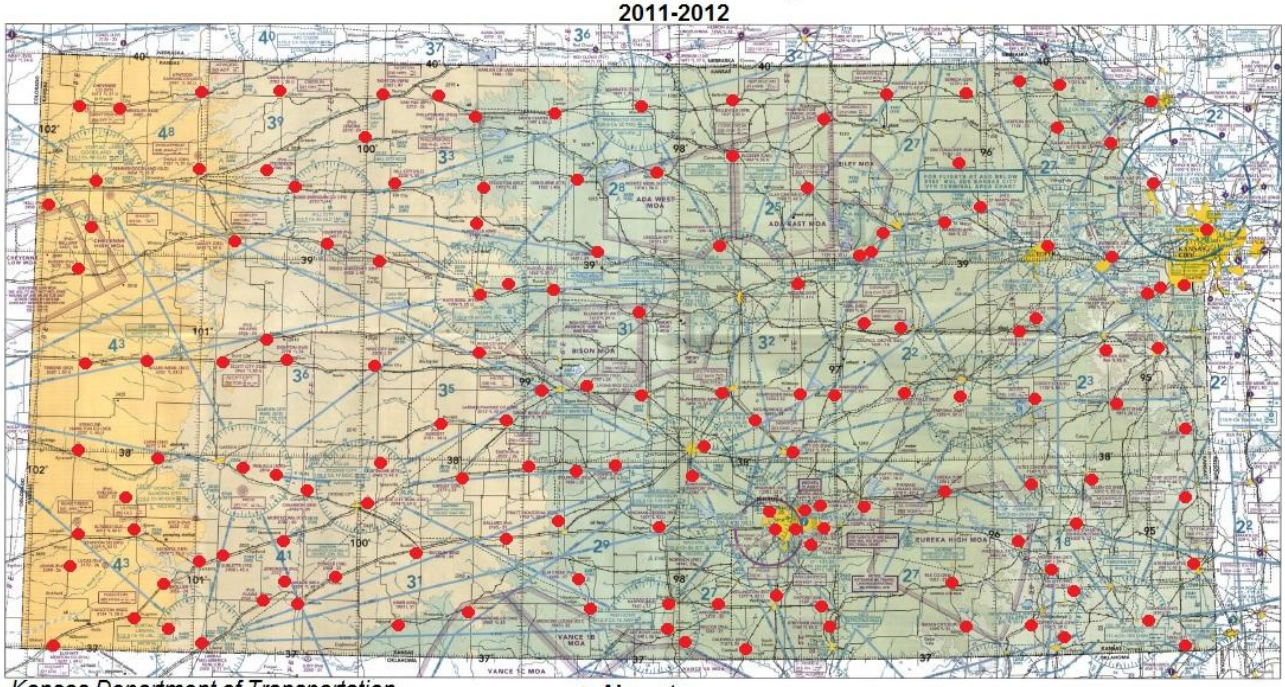


Rail Not Capable of Handling 286,000 Pound Cars

8.2 AIR TRANSPORTATION

The State of Kansas has eight commercial service (Dodge City, Garden City, Great Bend, Hays, Liberal, Manhattan, Salina, and Wichita) and 132 general aviation airports consisting of 47,651 employees with a combined payroll of more than $2.3 billion and generate nearly $10.4 billion in economic activity. Kansas airports provide a number of health, welfare, and safety benefits, the impacts including aerial agricultural spraying, medical transport and evacuation, flight training, law enforcement, wildlife management, military exercises, and search and rescue operations.

KANSAS AERONAUTICAL CHART
2011-2012



Kansas Department of Transportation

● **Airports**

TOTAL ECONOMIC IMPACTS FOR KANSAS AIRPORTS

Associated City	*Airport Name*	*Total Employment*	*Total Payroll*	*Total Output*
Commercial Service Airports				
Dodge City	Dodge City Regional	159	$5,267,500	$19,582,400
Garden City	Garden City Regional	187	$5,774,100	$25,296,900
Great Bend	Great Bend Municipal	119	$4,482,500	$12,199,000
Hays	Hays Regional	179	$5,769,100	$24,579,200
Liberal	Liberal Mid-America Regional	200	$6,122,500	$28,725,500
Manhattan	Manhattan Regional	233	$6,483,200	$22,888,900
Salina	Salina Municipal	995	$39,613,600	$146,843,800
Wichita	Wichita Mid-Continent	22,313	$1,196,316,900	$4,685,303,200
Commercial Service Airports Total		**24,385**	**$1,269,829,400**	**$4,965,418,900**
General Aviation Airports				
Abilene	Abilene Municipal	18	$359,400	$1,069,600
Anthony	Anthony Municipal	3	$92,300	$517,200
Anthony	Wilcox Field	7	$46,400	$52,500
Ashland	Harold Krier Field	4	$120,200	$858,900
Atchison	Amelia Earhart	7	$162,900	$499,400
Atwood	Atwood-Rawlins County	30	$814,400	$5,908,500
Augusta	Augusta Municipal	122	$5,048,700	$23,753,300
Baldwin City	Vinland Valley Aerodrome	82	$2,959,200	$3,536,400
Belleville	Belleville Municipal	4	$111,100	$692,100
Beloit	Moritz Memorial	18	$577,300	$2,265,100
Benton	Stearman Field	22	$519,600	$2,675,200
Bird City	Bressler Field	11	$227,500	$660,200

Associated City	Airport Name	Total Employment	Total Payroll	Total Output
Burlington	Coffey County	15	$433,500	$1,993,900
Chanute	Chanute-Martin Johnson	35	$1,077,800	$3,160,000
Cimarron	Cimarron Municipal	1	$23,100	$130,300
Clay Center	Clay Center Municipal	14	$291,100	$1,081,400
Coffeyville	Coffeyville Municipal	15	$220,000	$1,120,900
Colby	Shalz Field	20	$596,000	$4,036,800
Coldwater	Comanche County	1	$19,400	$72,000
Concordia	Blosser Municipal	8	$134,800	$437,000
Dighton	Dighton	less than 1	$30,100	$66,800
El Dorado	Capt. Jack Thomas	13	$496,500	$1,778,600
Elkhart	Elkhart-Morton County	11	$333,000	$2,440,900
Ellinwood	Ellinwood Municipal	11	$423,800	$3,312,500
Ellsworth	Ellsworth Municipal	8	$242,800	$1,494,600
Emporia	Emporia Municipal	53	$2,160,100	$6,330,100
Eureka	Eureka Municipal	5	$189,000	$561,700
Fort Scott	Fort Scott Municipal	8	$200,100	$1,238,000
Fredonia	Fredonia	1	$4,400	$15,200
Gardner	Gardner Municipal	15	$282,400	$1,008,800
Garnett	Garnett Municipal	8	$277,400	$669,100
Goodland	Renner Field-Goodland Municipal	125	$3,721,200	$15,465,400
Greensburg	Paul Windle Municipal	1	$56,200	$424,000
Harper	Harper Municipal	5	$172,700	$1,344,700
Herington	Herington Regional	12	$249,400	$1,141,400
Hill City	Hill City Municipal	13	$292,700	$1,513,700
Hillsboro	Alfred Schroeder Field	1	$41,500	$223,600
Hoxie	Hoxie-Sheridan County	13	$452,700	$3,485,800
Hugoton	Hugoton Municipal	16	$490,000	$2,154,000
Hutchinson	Hutchinson Municipal	169	$5,336,400	$15,182,400
Independence	Independence Municipal	2,066	$88,226,500	$578,142,300
Ingalls	Ingalls Municipal	7	$281,600	$2,341,100
Iola	Allen County	31	$711,700	$2,871,600
Jetmore	Jetmore Municipal	less than 1	$2,900	$16,900
Johnson	Stanton County Municipal	41	$999,900	$6,142,200
Junction City	Freeman Field	91	$3,333,200	$12,608,600
Kingman	Kingman-Clyde Cessna Field	13	$228,500	$994,100
Kinsley	Kinsley Municipal	35	$1,424,500	$13,117,600
Lakin	Lakin	11	$441,400	$1,541,700
Larned	Larned-Pawnee County	11	$326,900	$2,243,100
Lawrence	Lawrence Municipal	96	$3,558,900	$10,722,800
Leavenworth	Sherman Army Airfield	30	$960,300	$2,701,000
Leoti	Mark Hoard Memorial	18	$635,800	$5,003,000
Lincoln	Lincoln Municipal	11	$338,000	$2,561,700
Lyndon	Pomona Lake	1	$26,400	$139,700
Lyons	Lyons-Rice County Municipal	28	$710,600	$3,591,400
Mankato	Mankato	5	$167,600	$941,200
Marion	Marion Municipal	3	$62,300	$196,100
Marysville	Marysville Municipal	7	$334,600	$813,400
McPherson	McPherson	34	$856,600	$2,369,800
Meade	Meade Municipal	7	$178,400	$1,178,600
Medicine Lodge	Medicine Lodge	less than 1	$27,600	$146,400
Minneapolis	Minneapolis City-County	6	$119,300	$866,100
Montezuma	Montezuma Municipal	10	$201,400	$1,223,900
Moundridge	Moundridge Municipal	16	$583,700	$2,559,700
Neodesha	Neodesha Municipal	1	$27,800	$124,600
Ness City	Ness City Municipal	less than 1	$8,900	$38,000
Newton	Newton City/County	440	$16,712,000	$56,889,300
Norton	Norton Municipal	10	$299,100	$2,304,100
Oakley	Oakley Municipal	26	$557,300	$3,916,000
Oberlin	Oberlin Municipal	12	$177,900	$805,600
Olathe	Cedar Air Park	10	$90,800	$288,100

Associated City	Airport Name	Total Employment	Total Payroll	Total Output
Olathe	Johnson County Executive	377	$10,012,500	$36,608,900
Olathe	New Century AirCenter	478	$24,907,400	$92,854,500
Osage City	Osage City Municipal	45	$2,077,100	$7,071,600
Osborne	Osborne Municipal	9	$147,900	$1,223,500
Oswego	Oswego Municipal	2	$14,000	$81,400
Ottawa	Ottawa Municipal	10	$233,000	$875,100
Oxford	Oxford Municipal	3	$66,400	$345,600
Paola	Miami County	29	$952,500	$3,390,000
Parsons	Tri-City	19	$407,800	$1,810,700
Phillipsburg	Phillipsburg Municipal	8	$262,100	$1,977,700
Pittsburg	Atkinson Municipal	54	$1,727,900	$7,114,500
Pleasanton	Gilmore	4	$91,000	$477,700
Pratt	Pratt Regional	47	$1,228,100	$5,319,900
Rose Hill	Cook Airfield	6	$115,900	$503,600
Russell	Russell Municipal	13	$340,900	$1,856,700
Sabetha	Sabetha Municipal	less than 1	$22,300	$83,500
Satanta	Satanta Municipal	3	$119,000	$920,600
Scott City	Scott City Municipal	17	$394,600	$1,916,700
Smith Center	Smith Center Municipal	17	$470,600	$3,018,100
St. Francis	Cheyenne County Municipal	17	$306,700	$1,303,700
Stafford	Stafford Municipal	less than 1	$19,700	$38,900
Sublette	Sublette Flying Club	3	$42,100	$173,600
Syracuse	Syracuse-Hamilton County Municipal	29	$724,100	$4,532,200
Topeka	Forbes Field	1,303	$54,134,500	$99,960,000
Topeka	Philip Billard Municipal	199	$6,800,700	$14,258,300
Tribune	Tribune Municipal	5	$151,800	$899,700
Ulysses	Ulysses	39	$1,189,400	$5,716,500
WaKeeney	Trego WaKeeney	6	$124,000	$899,700
Wamego	Wamego Municipal	1	$30,800	$184,100
Washington	Washington County Memorial	13	$277,600	$1,445,700
Wellington	Wellington Municipal	35	$1,025,400	$4,660,400
Wichita	Beech Factory	11,014	$486,998,500	$1,783,759,000
Wichita	Cessna Aircraft Field	3,020	$133,614,700	$890,973,900
Wichita	Col. James Jabara	738	$33,592,300	$89,923,600
Wichita	Riverside	8	$177,700	$582,300
Wichita	Westport	11	$310,100	$1,170,100
Winfield/Arkansas City	Strother Field	1,669	$156,983,300	$1,542,667,500
Yates Center	Yates Center	less than 1	$500	$11,200
Other General Aviation Airports*		13	$52,400	$167,700
General Aviation Airports Total		**23,266**	**$1,072,046,800**	**$5,444,550,100**
All Airports Total		**47,651**	**$2,341,876,200**	**$10,409,969,000**

* Other General Aviation Airports includes Argonia Municipal, Bucklin, C.E. Grutzmacher Municipal, Caldwell Municipal, Cotton Wood Falls, Council Grove Municipal, Elk County, Fowler, Hiawatha Municipal, Hillside, Horton Municipal, Lucas, Norwich, Patty Field, Plainville Airpark, Rush County, Sedan City, Seneca Municipal, St. Marys Airpark, Stockton Municipal, Van Pak, and Westport Auxiliary.
Sources: Wilbur Smith Associates and IMPLAN multipliers.
Prepared: April 2010.

FUTURE TRENDS

Public airports will become increasingly important tools for economic development as the business and industrial community continues to change and evolve.

8.3 SURFACE TRANSPORTATION

Virtually all of the day-to-day commodities necessary for maintenance of the resident population are supplied by commercial surface vehicles which are directly dependent upon the county-wide network of streets, road and highways. Additionally, with the decline of public bus service, personal transportation for residents of the counties are entirely dependent upon the use of private automobiles which require an adequate network of useable primary, secondary and local travelways.

8.3.1 PRIMARY AND SECONDARY HIGHWAY SYSTEM

The region is served by a substantial network of federal and state highways that traverse all areas of the jurisdiction. Supplementing the federal and state highway system is a network of all-weather surfaced Federal Aid Secondary (FAS) roads. Together with the highway system, the network of FAS routes is critical to movement of bulk farm produce and commodities as well as personal transportation. Collectively, the system of surface travelways allows direct access to the major trans-continental highway system and one to three day travel time from any major metropolitan market area in the nation.

During Fiscal Year 2009, the Kansas Department of Transportation conducted an Annual Average Daily Traffic (AADT) count of primary and secondary collectors which includes federal, state and Federal Aid Secondary (FAS) roads.

8.3.2 CLASSIFICATIONS

Expressways

Very large, high capacity travelways typified by the divided median, controlled access highway common to the federal interstate system.

Major Arterials

A network of through roads serving major traffic movements. They not only interconnect the various sections of the County, but also individual communities with the external highway system. State highway systems fall into this category.

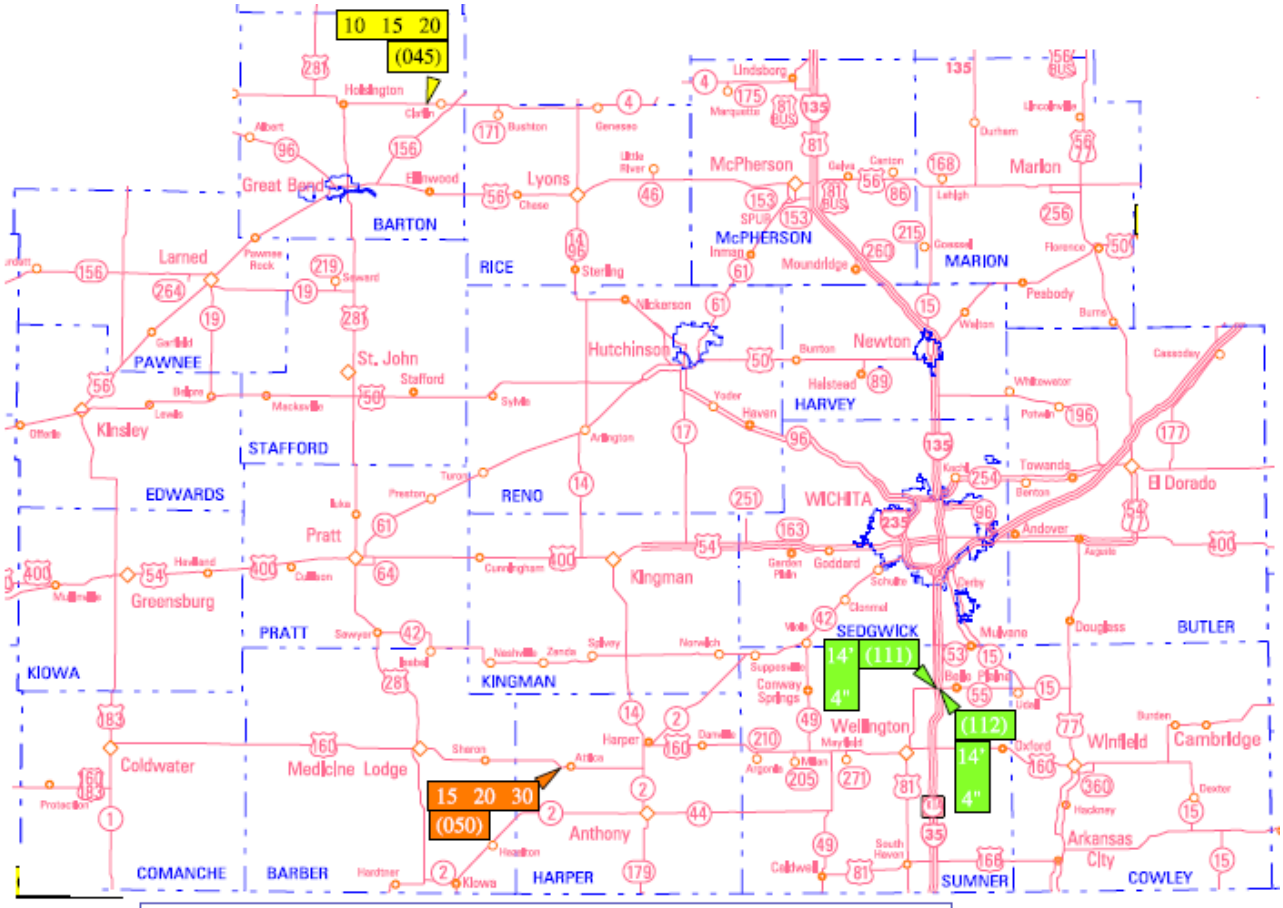
Minor Arterials

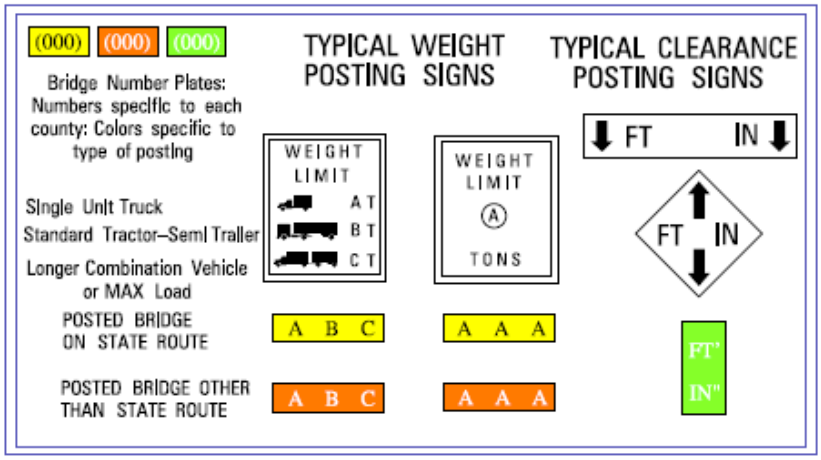
Function in a manner similar to major arterial roadways as they provide access to various sections of the County as well as individual communities. FAS and County roads fall under this category.

Collector Roads

Used to collect traffic from the local roads and distribute it to the major and minor arterial systems since traffic movement is the primary concern. County roads fall into this category and serves as a connector to other County and FAS roads.

8.3.3 BRIDGE RESTRICTIONS





9 TIER II REPORTING FACILITIES/RISK MANAGEMENT PLAN SITES

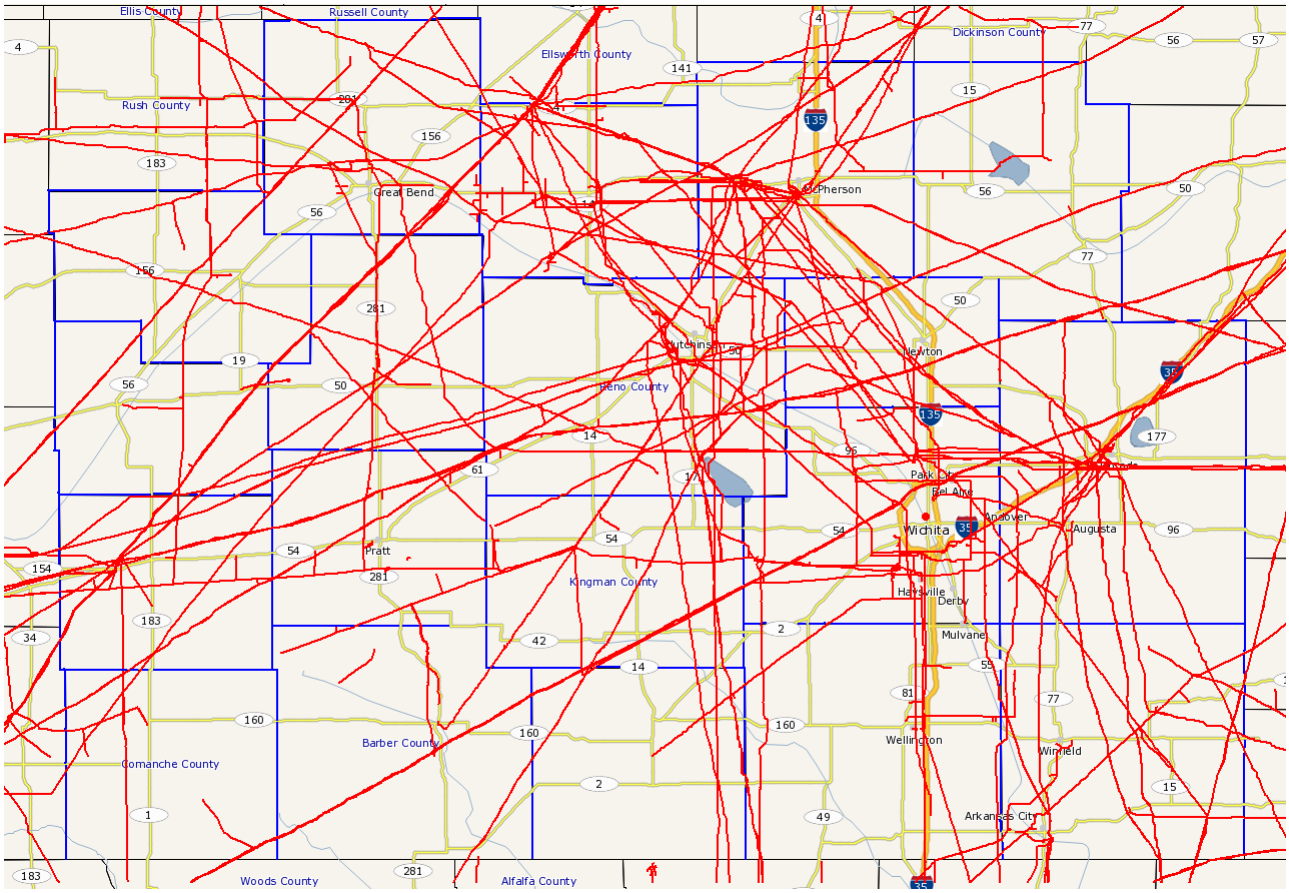
There are over 1,700 Tier II facilities located within the South Central Kansas region of which more than 90% are oil and gas leases. Facilities covered by Emergency Planning and Community Right-to-Know Act (EPCRA) requirements must submit an Emergency and Hazardous Chemical Inventory Form to the Local Emergency Planning Committee (LEPC), the Commission on Emergency Planning and Response (CEPR), and the local fire department annually. Facilities provide either a Tier I or Tier II form. EPCRA is also known as Superfund Amendments and Reauthorization Act (SARA) Title III.

Risk Management Plans (RMPs): Under the authority of section 112(r) of the Clean Air Act, the Chemical Accident Prevention Provisions require facilities that produce, handle, process, distribute, or store certain chemicals to develop a Risk Management Program, prepare a Risk Management Plan (RMP), and submit the RMP to EPA. The following information was obtained from the Right-To-Know Network:

Total number of facilities: **915**
Number of deregistered facilities: **237**
Number of processes that could reach off-site: **990**
Total pounds of toxic chemicals in processes: **477,558,446**
Total pounds of flammable chemicals in processes: **7,494,532,084**
Number of 5-year accidents: **64**
Number of deaths from 5-year accidents: **13**
Number of injuries from 5-year accidents: **126**
Amount of property damage from 5-year accidents: **$369,471**

10 PIPELINE STATISTICS

Natural gas and petrochemical company pipelines traverse South Central Kansas. Pipelines include transmission, local distribution, and gathering systems. Transmission pipelines (shown on the map below) move products from the production area or refinery to outlets such as bulk storage terminals or loading facilities. Local distribution systems may also transport liquid petroleum and natural gas. Liquid petroleum distribution systems transport product from the bulk storage facility by rail car or tank trucks. Local natural gas distribution companies (LDCs) use pipelines to move natural gas from a city gate or town border station to distribution systems. Local distribution systems transport natural gas through mains that are usually located along or under city streets to service lines that connect to homes and businesses. Gathering pipelines link the production areas to central collection points.



Source: National Pipeline Mapping System

BLACK HILLS ENERGY

Black Hills Corporation serves 750,000 utility customers in Colorado, Iowa, Kansas, Montana, Nebraska, South Dakota, and Wyoming. Black Hills Energy, a division of Black Hills Corporation, serves 107,000 natural gas customers in 54 Kansas communities. The company's non-regulated businesses generate wholesale electricity, produce natural gas, oil and coal, and market energy.

CONOCOPHILLIPS PIPE LINE COMPANY (CPPL)

CPPL operates more than 12,000 miles of pipeline and more than 80 storage terminals in the United States. CPPL transports both raw and finished refined products, including crude oil, propane, and refined products such as gasoline, diesel and jet fuel. Motor fuels are stored in terminals were tanker trucks pick them up for delivery to local retail outlets. CPPL operates approximately 900 miles of pipeline throughout the state of Kansas. These various pipelines transport refined petroleum products to various terminals and storage facilities within Kansas. CPPL's refined product pipelines deliver to terminals located in Oklahoma, Texas, Kansas, Missouri, Indiana, and Illinois.

KANSAS GAS SERVICE (KGS)

KGS is a division of ONEOK, Inc, provides clean, safe, and reliable natural gas to more than 647,000 residential, commercial and industrial customers across the state of Kansas. Natural gas is delivered to the company's distribution systems from transmission lines, some of which are owned by KGS, at operating pressures typically between 150 pounds per square inch (psig) and 1,000 psig. Natural gas is then delivered through distribution pipelines that generally operate at 60 psig or less. KGS maintains, operates, and monitors approximately 19,075 miles of transmission, distribution and service pipelines.

NORTHERN NATURAL GAS COMPANY (NORTHERN)

Northern is based in Omaha, Nebraska, and operates an interstate natural gas pipeline system extending from Texas to the upper Midwest. The system includes over 15,000 miles of natural gas pipeline, capable of 5.3 billion cubic feet per day (Bcf/d) of market area capacity, plus 2.0 Bcf/d of field capacity. Northern has a total of five natural gas storage facilities, three of which are underground facilities and the other two are Liquefied Natural Gas (LNG) facilities. All five total Bcf which includes 4 Bcf of liquefied natural gas. Northern employs over 900 people and provides transportation and storage services to approximately 75 utilities and numerous end-use customers in the upper Midwest.

ONEOK FIELD SERVICES COMPANY, LLC

ONEOK, Inc., an Oklahoma corporation, is a diversified energy company involved in natural gas processing, gathering, storage and transmission in the Mid-Continent areas of the United States. The company's gathering and processing segment gathers and processes natural gas, and fractionates natural gas liquids through its subsidiary, ONEOK Field Services Company.

Specifically, ONEOK Field Services Company has a processing capacity of approximately 2.0 Bcf/d with approximately 13,800 miles of gathering pipelines that supply the gas processing plants. The gas processing operation primarily includes the extraction of mixed natural gas liquids from natural gas, and their fractionation (separation) into component products (ethane, propane, iso-butane, normal butane and natural gasoline). The component products are used by and sold to diverse customer base of end users for petrochemical feedstock, residential uses, and blending into motor oils.

The gathering operation connects unaffiliated and affiliated producing wells to the processing plants. It consists of the gathering of natural gas through pipeline systems, including compression, treatment, and dehydration services. In Kansas, ONEOK Field Services operates approximately 6,000 miles of pipeline, 5,400 gas wells, 3 processing plants, and 215,000 horsepower of natural gas compression.

ONEOK NGL PIPELINE, LLC

ONEOK NGL Pipeline, L.L.C., operates approximately 1,800 miles of pipelines through the state of Kansas that gather and transport products known as Natural Gas Liquids (NGL). These products, at any given time, can be a varied mixture of NGL, LPG (Liquid Petroleum Gas) or HVL (Highly Volatile Liquids). They are a mixture consisting of ethane, propane, butane, natural gasoline, ethane-propane mixture, and propylene. The Kansas pipeline system gathers raw NGL and transports the products to a fractionation and storage facility in Medford (Oklahoma), Hutchinson and Bushton (Kansas). Once the products have been fractionated, they are distributed to areas in Central Kansas and Gulf Coast markets. This system consists of pipelines ranging from 3 inches to 16 inches in diameter.

PANHANDLE EASTERN PIPE LINE COMPANY

Panhandle Eastern Pipe Line Company operates a 6,500-mile interstate natural gas pipeline system with access to diverse supply sources. The company has access to 74 Bcf of storage facilities and can deliver 2.8 Bcf/d of natural gas to the Midwest and East Coast markets.

QUEST PIPELINES (KPC), L.P.

Quest Pipelines (KPC) owns and operates a 1,120-mile interstate gas pipeline which transports natural gas from Oklahoma and Western Kansas to the metropolitan Wichita and Kansas City markets. Further, it is one of the only three pipeline system currently capable of delivering gas into the Kansas City metropolitan

market. The KPC system includes three compressor stations with a total of 14,680 horsepower and has a capacity of approximately 160 Mmcf/day. KPC has supply interconnections with the Transok, Panhandle Eastern and ANR pipeline systems, allowing distribution from the Anadarko and Arkoma basins, as well as the western Kansas and Oklahoma panhandle producing regions. KPC's two primary customers are Kansas Gas Service (KGS) and Missouri Gas Energy (MGE), both of which are served under long-term natural gas transportation contracts. KGS, a division of ONEOK, Inc. is the local distribution company in Kansas for Kansas City and Wichita as well as a number of other municipalities; while MGE, a division of Southern Union Company, is a natural gas distribution company that serves over a 500,000 customers in 155 western Missouri communities.

SEMCRUDE, L.P.

SemCrude purchases crude oil and condensates from independent producers and operators as well as aggregators and independent refiners located in Colorado, Kansas and Oklahoma. Specifically, SemCrude gathers, transports and stores crude oil and condensates from North America's Gulf Coast, Central Energy Corridor to Canada. The crude oil and condensate is transported via tank trucks and pipelines to third party pipelines as well as to the Cushing, Oklahoma interchange. (See also White Cliffs Pipeline, L.P.)

WHITE CLIFFS PIPELINE, L.P.

This recently formed limited liability company (LLC) has constructed a 12-inch diameter pipeline approximately 524 miles in length for the purpose of transporting high quality crude oil produced from the Wattenberg Field in the Denver Julesburg Basin of Colorado to the market and pipeline interconnect center at Cushing, Oklahoma (known as the "Cushing Hub"). Specifically, the White Cliffs Pipeline System originates Northeast of Denver, Colorado and traverses through the Western and South central counties of Kansas prior to termination at the SemGroup Energy Partners (SGLP) Cushing Terminal. White Cliffs Pipeline is operated by SemCrude L.P. headquartered in Oklahoma City, Oklahoma.

TransCanada[19]

The U.S. $13 billion Keystone pipeline system will play an important role in linking a secure and growing supply of Canadian crude oil with the largest refining markets in the United States, significantly improving North American security supply.

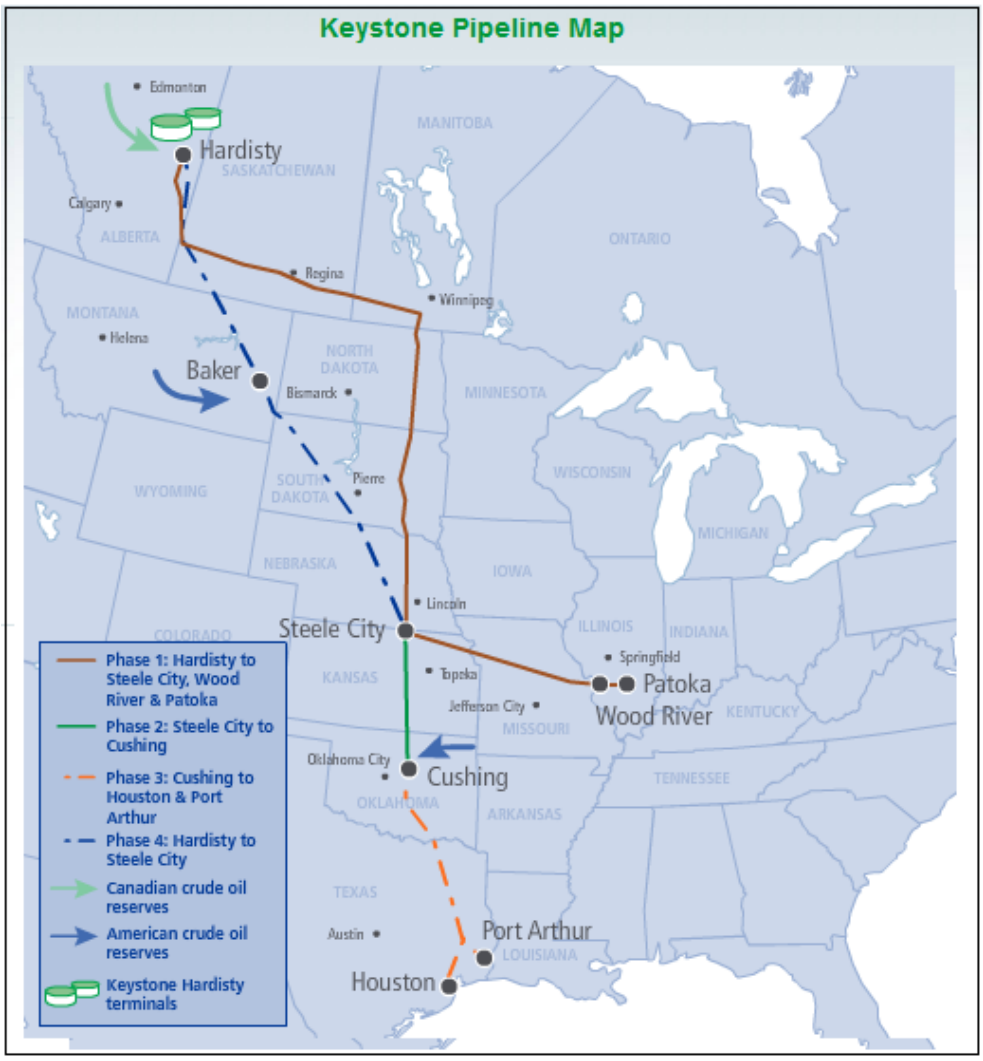
In June 2010 TransCanada commenced commercial operation of the first phase of the Keystone Pipeline System. Keystone's first phase was highlighted by the conversion of natural gas pipeline to crude oil pipeline and construction of an innovative bullet line that brings the crude oil non-stop from Canada to market hubs in the U.S. Midwest.

Keystone Cushing (Phase II), an extension of the Keystone Pipeline from Steele City, Nebraska to Cushing, Oklahoma went into service in February 2011. The 36-inch pipeline connects to storage and distribution facilities at Cushing, a major crude oil marketing/refining and pipeline hub.

The proposed Keystone Gulf Coast Expansion Project is an approximate 2,673-kilometre (1,661-mile), 36-inch crude oil pipeline that would begin at Hardisty, Alberta and extend southeast through Saskatchewan, Montana, South Dakota and Nebraska. It would incorporate a portion of the Keystone Pipeline (Phase II) through Nebraska and Kansas to serve markets at Cushing, Oklahoma before continuing through Oklahoma to a delivery point near existing terminals in Nederland, Texas to serve the Port Arthur, Texas marketplace.

On Nov. 14, TransCanada announced it supports proposed legislation within the State of Nebraska to move the Keystone XL pipeline project forward. This new route is reflected as Phase 4 on the map shown on the next page.

[19] *TransCanada website, http://www.transcanada.com/keystone.html*



Keystone Phase 1

Hardisty to Steele City, Wood River & Patoka

Status: **Completed**
In-Service: **June 2010**
Length: **1,853 miles (2,981 km)**
Diameter: **30 inches (762 mm)**
Pump Stations: **39**
Capacity: **435,000 barrels per day**

Keystone Phase 2

Steele City to Cushing

Status: **Completed**
In-Service: **February 2011**
Length: **298 miles (480 km)**
Diameter: **36 inches (912 mm)**
Pump Stations: **11**
Capacity: **increased Keystone to 591,000 barrels per day**

Keystone Phase 3

Cushing to Houston & Port Arthur

Status: **Regulatory review**
In-Service: **Target 2013**
Length: **435 miles (700 km)**
Diameter: **36 inches (912 mm)**
Pump Stations: **26**
Capacity: **When completed, Keystone XL will increase the commercial design of the Keystone Pipeline System to approximately 1.3 million barrels per day**

Keystone Phase 4

Hardisty to Steele City

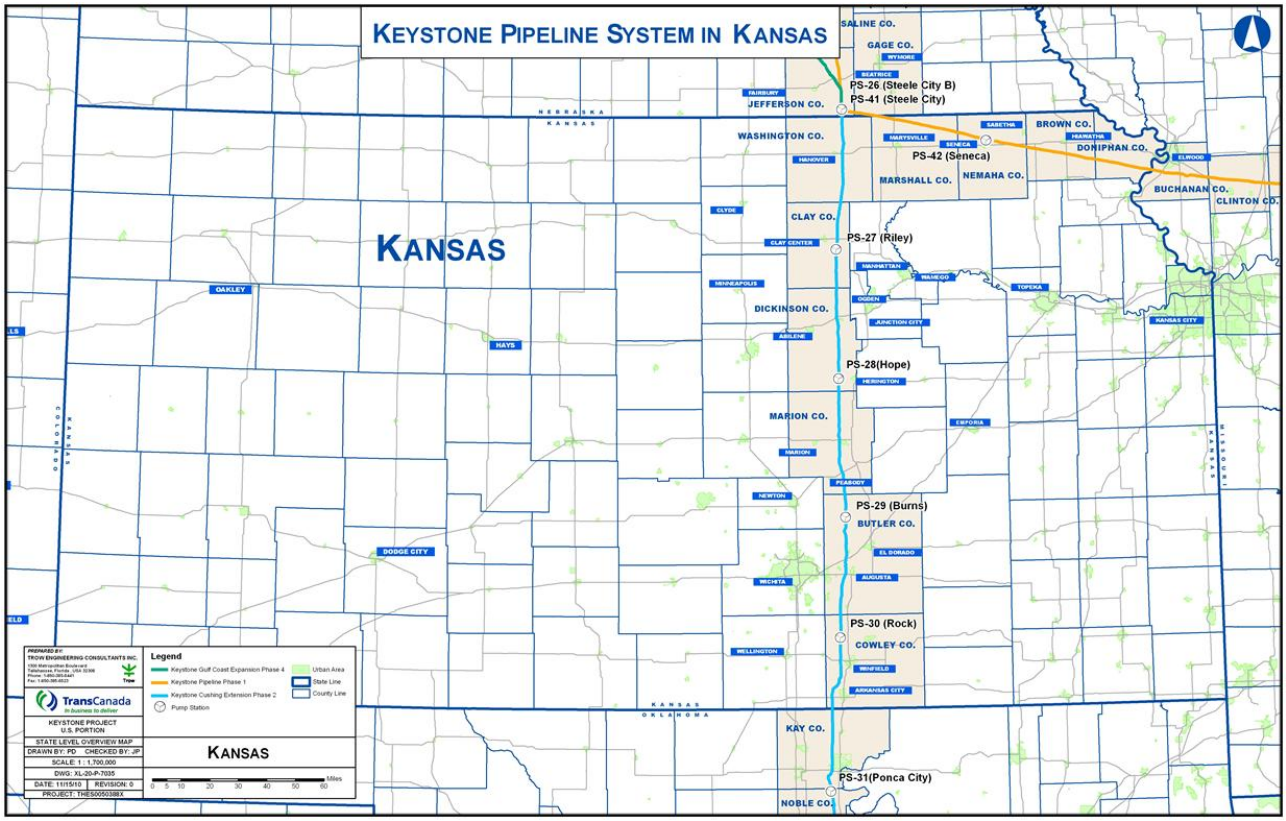
Status: **Regulatory review**
In-Service: **Target 2013**
Length: **1,179 miles (1,897 km)**
Diameter: **36 inches (912 mm)**
Pump Stations: **26**
Capacity: **When completed, Keystone XL will increase the commercial design of the Keystone Pipeline System to approximately 1.3 million barrels per day**

Source: TransCanada

Keystone Pipeline in Kansas[20]

The Keystone Pipeline System includes several crude oil pipelines being built by TransCanada, a Canadian energy company. The map shows the various components of the System. The first phase of the Keystone Pipeline System originates in Hardisty, Alberta, and connects to Steele City, Nebraska, before turning east to serve refineries in Illinois. A portion of this pipeline crosses Kansas for approximately 100 miles, running through Marshall, Brown, Nemaha, and Doniphan counties. The first phase of the Keystone Pipeline System went into service on June 30, 2010.

Keystone Cushing, the second phase of the Keystone Pipeline System, connects Steele City, Nebraska, to Cushing, Oklahoma. The extension crosses Kansas for approximately 210 miles, through Washington, Clay, Dickinson, Marion, Butler, and Cowley counties. Keystone Cushing went into service in February 2011. The following map gives a general route through Kansas of Phase 1 (Northeast area) and Phase 2 (North to South).



Source: TransCanada- Key Projects Maps

Pumping stations shown above are located in Clay County (PS-27 - Riley), Dickinson County (PS-28 - Hope), Butler County (PS-29 – Burns), and Cowley County (PS-30 – Rock).

[20] *Kansas Legislator Briefing Book 2012*

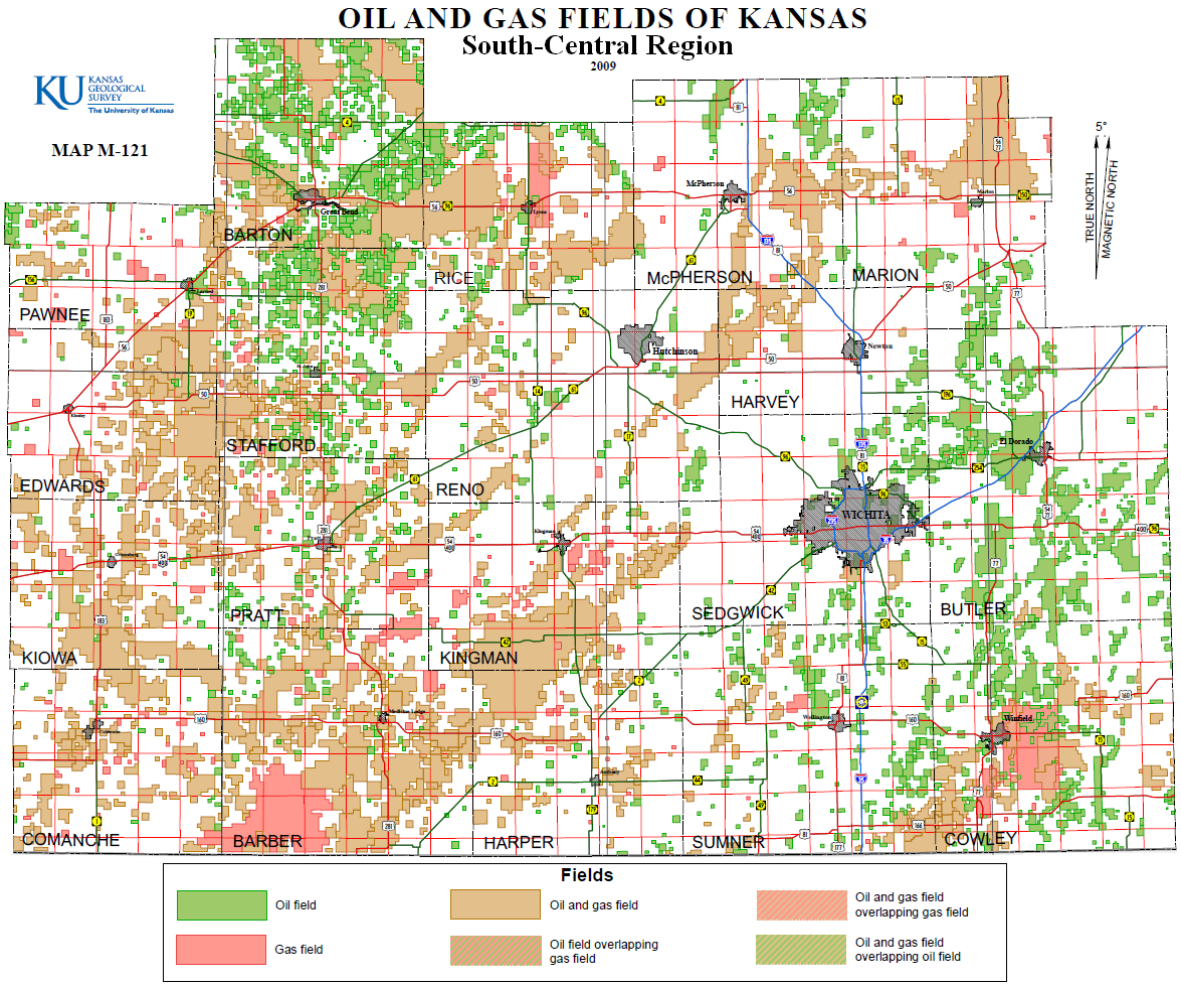
11 Oil and Gas Field Statistics

According to Kansas Geological Survey information, there was a total of 45,999 oil wells in production during 2010, and 25,232 gas wells in production for the same period as shown in the tables below.

Year	Oil		
	Production (bbls)	Wells	Cumulative (bbls)
1995	45,367,404	42,820	5,802,691,000
1996	43,625,596	48,989	5,846,316,596
1997	41,289,345	47,037	5,887,605,941
1998	36,378,608	44,446	5,923,984,549
1999	33,905,125	41,404	5,957,889,674
2000	35,174,434	42,165	5,993,064,108
2001	34,124,322	41,545	6,027,188,430
2002	33,379,734	41,383	6,060,568,164
2003	33,972,033	41,206	6,094,540,197
2004	33,878,472	41,920	6,128,418,669
2005	33,619,258	43,012	6,162,037,927
2006	35,669,001	43,924	6,197,706,928
2007	36,590,232	43,416	6,234,297,160
2008	39,658,311	45,130	6,273,955,471
2009	39,465,503	45,618	6,313,420,974
2010	40,467,966	45,999	6,353,888,940

Year	Gas		
	Production (mcf)	Wells	Cumulative (mcf)
1995	733,846,903	15,405	31,957,139,000
1996	735,034,582	16,572	32,692,173,582
1997	690,383,524	16,742	33,382,557,106
1998	606,699,695	16,794	33,989,256,801
1999	567,679,755	16,793	34,556,936,556
2000	533,658,257	17,124	35,090,594,813
2001	486,019,929	17,553	35,576,614,742
2002	458,920,155	17,910	36,035,534,897
2003	423,509,989	18,387	36,459,044,886
2004	400,592,922	19,172	36,859,637,808
2005	379,860,310	20,238	37,239,498,118
2006	375,433,250	22,579	37,614,931,368
2007	370,923,747	24,389	37,985,855,115
2008	378,721,134	25,640	38,364,576,249
2009	359,747,085	25,850	38,724,323,334
2010	331,539,924	25,232	39,055,863,258

Note: bbls is barrels; mcf is 1,000 cubic feet.



County	Active Fields	Oil Wells	Gas Wells	Acres
Barber	200	1,032	1,239	559,400
Barton	305	1,816	48	565,680
Butler	134	1,307	0	241,640
Comanche	109	258	420	285,600
Cowley	195	685	47	329,460
Edwards	70	280	210	164,960
Harper	95	501	442	202,680
Harvey	25	113	42	92,690
Kingman	103	760	755	240,800
Kiowa	93	267	228	237,560
Marion	46	365	224	170,650
McPherson	55	618	41	175,880
Pawnee	100	141	85	165,640
Pratt	180	532	271	288,560
Reno	96	400	117	136,560
Rice	92	846	67	288,560
Sedgwick	68	127	4	73,160
Stafford	283	1,157	94	416,160
Sumner	158	506	106	144,050
Totals	**2,407**	**11,711**	**4,440**	**4,779,690**

Top ten counties for oil production in 2010

Kansas total production for 2010 was 40,465,095 barrels. The production from the top ten counties (20,878,441 barrels) amounted to about 52% of the state's total, up about 4% from 2009.

County	bbl	% of total	2009 Rank	% Change from 2009 volume
1. Ellis	3,290,640	8.1	1	+7.6
2. Barton	2,193,331	5.4	3	+7.1
3. Rooks	2,008,076	5.0	5	+1.8
4. Haskell	2,005,811	5.0	2	-5.2
5. Russell	1,993,768	4.9	4	-0.2
6. Ness	1,921,830	4.7	6	+8.1
7. Barber	1,822,699	4.5	8	+12.7
8. Finney	1,672,378	4.1	7	-3.4
9. Graham	1,552,645	3.8	9	+3.5
10. Stafford	1,292,564	3.2	10	+0.5
State Total	40,465,095			+2.5

Top ten counties for gas production in 2010

Kansas total production for 2010 was 331,302,145 MCF (thousand cubic feet). The production from the top ten counties (244,025,213 MCF) amounted to 74% of the state's total, about the same as in 2009.

County	mcf	% of total	2009 Rank	% Change from 2009 volume
1. Stevens	48,759,665	14.7	1	-9.6
2. Grant	34,146,267	10.4	2	-8.5
3. Kearny	30,829,709	9.3	3	-7.8
4. Haskell	23,720,304	7.2	4	-10.0
5. Morton	23,526,897	7.1	5	-7.0
6. Finney	20,648,858	6.2	6	-7.2
7. Barber	20,002,213	6.0	8	-14.6
8. Seward	16,966,191	5.1	7	-16.7
9. Neosho	12,927,831	3.9	--	-10.6
10. Stanton	12,497,278	3.8	9	-8.9
State Total	331,302,145			-7.8

Top ten fields for oil production in 2010

Kansas total production for 2010 was 40,465,095 barrels. The production from the top ten fields (5,842,019 barrels) amounted to 14.4% of the state's total, down about 1% from 2009.

Field	bbl	% of total	2009 Rank	% Change from 2009 volume
1. Bemis-Shutts	1,020,003	2.5	1	-0.2
2. Chase-Silica	686,030	1.7	4	+7.3
3. Eubank	627,986	1.6	2	-16.3
4. Trapp	614,479	1.5	5	-0.9
5. Damme	553,190	1.4	3	-17.8
6. El Dorado	523,773	1.3	6	+0.5
7. Hall-Gurney	460,672	1.1	8	-2.8
8. Spivy-Grabs-Basil	455,717	1.1	7	-5.5
9. Fairport	450,498	1.1	9	+2.6
10. Victory	449,671	1.1	--	+39.8

Top ten fields for gas production in 2010

Kansas total production for 2010 was 331,302,145 MCF (thousand cubic feet). The production from the top ten fields (247,789,515 MCF) amounted to 75% of the state's total about the same as in 2009.

Field	MCF	% of total	2009 Rank	% Change from 2009 volume
1. Hugoton Gas Area	138,013,572	41.7	1	-6.8
2. Panoma Gas Area	41,061,494	12.4	2	-8.5
3. Cherokee Basin Coal Gas Area	38,767,844	11.7	3	-10.8
4. Spivy-Grabs-Basil	6,895,595	2.1	4	-4.5
5. Bradshaw Gas Area	5,674,270	1.7	5	-9.7
6. Greenwood Gas Area	5,557,327	1.7	6	-2.6
7. Cherry Creek Niobrara Gas Area	4,280,454	1.3	8	-13.7
8. Kinsler	2,764,720	0.8	--	+2.0
9. Aetna Gas Area	2,628,151	0.8	9	-15.8
10. Haynesville East	2,146,088	0.6	10	-21.6

Gas Storage Areas

Field name: Alden; Operated by Williams Gas Pipeline Central
Located in: Rice County
Reservoir discovered: 1938; Year Activated: 1960; Active?: Yes
Storage Type: Depleted Reservoir
Original Contents: Gas; Original Pressure: 1,120 (psig); Original reserves: 14,774 (mmcf)
Formation Name: Misener Sand
Storage Lithology: Sandstone
Gross Thickness: 20 (feet)
Trap Type: Structural/Stratigraphic
Formation Depth Maximum: 3,318 ; Minimum:
Injection or Withdrawal Wells: 20
Observation, Pressure Control Wells: 3
Compressor Horsepower: 2400
Pipe Diameter Maximum: 16; Minimum 2
Base Gas Volume: 9,800 (mmcf)
Maximum Developed Gas Volume: 4200 (mmcf)
Maximum Storage Pressure: 1,120 (psig)
Maximum Daily Deliverability: 134,000 (mcf)
Maximum Designed Daily Volume: (mcf)
Annual Cycling Capability:
Undeveloped Capacity: 0 (mmcf)

Field name: Brehm; Operated by Midcontinent Market Center
Located in: Pratt County
Reservoir discovered: 1961; Year Activated: 1982; Active?: Yes
Storage Type: Depleted Reservoir
Original Contents: Oil; Original Pressure: 1,325 (psig); Original reserves: (mmcf)

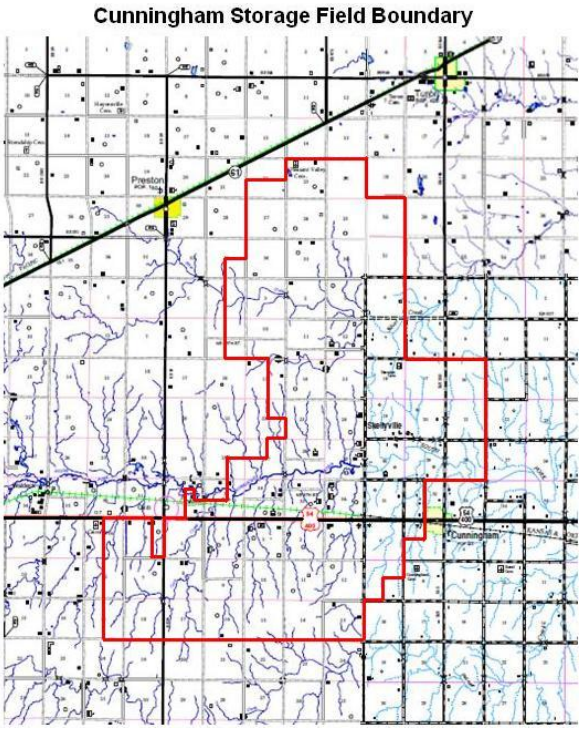
Formation Name: Simpson
Storage Lithology: Sandstone
Gross Thickness: 35 (feet)
Trap Type: Structural Trap
Formation Depth Maximum: 4,450 ; Minimum: 4,200
Injection or Withdrawal Wells: 8
Observation, Pressure Control Wells: 9
Compressor Horsepower: 1600
Pipe Diameter Maximum: 8; Minimum 4
Base Gas Volume: 1,989 (mmcf)
Maximum Developed Gas Volume: 2,000 (mmcf)
Maximum Storage Pressure: 1,260 (psig)
Maximum Daily Deliverability: 40,000 (mcf)
Maximum Designed Daily Volume: 40,000 (mcf)
Annual Cycling Capability: 1
Undeveloped Capacity: 0 (mmcf)

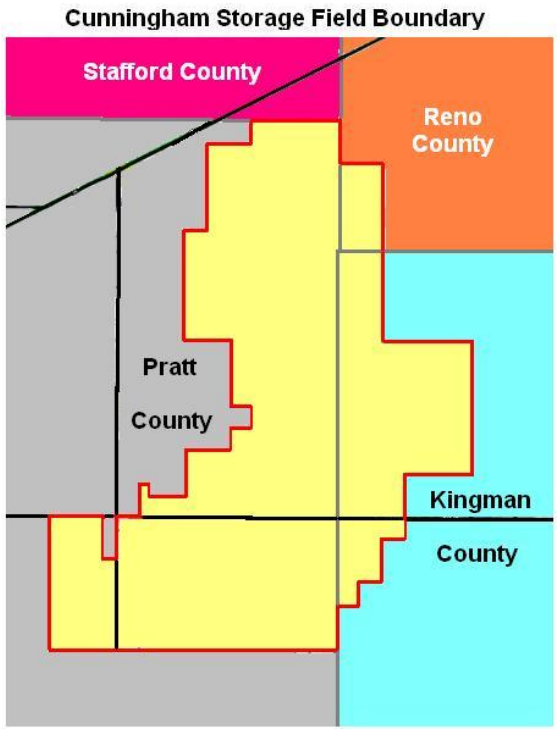
Field name: Collinson; Operated by Reliant Energy Gas Transmission
Located in: Cowley County
Reservoir discovered: 1944; Year Activated: 1947; Active?: Yes
Storage Type: Depleted Reservoir
Original Contents: Gas; Original Pressure: 669 (psig); Original reserves: 2,393 (mmcf)
Formation Name: Severy
Storage Lithology: Sandstone
Gross Thickness: 42 (feet)
Trap Type: Structural Trap
Formation Depth Maximum: 1,438 ; Minimum: 1,423
Injection or Withdrawal Wells: 2
Observation, Pressure Control Wells: 0
Compressor Horsepower: 400
Pipe Diameter Maximum: 6; Minimum 4
Base Gas Volume: 1,260 (mmcf)
Maximum Developed Gas Volume: (mmcf)
Maximum Storage Pressure: 535 (psig)
Maximum Daily Deliverability: 10000 (mcf)
Maximum Designed Daily Volume: (mcf)
Annual Cycling Capability:
Undeveloped Capacity: 0 (mmcf)
Comments: Field being blown down. No longer a storage asset.

Field name: Cunningham; Operated by Northern Natural Gas Co.
Located in: Pratt County
Reservoir discovered: 1931; Year Activated: 1978 ; Active?: Yes
Storage Type: Depleted Reservoir
Original Contents: Gas, Oil & Water; Original Pressure: 1,540 (psig); Original reserves: 74,000 (mmcf)
Formation Name: Viola
Storage Lithology: Dolomite
Gross Thickness: 40 (feet)
Trap Type: Structural Trap
Formation Depth Maximum: 4,361 ; Minimum: 3,923
Injection or Withdrawal Wells: 53
Observation, Pressure Control Wells: 18
Compressor Horsepower: 13,545
Pipe Diameter Maximum: 24; Minimum 2
Base Gas Volume: 30,000 (mmcf)
Maximum Developed Gas Volume: 26,000 (mmcf)
Maximum Storage Pressure: 1,600 (psig)
Maximum Daily Deliverability: 650,000 (mcf)
Maximum Designed Daily Volume: (mcf)

Annual Cycling Capability: 2
Undeveloped Capacity: 0 (mmcf)

Cunningham Storage Field – Opened in 1977 by injection into the Viola formation, the natural gas storage field now covers three counties and is owned and operated by Northern Natural Gas Company. As of July 1, 2010, it is no longer regulated by the Kansas Corporation Commission. The following maps show the boundary and located of the field.





Source: Kansas Corporation Commission, June 2010

Field name: Lyons; Operated by Northern Natural Gas Co.
Located in: Rice County
Reservoir discovered: 1936; Year Activated: 1975 ; Active?: Yes
Storage Type: Depleted Reservoir
Original Contents: Gas, Oil & Water; Original Pressure: 1,165 (psig); Original reserves: 28,873 (mmcf)
Formation Name: Arbuckle
Storage Lithology: Dolomite
Gross Thickness: 250 (feet)
Trap Type: Anticline
Formation Depth Maximum: 3,883 ; Minimum: 3,463
Injection or Withdrawal Wells: 34
Observation, Pressure Control Wells: 22
Compressor Horsepower: 4000
Pipe Diameter Maximum: 16; Minimum 4
Base Gas Volume: 32,400 (mmcf)
Maximum Developed Gas Volume: 5,100 (mmcf)
Maximum Storage Pressure: 1,400 (psig)
Maximum Daily Deliverability: 120,000 (mcf)
Maximum Designed Daily Volume: (mcf)
Annual Cycling Capability: 1
Undeveloped Capacity: 0 (mmcf)

Field name: Yaggy; Operated by Midcontinent Market Center
Located in: Reno County
Reservoir discovered; Year Activated: 1993 ; Active?: Yes
Storage Type: Bedded Salt
Original Contents: Salt; Original Pressure: (psig); Original reserves: (mmcf)
Formation Name: Hutchinson Salt
Storage Lithology: Salt
Gross Thickness: 350 (feet)
Trap Type: Salt Cavern
Formation Depth Maximum: 810 ; Minimum: 633
Injection or Withdrawal Wells: 70
Observation, Pressure Control Wells: 30
Compressor Horsepower: 12,000
Pipe Diameter Maximum: 16; Minimum 4
Base Gas Volume: 565 (mmcf)
Maximum Developed Gas Volume: 3,000 (mmcf)
Maximum Storage Pressure: 645 (psig)
Maximum Daily Deliverability: 250,000 (mcf)
Maximum Designed Daily Volume: 250,000 (mcf)
Annual Cycling Capability:
Undeveloped Capacity: 1,600 (mmcf)

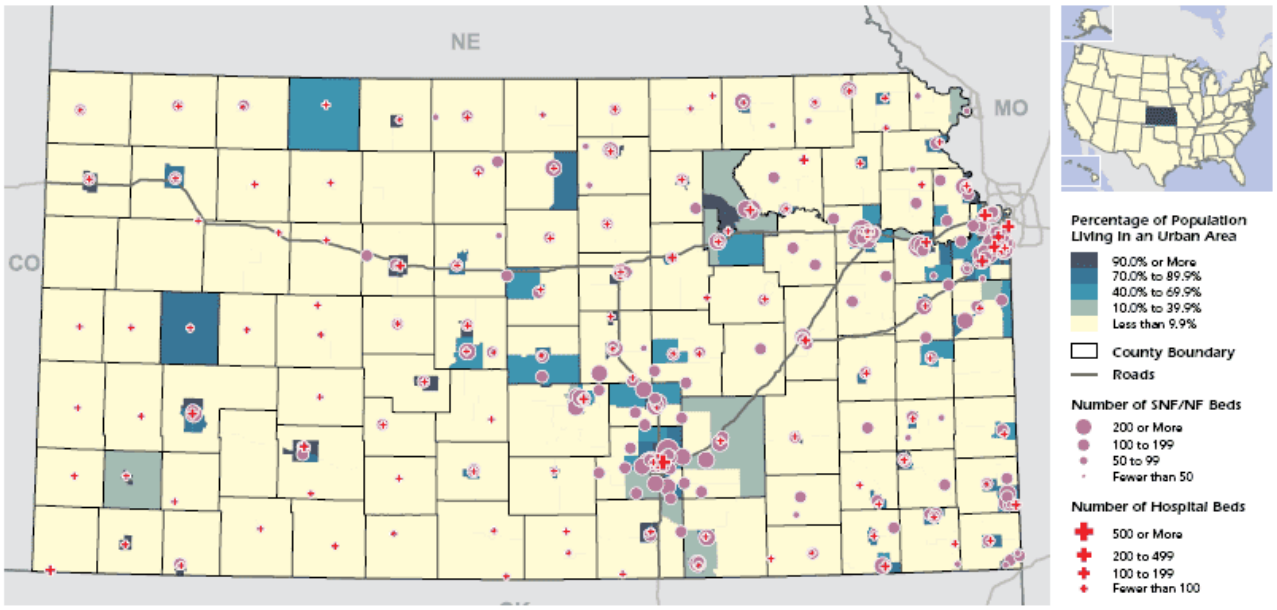
Helium--Helium is present in small quantities in natural gas produced from the Cunningham pool in western Kingman County and eastern Pratt County. During World War II an extraction plant was built by the U. S. Government near Cunningham to help meet the wartime demand for helium. The plant began operation on January 17, 1944, and operating continuously until July 9, 1945, produced 43 million cubic feet of helium. The extraction plant was dismantled shortly thereafter, and helium is not currently being produced.

VULNERABILITY ANALYSIS

11 HEALTH CARE FACILITIES

Health care facilities include hospitals, assisted living, hospices, nursing facilities, adult day care, boarding care homes, and home plus providers.

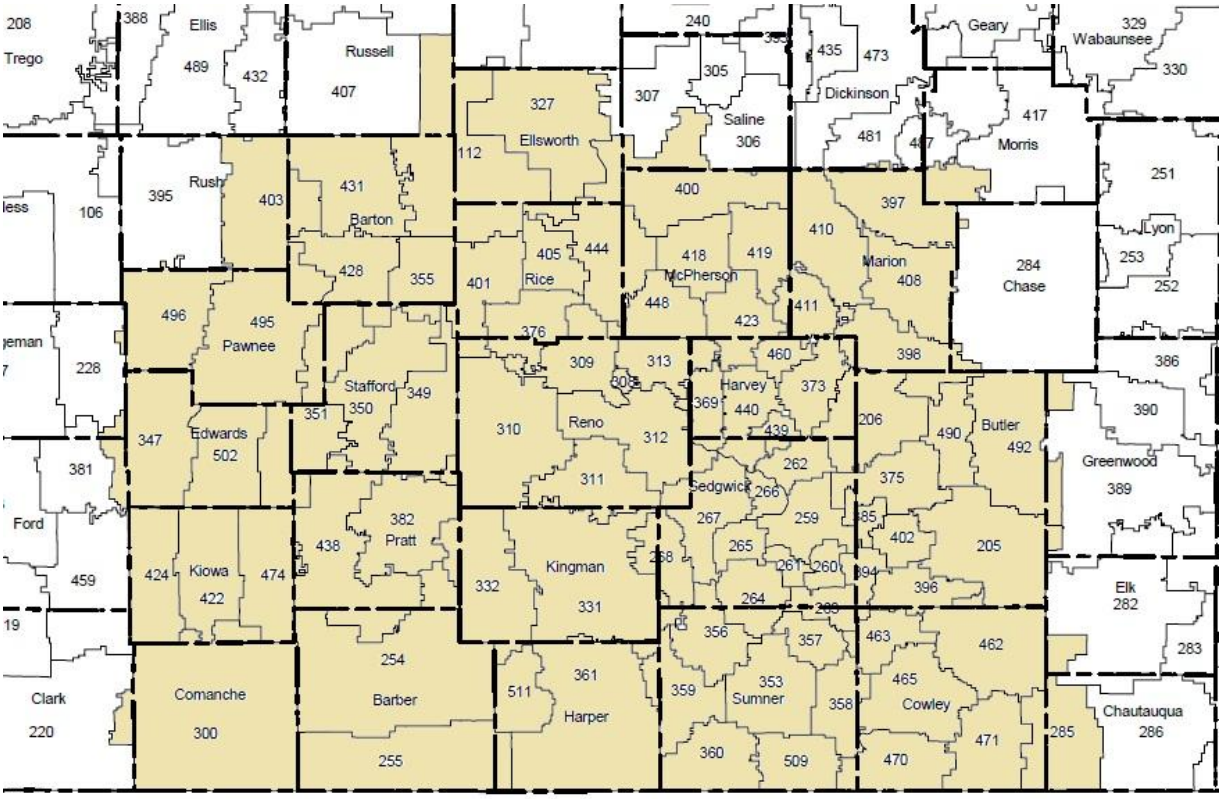
Kansas: Health Care Facilities



Source: U.S. DHHS - Agency for Healthcare Research & Quality

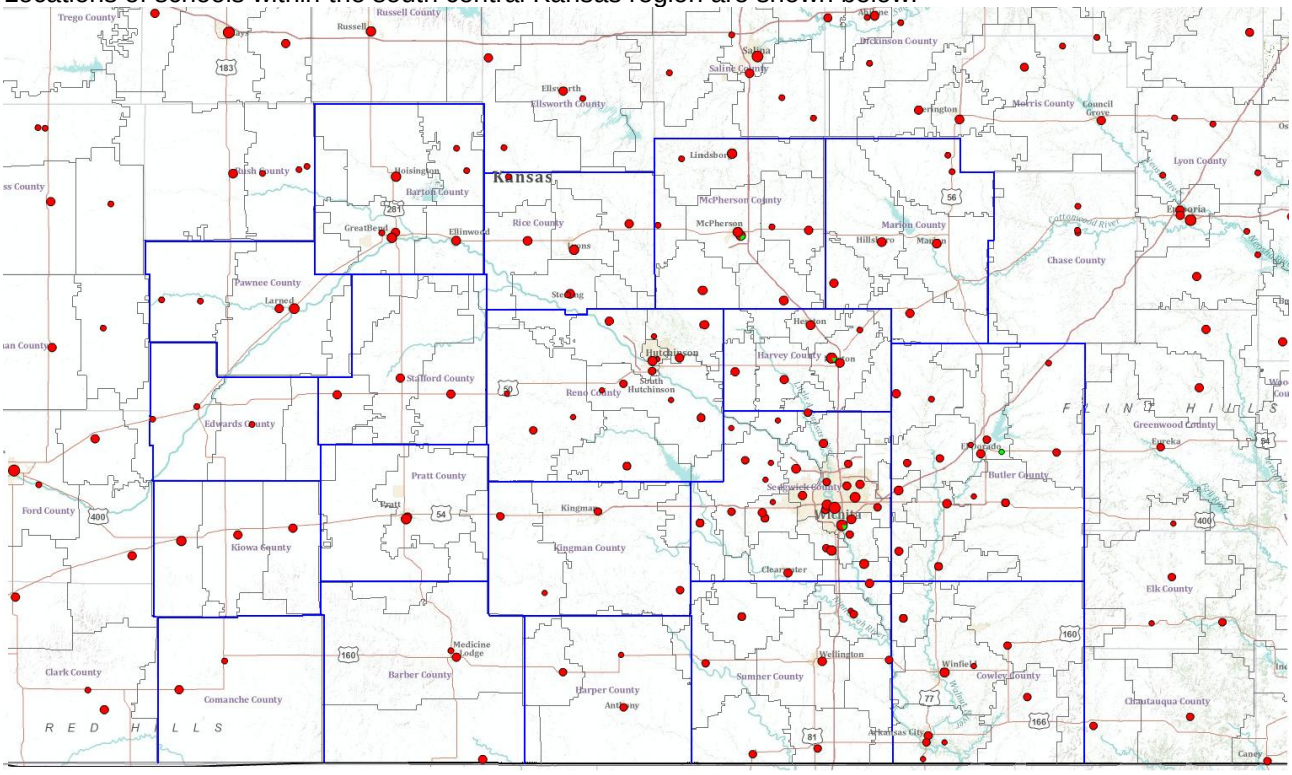
12 EDUCATIONAL INSTITUTIONS

The following regional map shows all of the school districts that cover each county:



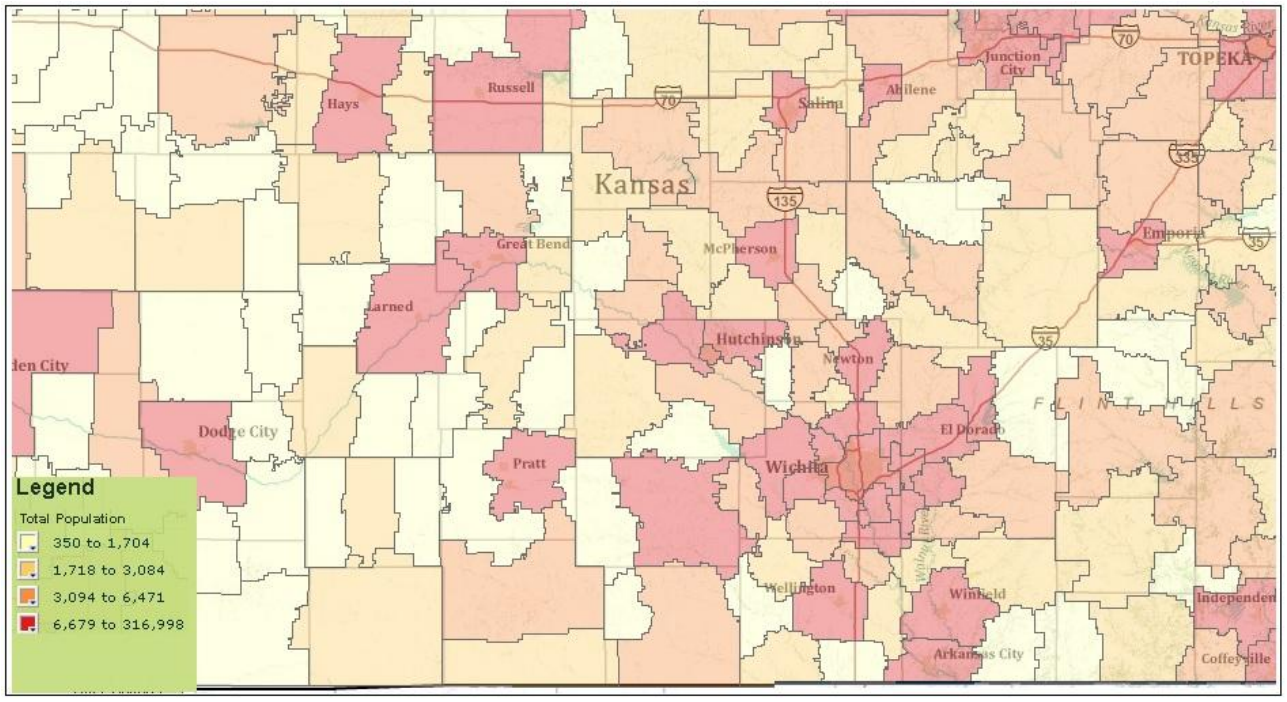
Source: Kansas State Board of Education

Locations of schools within the south central Kansas region are shown below:

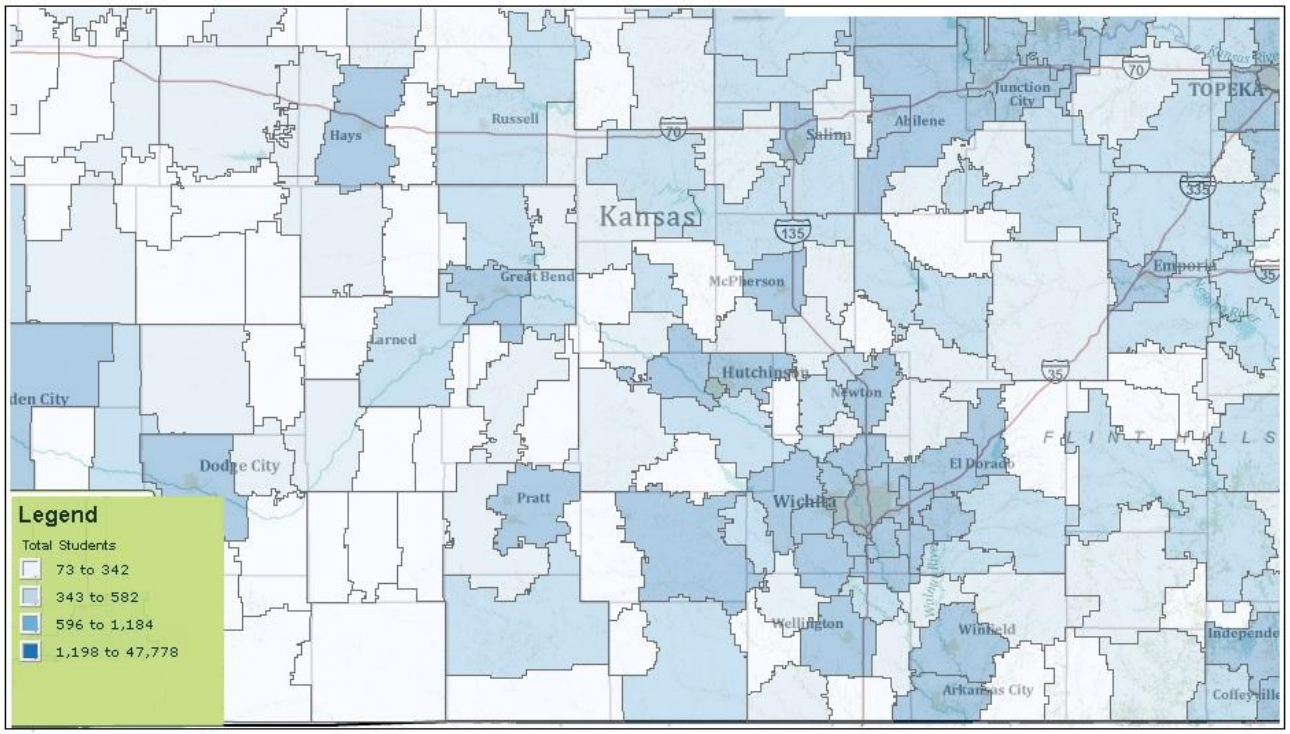


Source: Kansas State Board of Education

The following maps show the general and student populations in relation to the surrounding areas. Rural areas are lighter in color versus suburban areas.



Source: Kansas State Board of Education



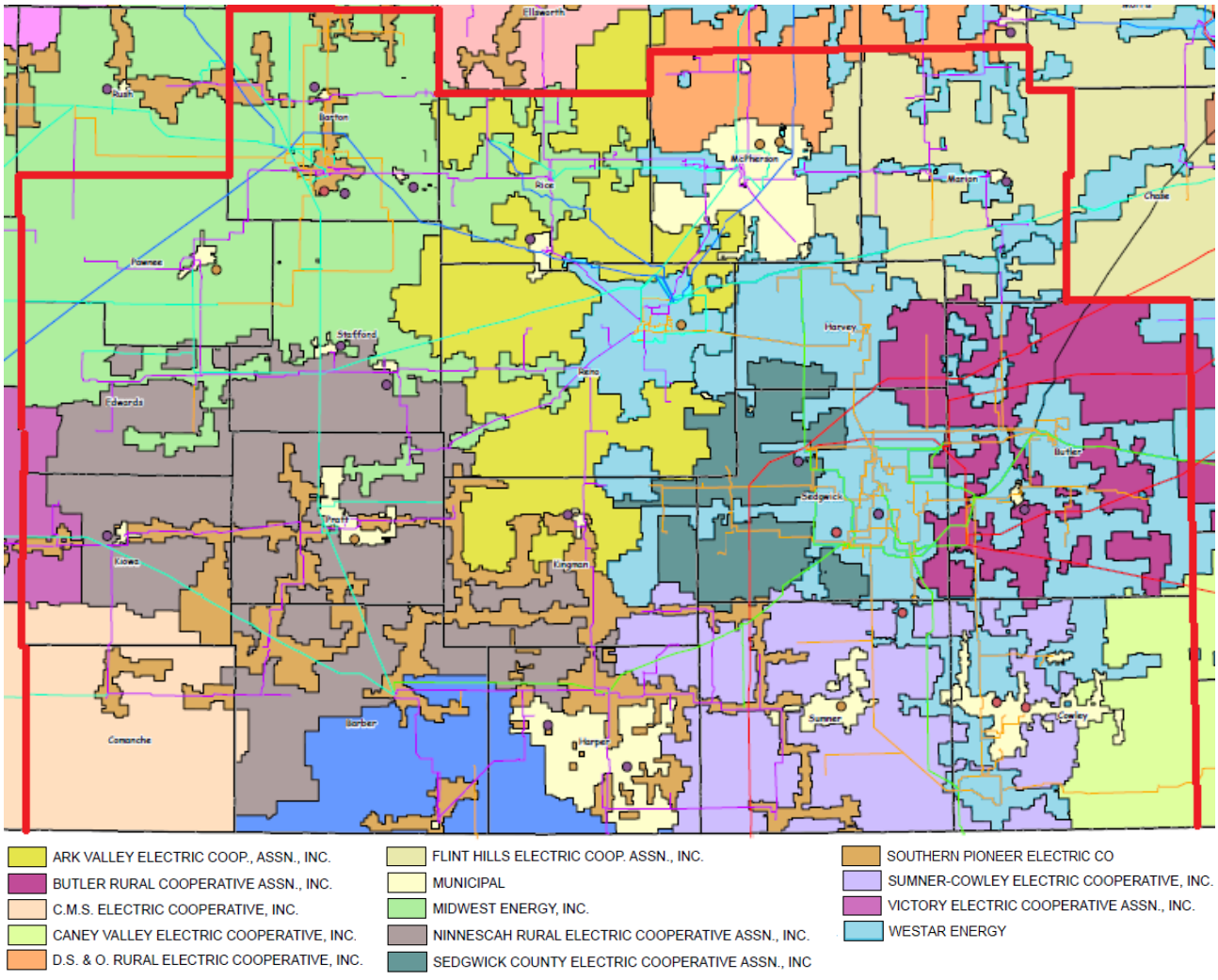
Source: Kansas State Board of Education

13 UTILITIES

13.1 ELECTRICAL DISTRIBUTION SYSTEM

The following map from the Kansas Commerce Commission shows the coverage areas of the electric companies:

ELECTRIC CERTIFIED AREAS, TRANSMISSION LINES AND POWER PLANTS IN SOUTH CENTRAL KANSAS



Source: Kansas Corporation Commission

ARK VALLEY ELECTRIC COOPERATIVE ASSOCIATION, INC

The Cooperative is a member-owned utility provider. Members of Ark Valley Electric purchase electricity within its rural service territory. Ark Valley's electric lines, of over 2,000 miles, stretch across nine counties in central Kansas. As a member-owned, locally-based electric cooperative, Ark Valley Electric is more concerned with people than with profits. Ark Valley Electric Cooperative became a Touchstone Energy Cooperative on April 27, 1998 when the Board authorized participation. Touchstone Energy is a marketing alliance for the many electric cooperatives across America. Touchstone Energy Cooperatives have to meet certain standards to belong, and Touchstone Energy reminds us that if combined together the cooperatives are the biggest electric utility in the United States.

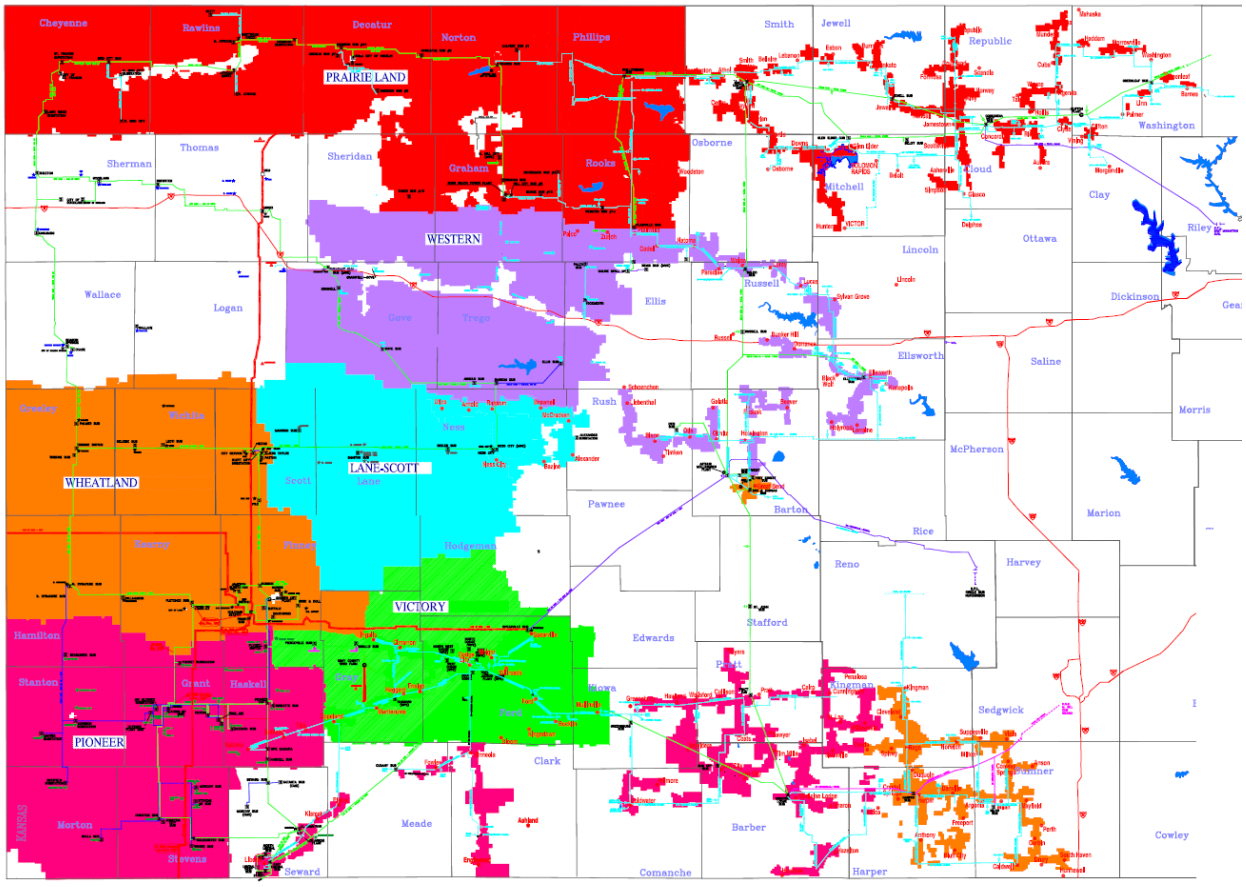
BUTLER RURAL ELECTRIC COOPERATIVE INC (BUTLER REC)

Butler REC is owned by its members and governed by a Board of Directors elected from the membership by the members. We are regulated by the Rural Utilities Services Administration. We supply electric power to 7,000 meters through 1,850 miles of transmission and distribution lines and own 13 substations or delivery points. Through our membership in Kansas Electric Power Cooperative, we own part of the nuclear generating facility at Wolf Creek. This also allows us to have access to power grids, enabling the purchase of hydro-power, the least expensive power available, from the Southwest Power Administration. Our primary financing is done through National Rural Utilities Cooperative Finance Corporation. We provide electric power to residential, commercial and industrial accounts in portions of Butler, Chase, Cowley, Greenwood, Harvey, Marion, and Sedgwick counties.

MID-KANSAS ELECTRIC COMPANY, LLC (MKEC)

MKEC is an electric company formed by six rural electric cooperatives for the purpose of acquiring the assets of Aquila's Kansas Electric Network. The cooperatives and their headquarters community include: Lane-Scott Electric Cooperative, Inc. – Dighton; Southern Pioneer Electric Company, LLC – Ulysses; Prairie Land Electric Cooperative, Inc. – Norton; Victory Electric Cooperative Association, Inc. – Dodge City; Western Cooperative Electric Association, Inc. – WaKeeney; and Wheatland Electric Cooperative, Inc. – Scott City.

Territory Acquired from Aquila, Inc



The MKEC system comprises 68,578 connected retail services that are in or near 176 communities and spread throughout a 32-county region in central and western Kansas. When added to the existing customers, a total of 124,700 connected retail service customers are served by the MKEC owners.

	Current Customers	Mid-Kansas Additions	Total Customers
Lane-Scott	2,988	2,572	5,560
Pioneer	15,296	*17,163	32,459
Prairie Land	8,698	16,020	24,718
Victory	4,460	14,568	19,028
Western	5,064	6,282	11,346
Wheatland	16,957	14,632	31,589
TOTAL*	53,463	71,237	124,700*
**Customers served by Southern Pioneer Electric Company.* **Total does not include consumers served by wholesale municipal customers*			

In addition to these retail electric customers, MKEC provides partial or all requirements wholesale service to 22 municipal systems. The communities receiving partial or all-requirements service include: Ashland, Attica, Beloit, Cawker City, Cimarron, Glasco, Glen Elder, Greensburg, Hoisington, Holyrood, Isabel, Kingman, Lincoln, Lucas, Luray, Mankato, Montezuma, Osborne, Pratt, Russell, Stockton, and Washington. The population served by MKEC is estimated to be 149,182.

MKEC Members also own and manage Sunflower Electric Power Corporation, a generation and transmission service provider headquartered in Hays, Kansas. MKEC currently consists of 608 megawatts of generation, 995 miles of transmission line, and 49 substations, assets that help provide affordable, reliable generation to their members in central and western Kansas.

The Mid-Kansas fleet of generating units will consist of units located near Liberal, Dodge City, Great Bend, Montezuma, and Clifton, Kansas. Collectively, these units are capable of producing 1,203 megawatts (MW).

- The **Cimarron River Station**, located east of Liberal, Kansas, consists of two natural gas based units. The 58 MW generating unit went commercial in 1963. The second unit is a simple cycle, General Electric Frame 5 combustion turbine rated at 14 MW.
- In Great Bend, Kansas, the **Arthur Mullergren Station** is configured with three generating units. Units 1 and 2 are retired. Unit 3 operates with a capacity of 96 MW.
- The **Judson Large Station**, located in Dodge City, Kansas includes four generating units. Units 1, 2 and 3 are retired units of various ratings. Unit 4 operates with a generating capacity of approximately 145 MW.
- The 177 MW **Jeffrey Energy Center**, a 1,857 MW coal based complex, located near St. Marys, Kansas, that also includes two wind turbines. The majority interest in these units is owned by Westar Energy who also operates the facility.
- The **Clifton Station** is located in Clifton, Kansas. It is a natural gab-based united capable of generating 70 MW. It is managed by the Arthur Mullergren station, located in Great Bend, Kansas.
- The **Gray County Wind Farm**, powered by the western Kansas winds, is located near Montezuma, Kansas. The Mid-Kansas interest in this renewable energy facility is capable of producing 50 MW of energy generated by the western Kansas winds.

NINNESCAH RURAL ELECTRIC COOPERATIVE (REC)

Ninnescah REC is a member-owned, full service electric utility serving all or part of ten counties in South-Central Kansas. The Cooperative was formed in January 1939 and has been providing dependable electric energy to its members for over 65 years. Currently, the Cooperative services 3,971 meters in Barber, Comanche, Edwards, Harper, Kingman, Kiowa, Pawnee, Pratt, Stafford, and Reno counties.

SEDGWICK COUNTY ELECTRIC COOPERATIVE ASSN, INC

The Sedgwick County Electric Cooperative Association, Inc. has grown quite a bit since those early days. We now have 17 employees, 5,061 services, over 4,200 members, approximately 1,090 miles of energized lines, 6 substations, and over 95 million kWh sold yearly.

Sedgwick County Electric Cooperative primarily serves parts of five counties: Harvey, Kingman, Reno, Sedgwick & Sumner. Extreme eastern Stafford County also is served by the cooperative. There are some areas within these boundaries that are served by other electric companies.

- Having been located in Kansas, there have been many storms in our past. A sleet storm in December 1944 knocked out 41 of our poles. Wind and lightning storms of July 1948 caused major flooding and serious damage to our lines. Lines were damaged by farm buildings and trees that were blown through our lines.

- Other severe storms occurred in April 1951, July 1951, and November 1952. In 1957, severe floods had our linemen restringing line from boats.

- In February 1955, a heavy ice storm caused so much damage that crews and trucks from Ninnescah Electric Cooperative in Pratt and Central Kansas Electric Cooperative in Great Bend had to be borrowed to repair all the damage.

- A windstorm in March 1971 caused considerable damage in the Clearwater area. A tornado on Memorial Day weekend of 1973 wrecked homes along with lines and service wires.

- On June 19, 1990, a storm with wind speeds as high as 118 miles per hour went across part of our area. Approximately 200 poles, four miles of transmission line, an estimated 80 miles of primary line and numerous transformers were lost or damaged. Crews totaling 13 men and 5 trucks from Midwest Electric worked for 8 days to reconstruct the four miles of transmission line south of Andale substation. Tiede Line Contractors worked 3 weeks replacing 50 distribution poles. These crews allowed our linemen to work on member services and building new service lines. Help was also given from DS&O Electric Cooperative from Solomon, KS, PR&W Electric Cooperative from Wamego, KS, Ninnescah Electric Cooperative from Pratt, KS, and C&W Electric Cooperative from Clay Center, KS. Tree crews from Asplund Tree Service and Ranger Tree Service helped to clean up the debris from trees.

- On Friday, July 1, 1994, we were subjected to yet another windstorm with winds over 100 miles per hour. Over 3,000 houses were without electricity caused by damage to KG&E's transmission line that served three of our substations and two of our metering points. The cooperative lost approximately 75 poles and damaged lines and individual services. Most services were restored by Sunday evening. Once again, other cooperatives sent help -- Ninnescah Electric Cooperative out of Pratt, KS and Alfalfa Electric Cooperative out of Cherokee, OK.

SOUTHERN PIONEER (SPECO)

Southern Pioneer Electric Company (SPECo), a wholly-owned subsidiary of Pioneer Electric Cooperative, Inc., joined five other electric cooperatives to form Mid Kansas Electric Company, LLC for the purpose of purchasing Aquila's Kansas Electric Network. SPECo serves approximately 18,000 consumers and operates in 10 counties and 34 communities. The service territory stretches east from Liberal to Medicine Lodge and north to Pratt and back west to Greensburg, Kansas.

SUMNER-COWLEY ELECTRIC COOPERATIVE INC.

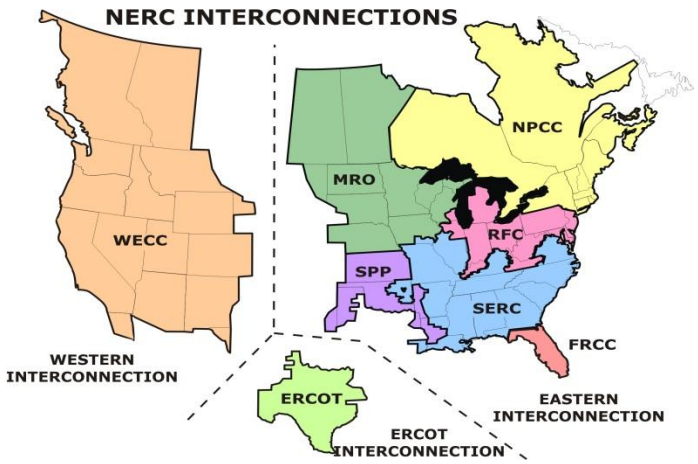
Providing electric services to rural areas of Sumner County since 1938. Sumner-Cowley currently provides electric service to rural areas in all of Sumner country, half of Cowley County, and areas of Harper, Sedgwick and Kingman counties. In addition, the cooperative extends into extreme eastern Stafford County. The service area encompasses approximately 2,500 square miles, with approximately 4,300 meters and nearly 2,000 miles of line. Headquartered in Wellington, Sumner-Cowley is one of 27 distribution electric cooperatives serving consumer members in the state of Kansas.

SUNFLOWER ELECTRIC POWER CORPORATION

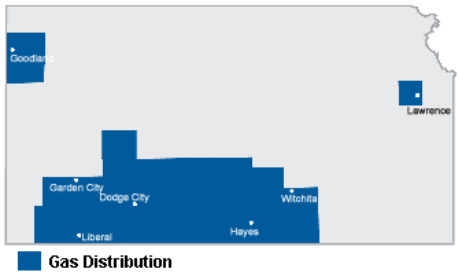
Operates and maintains this fleet of units for Mid-Kansas during the interim regulatory period. Ultimately, these units will be integrated into Sunflower’s existing fleet of coal and natural gas based generating units that have a generating capacity of 595 MW. When combined together, Sunflower will operate more than 1,200 MW of generating capacity that will be available to serve the needs of the 69,000 Mid-Kansas customers and the 54,000 connected meters already served by Sunflower’s six Member Systems.

WESTAR ENERGY

Westar Energy is part of the Southwest Power Pool (SPP) which is a group of 46 members serving more than 4 million customers and covers a geographic area of 255,000 square miles containing a population of over 18 million people. The SPP is one of six North American Electric Reliability Council (NERC) regions that make up the Eastern Interconnect. The Eastern Interconnect is one of three national power grids with a limited interconnection to the Western Interconnect and direct current line to the Texas (ERCOT) Interconnect. All electric utilities in the mainland United States are connected to at least one other utility via these power grids.



CO-OP RENEWABLE ENERGY PROFILE IN KANSAS



- Generation and transmission (G&T) co-ops in Kansas have capitalized on the state's plentiful wind and agricultural waste as sources of renewable energy.
- Sunflower Electric Cooperative purchases 50 MW from the Gray County Wind Farm and another 74.4 MW from the Smoky Hills Wind Project. Midwest Energy Inc., also purchases 49 MW from this project.
- Under a long-term purchase power agreement with Westar Energy, Kansas Electric Power Cooperative (KEPCo) will have access to a pro rata share of renewable energy from Westar's 295 MW of wind generation.
- KEPCo receives an allocation of hydropower from Southwestern Power Administration (100 MW) and the Western Power Administration (14 MW).
- Kaw Valley Electric Cooperative Inc., receives hydroelectric power from the Southwestern Power Administration.
- Nemeha-Marshall and Doniphan receive hydro allocations.
- Butler Rural Electric Cooperative jointly operates a solar panel at Miami University in Ohio for research and educational purposes.

Co-op Renewable Energy Presence in Kansas

- No. of distribution co-ops: 27
- No. of customers: 216,140
- Co-op customers (percentage of total): 15%

- Co-op sales (percentage of total): 11%
- Residential kWh usage: 937

Elk River Wind Farm Project (Butler)

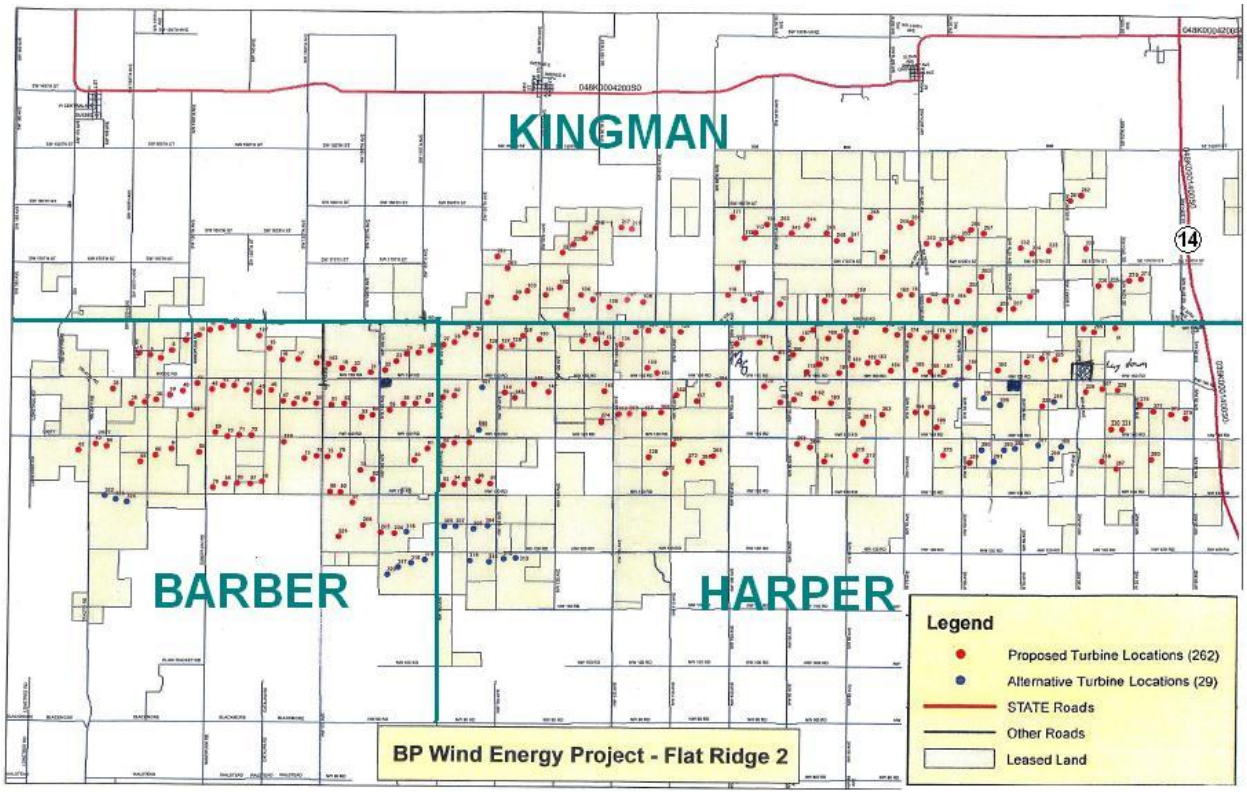
The 150 MW Elk River Wind Project is located in Butler County, approximately 45 miles east of Wichita near Beaumont. Primarily used to graze cattle, the total site is consists of 7,907 acres is owned by five local landowners. Empire District Electric Company selected Elk River and entered into a 20-year agreement with Iberdrola Renewables, Inc. to purchase wind energy from the facility. Empire anticipates it will purchase enough energy to meet the annual needs of about 42,000 homes.

Flat Ridge Wind Farm Project (Barber)

A 100 MW wind project with possible expansion to 250 MW. This project was developed by BP Wind Power and the first 100 MW has been contracted to Westar Energy with both BP and Westar each owning 50% of the project. Construction began in 2008 and commercial operation began in March 2009. The wind farm consists of 40 Clipper 2.5 MW turbines.

FLAT RIDGE 2 WIND FARM PROJECT (BARBER, HARPER, KINGMAN)

BP Wind Energy is buying 262 GE 1.6-megawatt wind turbines for its recently-announced Flat Ridge 2 wind farm planned for 66,000 acres in Harper, Barber, and Kingman counties. BP is spending $750 million for 350 GE turbines and services at Flat Ridge 2 and a smaller wind farm in Pennsylvania. BP will pay more than $1 million a year for 20 years to the 200 landowners hosting the turbines and about the same amount to the local governments. An on-line date of fall 2012 is anticipated. Associated Electric Cooperative will buy 3/4's of the power. The proposed locations are shown on the map below:

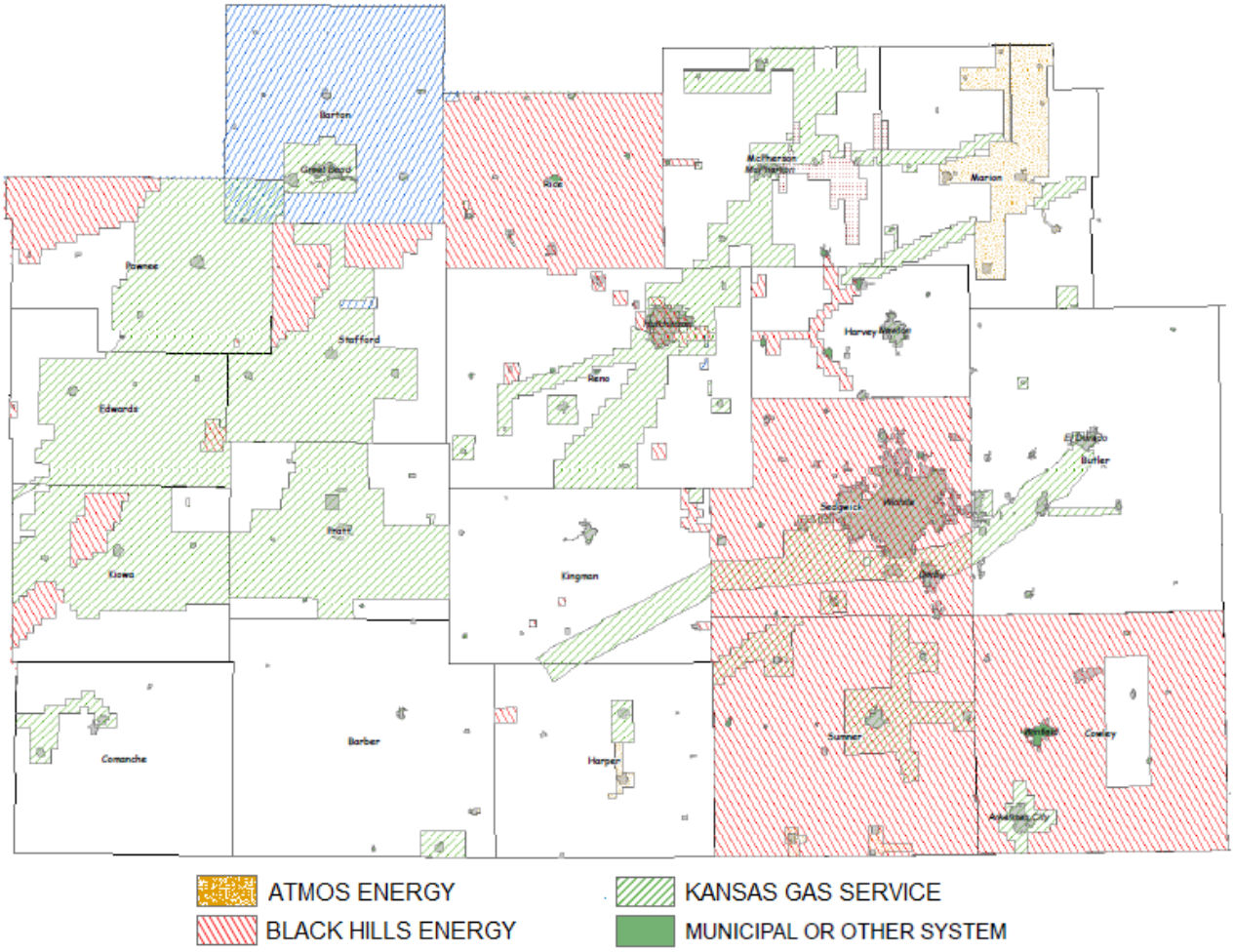


Source: BP Alternative

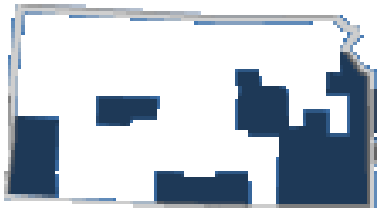
13.2 NATURAL GAS DISTRIBUTION SYSTEM

The following map from the Kansas Commerce Commission shows the coverage areas of these companies:

Certified Areas of Natural Gas Public Utilities in South Central Kansas



Atmos Energy



Atmos Energy is one of the largest natural-gas-only distributor in the United States. Regulated distribution operations deliver natural gas to 3.2 million residential, commercial, industrial, agricultural and public-authority customers. The distribution services are provided to more than 1,600 communities in 12 states. Counties in Kansas include: Rush, Wilson, Harper, Marion, Labette, Leavenworth, Ness, Coffey, Sumner, Montgomery, Chautauqua, Johnson, Chase, Morris, Allen, Douglas, Greenwood, Bourbon, Neosho, Barber, Dickinson, Grant, Miami, Stanton, Wyandotte, Kearny, Crawford, Linn, Hamilton, Elk, and Woodson.

BLACK HILLS ENERGY

Black Hills Energy is a Black Hills Corporation company that provides electric and natural gas service to over 600,000 customers in Colorado, Iowa, Kansas and Nebraska. Black Hills Corporation is a diversified energy company with a tradition of exemplary service and a vision to be the energy partner of choice - is based in Rapid City, South Dakota, with corporate offices in Golden, Colorado, and Omaha, Nebraska.

The company serves 759,000 utility customers in Colorado, Iowa, Kansas, Montana, Nebraska, South Dakota and Wyoming. The company's non-regulated businesses generate wholesale electricity, produce natural gas, oil and coal, and market energy.

13.3 WATER DISTRIBUTION SYSTEM[21]

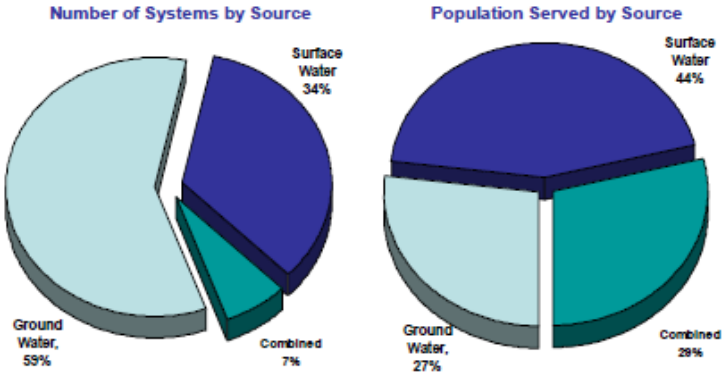
Under Kansas law, a public water supply system is defined as a system for the provision to the public of piped water for human consumption, if such system has at least 10 service connections or regularly serves an average of at least 25 individuals daily at least 60 days out of the year. There are two categories of public water supply systems: community and non-community. Community systems serve a year-round population; non-community systems serve a non-residential population such as motels, parks or daycare facilities. Kansas has about 1,100 public water supply systems, serving approximately 2.6 million Kansas residents. Fifty-nine percent of Kansas public water supply systems serve 500 or fewer people, while only five systems serve over 100,000. Public water supply systems are typically managed by a public entity, such as a municipality or a rural water district, but may also be managed privately. The governing bodies of public water supply systems bear primary responsibility for providing an adequate supply of high quality drinking water to the public.

SOURCES OF AND ACCESS TO SUPPLY

Most Kansas public water suppliers have their own source of raw water. Such sources include wells in alluvial or deeper aquifers, streams and rivers, springs or municipal lakes. Several suppliers use lakes developed through the Kansas Multipurpose Small Lakes Program or obtain water from the Kansas Water Marketing Program. Many public water suppliers also buy finished water at wholesale from another supplier, either as a sole source of supply or to supplement their own source(s). In eastern Kansas, the primary source of water is surface water: rivers, federal reservoirs, multipurpose small lakes and municipal lakes. In western Kansas, the primary source is ground water drawn from wells that reach into the water bearing aquifers. While 69% of the state's public water systems rely upon ground water sources, these systems serve only 27% of the population as shown on the graphic below:

[21] *Kansas Water Office*

Kansas Community Water Supply Source Data

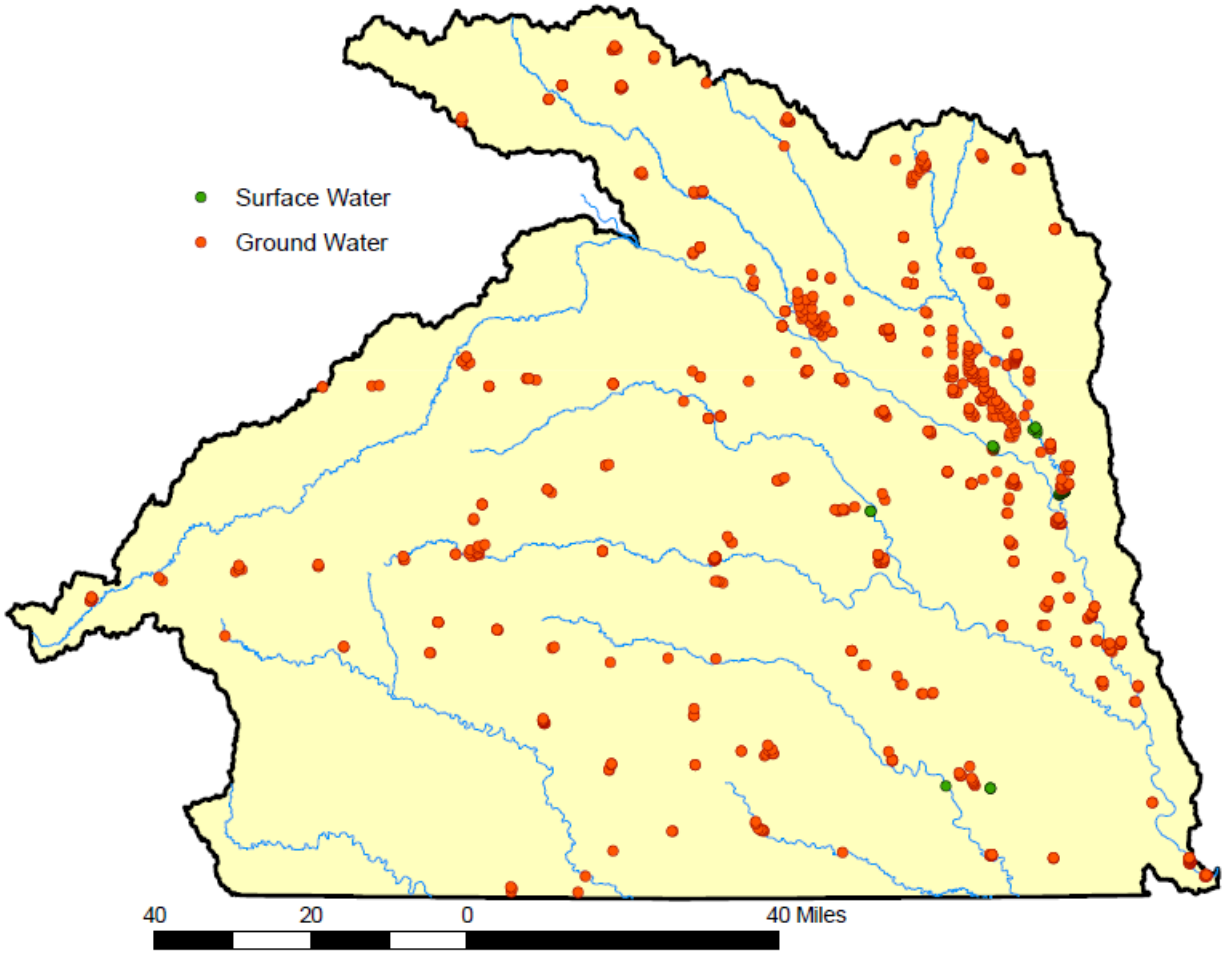


Graphic courtesy KDHE.

The following graphics show the locations of municipal points in each basin and identifies whether communities depend on groundwater or surface water sources.

Lower Arkansas Basin

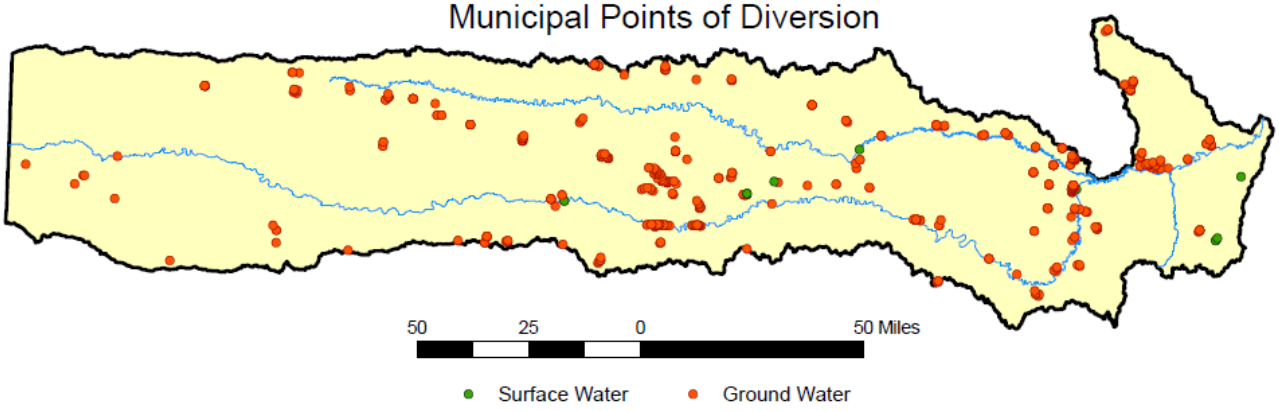
Municipal Points of Diversion



Data Source: Kansas Department of Agriculture, November 2008

Smoky Hill - Saline Basin

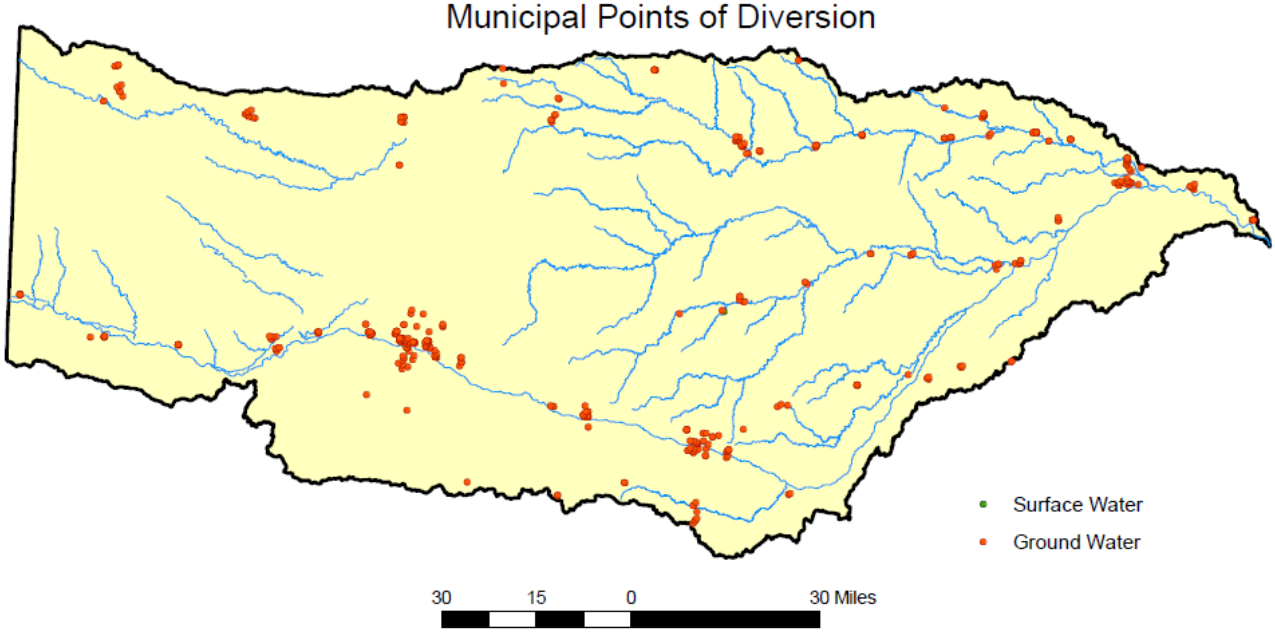
Municipal Points of Diversion



Data Source: Kansas Department of Agriculture, November 2008

Upper Arkansas Basin

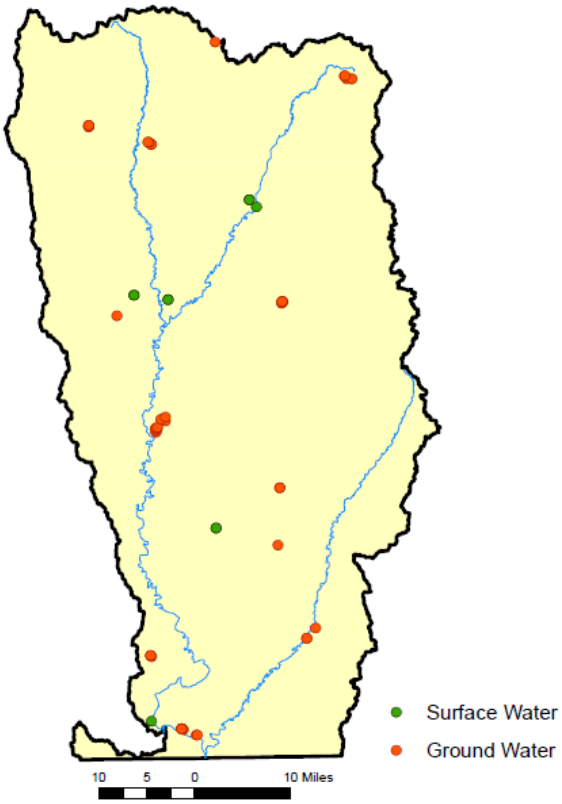
Municipal Points of Diversion



Data Source: Kansas Department of Agriculture, November 2008

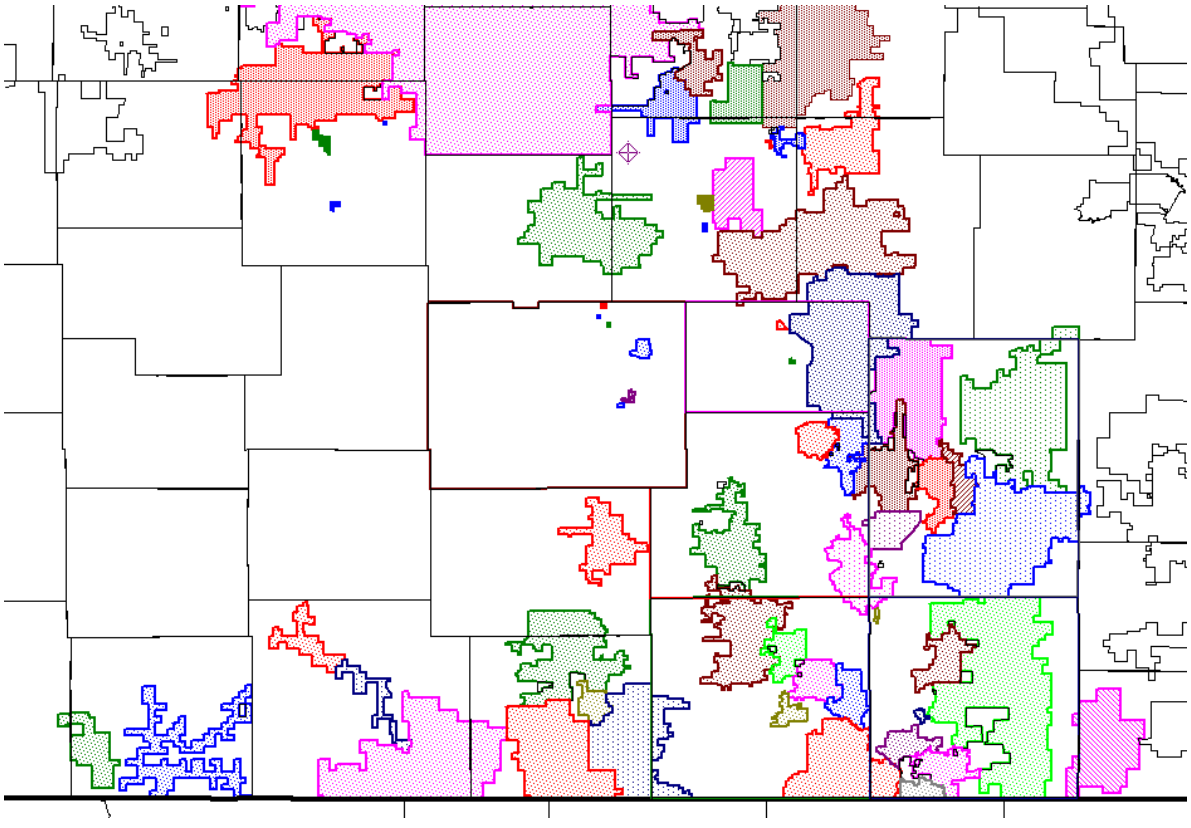
Walnut Basin

Municipal Points of Diversion



Data Source: Kansas Department of Agriculture, November 2008

RURAL WATER DISTRICTS



14 SOCIAL VULNERABILITY INDEX

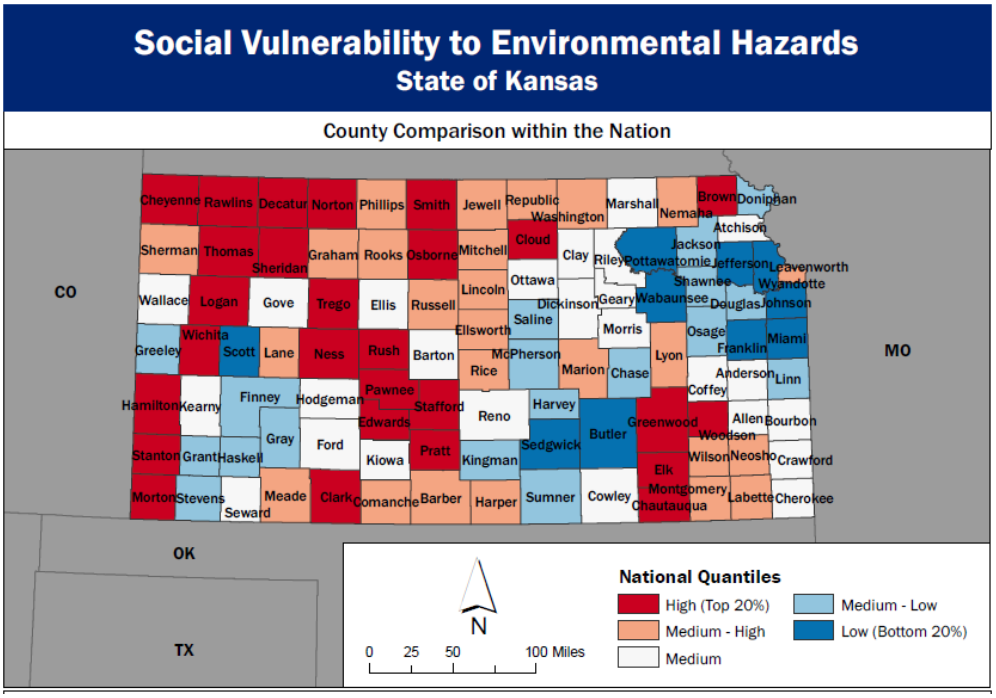
Social vulnerability is influenced by factors such as age, race and ethnicity, gender, education, disabilities, and financial resources (Cutter et al., 2000). The Social Vulnerability Index (SoVI) measures the social vulnerability of U.S. counties to environmental hazards. The index is a comparative metric that facilitates the examination of the differences in social vulnerability among counties. SoVI is a valuable tool for policy makers and practitioners. It graphically illustrates the geographic variation in social vulnerability. It shows where there is uneven capacity for preparedness and response and where resources might be used most effectively to reduce the pre-existing vulnerability. SoVI also is useful as an indicator in determining the differential recovery from disasters.

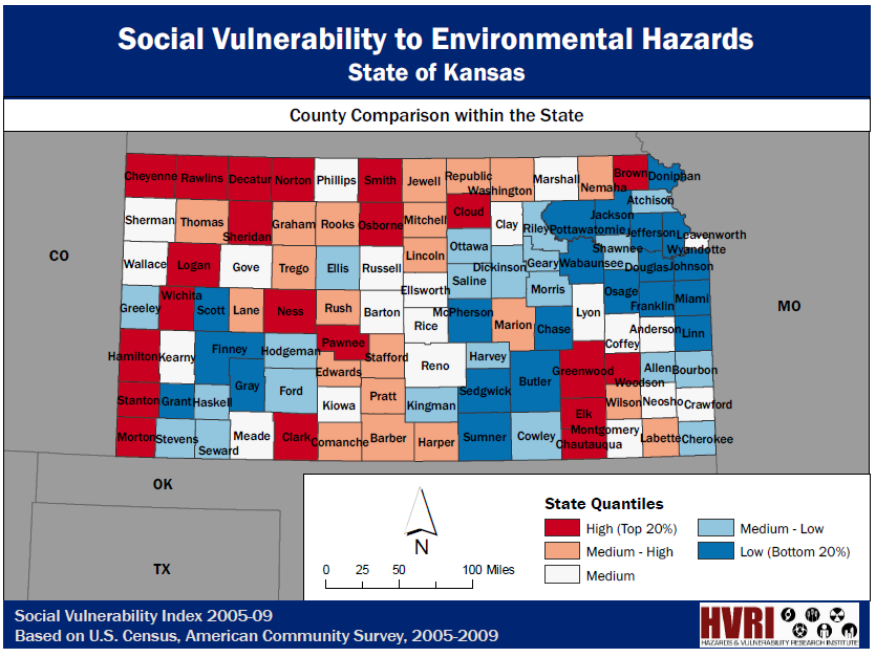
The socioeconomic and built environment data were compiled and geo-referenced by the Hazards Research Lab at the University of South Carolina. The socioeconomic and built environment variables were standardized and input into a principal components analysis to reduce the number of variables into a smaller set of indicators. Adjustments were made to the component's directionality (negative, positive) to insure that positive loadings were associated with increasing vulnerability, and negative loadings with decreasing vulnerability. Once the directions of the loadings were determined, the components were added together to determine the numerical social vulnerability score for each county.

The Social Vulnerability Index (SoVI®) 2005-09 measures the social vulnerability of U.S. counties to environmental hazards. The index is a comparative metric that facilitates the examination of the differences in social vulnerability among counties. SoVI® is a valuable tool for policy makers and practitioners. It graphically illustrates the geographic variation in social vulnerability. It shows where there is uneven capacity for preparedness and response and where resources might be used most effectively to reduce the pre-existing vulnerability. SoVI® also is useful as an indicator in determining the differential recovery from disasters.

The index synthesizes 31 socioeconomic variables, which the research literature suggests contribute to reduction in a community's ability to prepare for, respond to, and recover from hazards. Among them are socioeconomic status, elderly and children, development density, rural agriculture, race, gender, ethnicity, infrastructure employment, and county debt/revenue. The data are culled from national data sources, primarily those from the United States Census Bureau.

The following maps show the social vulnerability rankings of the counties in south central Kansas compared to the State of Kansas and nationally.





County	SoVI Score (2005-09)	Nat'l Percentile (2005-09)
Barber County	1.60079	0.768692
Barton County	0.21576	0.54693
Butler County	-2.93507	0.11454
Comanche County	1.61221	0.770283
Cowley County	0.04839	0.517976
Edwards County	2.0583	0.815781
Harper County	1.60436	0.76901
Harvey County	-0.80742	0.360802
Kingman County	-0.77988	0.364938
Kiowa County	0.49377	0.595609
McPherson County	-1.02246	0.323894
Marion County	1.29821	0.725103
Pawnee County	3.66384	0.926185
Pratt County	2.04931	0.815463
Reno County	0.05089	0.518613
Rice County	0.54822	0.606109
Sedgwick County	-1.95428	0.198855
Stafford County	2.11592	0.820554
Sumner County	-1.26085	0.286987

High (Top 20%)	Medium - High	Medium	Medium - Low	Low (Bottom 20%)

Special Needs Considerations

With the occurrence of a hazard event, the population groups that are most at risk are “Special Needs” populations. A Special Needs person is one who would require special assistance in the event of a hazard, more so than the average person. These populations include individuals (primarily non-workers) located in hospitals, nursing homes, group homes, schools, jails and prisons, and other such facilities. Special needs groups require assistance not just during a hazard event, but also before and after the event (i.e. during mitigation/preparation and response/recovery efforts). Disasters are socially created; therefore, mitigation efforts should focus on those populations that are most vulnerable. A spatial hazards evaluation of potential risks to special needs populations helps to identify visually where there is an intersection between the locations of hazard occurrences and Special Needs populations. This is essential in determining where to direct future efforts and resources.

15 EXPOSURE OF BUILT ENVIRONMENT

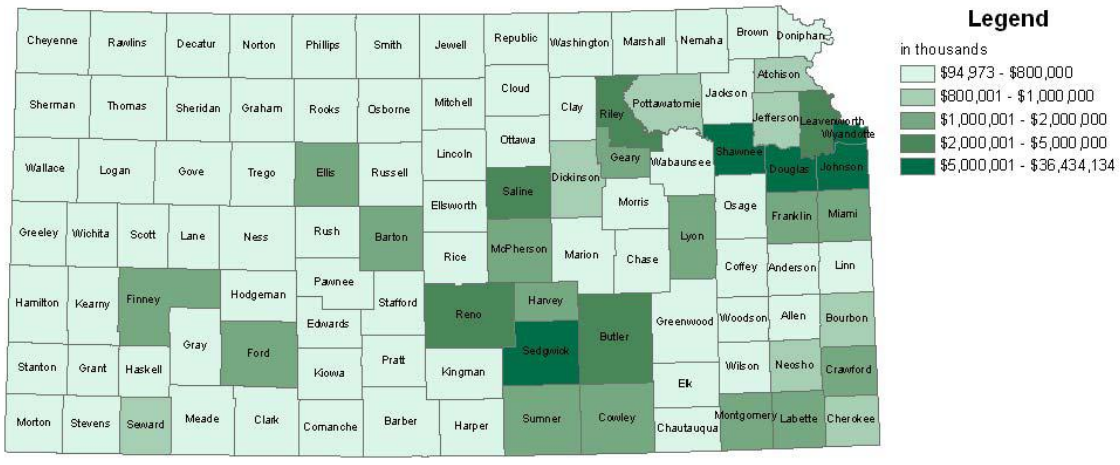
As indicated in the 2010 Kansas Hazard Mitigation Plan, this section quantifies the buildings exposed to potential hazards. The following table provides the value of the built environment, which in addition to the population information presented above forms the basis of the vulnerability and risk assessment presented in this plan.

ESTIMATED VALUES FOR THE KEY BUILDING OCCUPANCIES (USES) FOR KANSAS
(2005 VALUATIONS)

County	Residential ($000)	Commercial ($000)	Industrial ($000)	Agriculture ($000)	Religion ($000)	Government ($000)	Education ($000)	Total ($000)
Barber	246,549	36,011	6,951	4,994	3,174	495	3,554	301,728
Barton	1,041,236	199,854	96,423	13,890	17,189	5,070	4,865	1,378,527
Butler	2,559,240	201,441	23,547	6,797	21,457	9,859	8,629	2,830,970
Comanche	82,844	12,808	2,384	5,745	975	331	438	105,525
Cowley	1,473,314	187,552	66,350	7,941	11,313	4,255	6,599	1,757,324
Edwards	148,959	18,960	4,549	6,258	1,073	0	2,257	182,056
Harper	277,507	41,617	13,047	6,470	3,161	1,371	2,221	345,394
Harvey	1,416,887	174,424	51,496	8,624	18,146	8,547	12,316	1,690,440
Kingman	403,074	36,915	8,630	5,003	3,081	1,298	1,350	459,351
Kiowa	152,966	17,960	2,738	3,073	2,280	294	155	179,466
Marion	572,222	65,082	9,043	5,927	5,806	2,939	3,258	664,277
McPherson	1,311,527	191,178	48,739	4,695	17,620	2,328	7,374	1,583,461
Pawnee	314,681	32,040	1,844	7,367	4,121	2,775	1,100	363,928
Pratt	443,239	106,520	16,548	8,073	4,610	2,653	26,575	608,218
Reno	2,654,134	461,801	91,463	12,479	31,838	7,225	14,918	3,273,858
Rice	440,652	56,325	22,571	4,125	4,282	1,161	2,871	531,987
Sedgwick	20,664,216	3,452,698	632,176	29,078	196,221	32,515	95,756	25,102,660
Stafford	191,912	22,092	1,235	6,517	3,262	144	260	225,422
Sumner	1,090,144	113,869	57,134	3,792	7,054	1,689	9,186	1,282,868

Source: HAZUS-MH MR2

BUILDING EXPOSURE



Source: HAZUS-MH
Map Compilation: AMEC 9/4/07

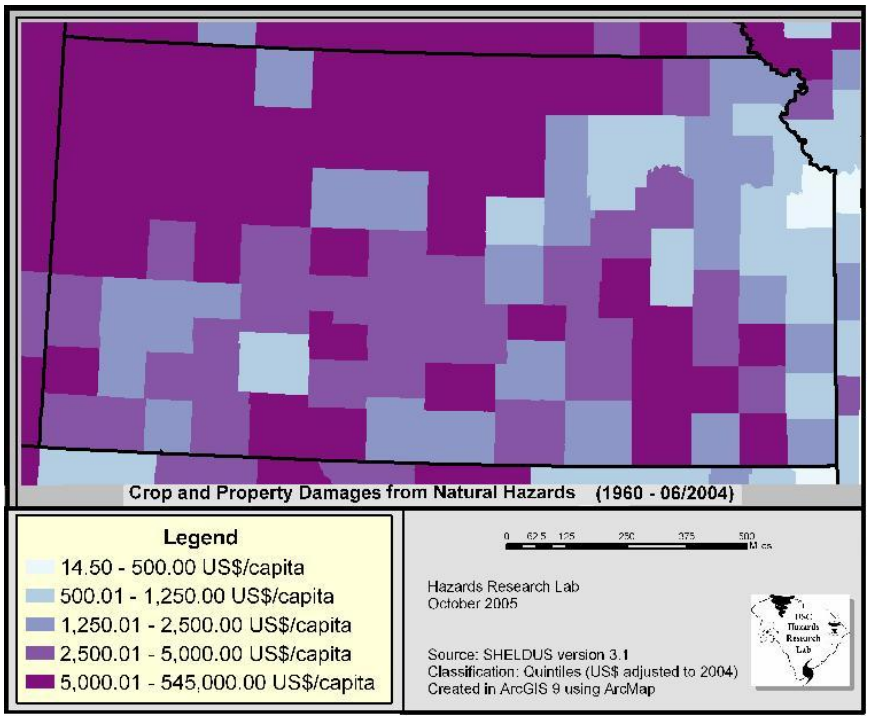
The figure above shows the distribution of the value of this exposure across the state. This information was derived from inventory data associated with FEMA's loss estimation software HAZUS-MH MR 2 (May 2006). HAZUS-MH classifies building stock types into seven categories: residential, commercial, industrial, agriculture, religion, government, and education. Values associated with each of these categories reflect 2005 valuations, based on RSMeans (a supplier of construction cost information) replacement costs.

16 SPATIAL HAZARD EVENTS AND LOSSES DATABASE FOR THE UNITED STATES (SHELDUS)

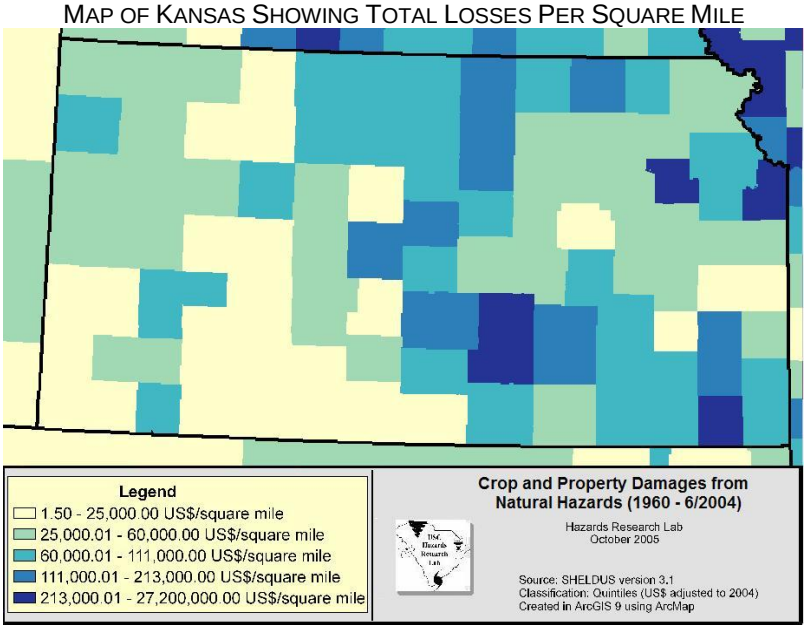
SHELDUS is a county-level hazard data set for the U.S. for 18 different natural hazard events types such thunderstorms, hurricanes, floods, wildfires, and tornados. For each event the database includes the beginning date, location (county and state), property losses, crop losses, injuries, and fatalities that affected each county.

The data were derived from several existing national data sources such as National Climatic Data Center's monthly Storm Data publications and NGDC's Tsunami Event Database. Only those events that generated more than $50,000 in damages or at least one death were included in SHELDUS. Since 1995, SHELDUS additionally includes all events that are reported in NCDC's Storm Data with a specific dollar amount.

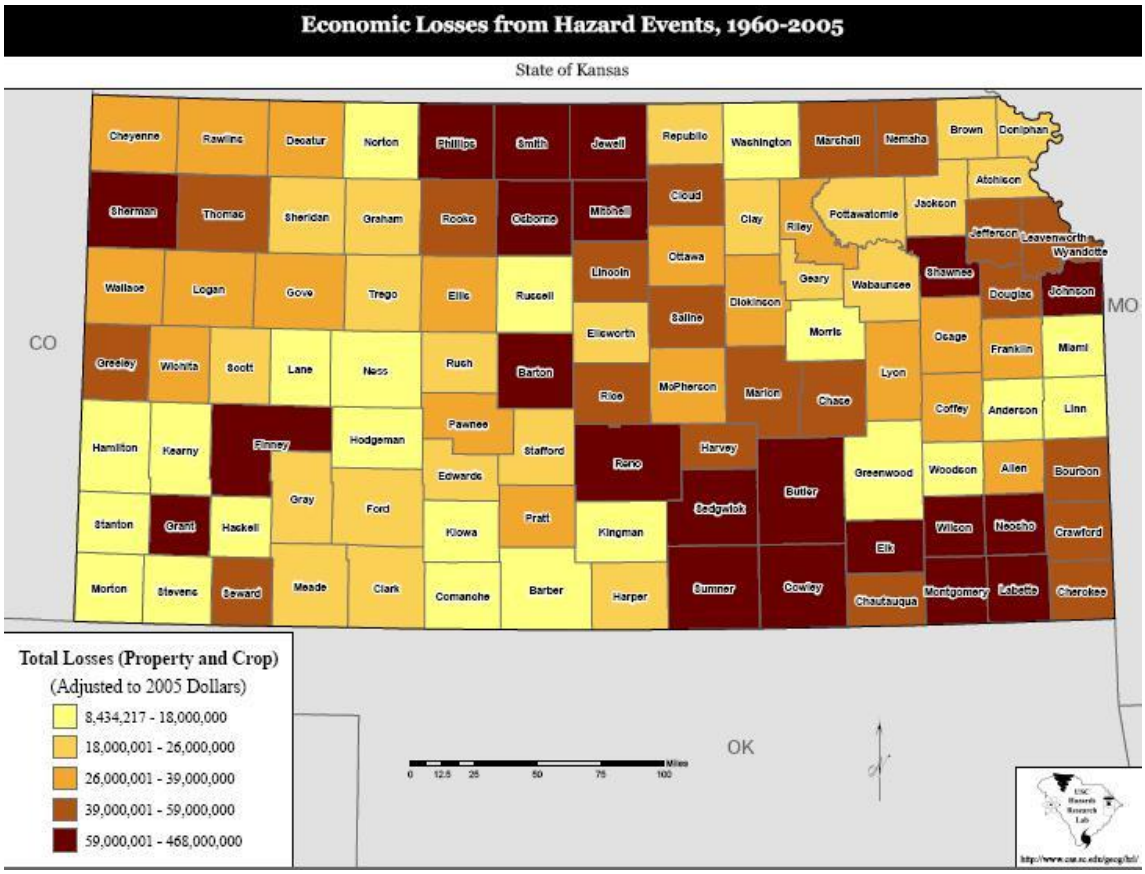
MAP OF KANSAS SHOWING TOTAL LOSSES PER CAPITA



MAP OF KANSAS SHOWING TOTAL LOSSES PER SQUARE MILE

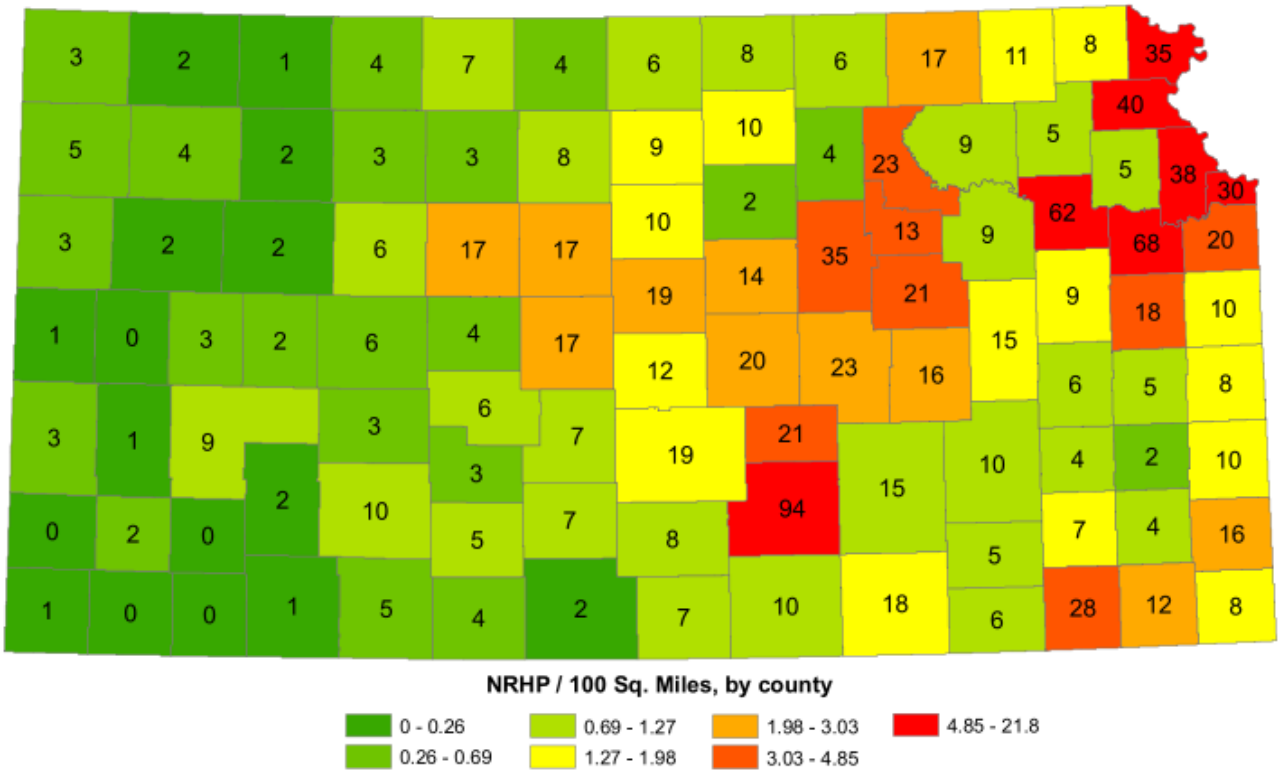


(Ref. Data and maps were compiled and geo-referenced by the Hazards Research Lab at the University of South Carolina)


Economic Losses from Hazard Events, 1960-2005
State of Kansas
CO
MO
OK
Cheyenne
Rawlins
Decatur
Norton
Phillips
Smith
Jewell
Republic
Washington
Marshall
Nemaha
Brown
Doniphan
Sherman
Thomas
Sheridan
Graham
Rooks
Osborne
Mitchell
Cloud
Clay
Pottawatomie
Jackson
Atchison
Jefferson
Leavenworth
Wyandotte
Wallace
Logan
Gove
Trego
Ellis
Russell
Lincoln
Ottawa
Riley
Geary
Shawnee
Wabaunsee
Douglas
Johnson
Greeley
Wichita
Scott
Lane
Ness
Rush
Barton
Ellsworth
Saline
Dickinson
Morris
Osage
Franklin
Miami
Hamilton
Kearny
Finney
Hodgeman
Pawnee
Stafford
Rice
McPherson
Marion
Chase
Lyon
Coffey
Anderson
Linn
Gray
Ford
Edwards
Reno
Harvey
Butler
Greenwood
Woodson
Allen
Bourbon
Stanton
Grant
Haskell
Kiowa
Pratt
Kingman
Sedgwick
Elk
Wilson
Neosho
Crawford
Morton
Stevens
Seward
Meade
Clark
Comanche
Barber
Harper
Sumner
Cowley
Chautauqua
Montgomery
Labette
Cherokee
Total Losses (Property and Crop)
(Adjusted to 2005 Dollars)
8,434,217 - 18,000,000
18,000,001 - 26,000,000
26,000,001 - 39,000,000
39,000,001 - 59,000,000
59,000,001 - 468,000,000
0 12.5 25 50 75 100
Miles

17 NATIONAL AND STATE REGISTER OF HISTORIC PLACES

The National and State Register of Historic Places honor historic properties. Properties eligible include districts, sites, buildings, structures, landscapes and objects significant to the prehistory or history of the community, state or nation.



Source: Kansas State Historical Society, National Register of Historic Places

18 THREATENED, ENDANGERED, SPECIES IN NEED OF CONSERVATION, AND CANDIDATE SPECIES

State and federally listed species are protected in Kansas as designated by the *Kansas Nongame and Endangered Species Conservation Act* of 1975. The act places the responsibility for identifying and undertaking appropriate conservation measures for listed species directly upon the Department of Wildlife and Parks through statutes and regulations. Regulations require the department to issue special action permits for activities that affect species listed as threatened and endangered in Kansas. Department personnel conduct environmental reviews of these proposed activities, and if necessary issue action permits with special conditions that help offset negative effects to listed species and critical habitats. The tables below show the numbers of threatened, endangered, species in need of conservation, and candidate species.

THREATENED (THR) & ENDANGERED (END) SPECIES	
Arkansas Darter *Etheostoma cragini* **State:** THR **Federal:** CAN **Critical Habitat:** YES **Arkansas River Shiner** *Notropis girardi* **State:** END **Federal:** THR **Critical Habitat:** YES **Arkansas River Speckled Chub** *Macrhybopsis tetranema* **State:** END **Federal:** NA **Critical Habitat:** YES **Bald Eagle** *Haliaeetus leucocephalus* **State:** THR **Federal:** THR **Critical Habitat:** NO **Eastern Spotted Skunk** *Spilogale putorius* **State:** THR **Federal:** NA **Critical Habitat:** NO **Eskimo Crulew** *Numenius borealis* **State:** END **Federal:** END **Critical Habitat:** NO	**Least Tern** *Sterna antillarum* **State:** END **Federal:** END **Critical Habitat:** NO **Piping Plover** *Charadrius melodus* **State**: THR **Federal:** THR **Critical Habitat:** NO **Silver Chub** *Macrhybopsis storeriana* **State:** END **Federal:** NA **Critical Habitat:** NO **Snowy Plover** *Charadrius alexandrinus* **State:** THR **Federal:** NA **Critical Habitat:** NO **Whooping Crane** *Grus Americana* **State:** END **Federal:** END **Critical Habitat:** NO Legend: CAN – Candidate, NA – Not Applicable
SPECIES IN NEED OF CONSERVATION (SNC)	
Black Rail *Laterallus jamaicensis* **State:** SNC **Federal:** NA **Critical Habitat:** NA **Black Tern** *Chlidonias niger* **State:** SNC **Federal:** NA **Critical Habitat:** NA **Eastern Hognose Snake** *Heterodon platirhinos* **State:** SNC **Federal:** NA **Critical Habitat:** NA **Ferruginous Hawk** *Buteo regalis* **State:** SNC **Federal:** NA **Critical Habitat:** NA **Golden Eagle** *Aquila chrysaetos* **State:** SNC **Federal:** NA **Critical Habitat:** NA **Long-billed Curlew** *Numenius americanus* **State:** SNC **Federal:** NA **Critical Habitat:** NA	**Plains Minnow** *Hybognathus placitus* **State:** SNC **Federal:** NA **Critical Habitat:** NA **River Shiner** *Notropis blennius* **State:** SNC **Federal:** NA **Critical Habitat:** NA **Short-eared Owl** *Asio flammeus* **State:** SNC **Federal:** NA **Critical Habitat:** NA **Whip-poor-will** *Camprimulgus vociferus* **State:** SNC **Federal:** NA **Critical Habitat:** NA **Yellow-throated Warbler** *Dendroica dominica* **State:** SNC **Federal:** NA **Critical Habitat:** NA Legend: NA – Not Applicable

Source: Kansas Department of Wildlife and Parks, Threatened and Endangered Species

Definitions

- Endangered species**:** any species of wildlife whose continued existence as a viable component of the state's wild fauna is determined to be in jeopardy. That term shall also include any species of wildlife determined to be an endangered species pursuant to Pub. L. No. 93-205 (December 28, 1973), the Endangered Species Act of 1973, and amendments thereto.

- Threatened species**:** any species of wildlife which appears likely, within the foreseeable future, to become an endangered species. That term shall also include any species of wildlife determined to be a threatened species pursuant to Pub. L. No. 93-205 (December 28, 1973), the Endangered Species Act of 1973, and amendments thereto.

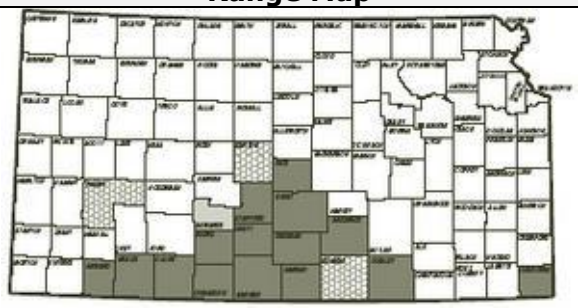
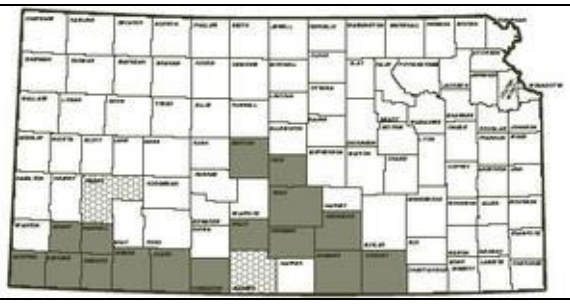
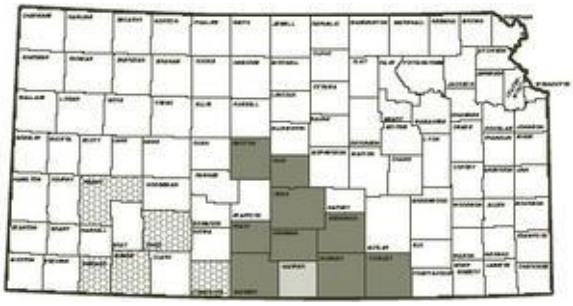
- Species in Need of Conservation**:** any nongame species deemed to require conservation measures in attempt to keep the species from becoming a threatened or endangered species.

- Nongame species**:** any species of wildlife not legally classified a game species, furbearer, threatened species, or endangered species by statute or by rule and regulation adopted pursuant to statute.

- Critical Habitat**:** specific areas documented as currently providing essential physical and biological features and supporting a self-sustaining population of a listed species; or specific areas not documented as currently supporting a listed species, but determined essential for the listed species by the secretary

Designated Critical Habitats

As defined by Kansas Administrative Regulations, critical habitats include those areas documented as currently supporting self-sustaining population(s) of any threatened or endangered species of wildlife as well as those areas determined by the Kansas Department of Wildlife and Parks to be essential for the conservation of any threatened or endangered species of wildlife. The species in these habitats are protected by the Kansas Nongame and Endangered Species Conservation Act and administrative regulations applicable thereto. Any time an eligible project is proposed that will impact the species' preferred habitats within its probable range; the project sponsor must contact the Environmental Services Section, Kansas Department of Wildlife and Parks, 512 SE 25th Ave., Pratt, Kansas 67124-8174. Department personnel can then advise the project sponsor on permit requirements.

Range Map	Description/Location
	*Arkansas Darter*: Reaching a maximum size of 2.5 inches, the Arkansas Darter is a stout-bodied member of the perch family. Arkansas Darters prefer shallow, clear, spring-fed tributary and headwater streams having sand or sandy-gravel substrates. The main stem of the South Fork Ninnescah River on the Sedgwick/Kingman County line (Sec. 19-T28S-R4W) to the confluence with the North Fork Ninnescah River (Sec. 36-T28S-R4W) in Sedgwick County.
	*Arkansas River Shiner*: This small (usually less than 2 inches) shiner is straw-colored with silvery sides. The fish is extremely dependent upon flood flows from June through August to successfully spawn. The main stem South Fork Ninnescah River and main stem Ninnescah from the Pratt County Lake in Sec. 7, T28S, R12W, Pratt County to the Ninnescah-Arkansas confluence in Sec. 35, T31S, R2E, Sumner County.
	*Arkansas River Speckled Chub*: This small (2 3/4 inches) chub has a slender, nearly transparent body with small dark dots scattered on its back. This species prefers shallow channels of permanently flowing streams where currents flow over clean fine sand. It avoids calm waters and silted stream bottoms. • The main stem South Fork Ninnescah River from the Pratt County Lake in Sec. 7, T28S, R12W to its confluence with the North Fork Ninnescah in Sec. 36, T28S, R4W, Sedgwick County. • The main stem Ninnescah River from its origin in Sec. 36, T28S, R4W, Sedgwick County to its confluence with the Arkansas River in Sec. 25, T31S, R2E, Sumner County.

RISK ASSESSMENT

Each hazard is profiled individually and also reflected in each county plan. The level of information presented in the profiles varies by hazard based on the information available. The plan is considered a living document and as new information comes in, it will be incorporated to provide a better assessment of the hazards that affect jurisdictions.

Detailed profiles for each of the identified hazards include information categorized as follows:

Hazard Description

This section consists of a general description of the hazard and the types of impacts it may have on a community. It also includes a ranking to indicate typical warning times and duration of hazard events.

Geographic Location

This section describes the geographic extent or location of the hazard in the planning area. Where available, maps are utilized to indicate the areas within the planning area that are vulnerable to the subject hazard.

Previous Occurrences

This section includes information on the historic event of the hazard and its impact on specific jurisdictions in the planning area.

Probability of Future Occurrence

The frequency of past events is used to gauge the likelihood of future occurrences. Where possible, the probability or chance of occurrence was calculated based on historical data. Probability was determined by dividing the number of events observed by the number of years and multiplying by 100. This gives the percent chance of the event happening in any given year. An example would be three droughts occurring over a 30-year period, which suggests a 10 percent chance of a drought occurring in any given year.

Magnitude/Severity

The magnitude of the impact of a hazard event is largely determined by the socio-economic political structure of the community and where the majority of the residents reside in relation to the specific topography of the region. This factor identifies the vulnerability of the area, which includes people, property, and the environment. The ratio of the resilience design of a community to the capabilities of its emergency response and recovery efforts will determine the magnitude and severity of the event.

Hazard Summary

To maintain a consistent reporting format, this plan used the HMPC derived methodology from the MitigationPlan.com planning tool to prioritize the hazards. This prioritization was based on a calculated priority risk index (CPRI) that considered four elements of risk: probability, magnitude/severity, warning time, and duration.

CALCULATED PRIORITY RISK INDEX (CPRI) ELEMENT DEFINITIONS

Element/Level	Characteristics
Probability	
4 - Highly Likely	Event is probable within the calendar year
	Event has up to 1 in 1 year chance of occurring (1/1=100%)
	History of events is greater than 33% likely per year
	Event is "Highly Likely" to occur
3 - Likely	Event is probable within the next three years
	Event has up to 1 in 3 years chance of occurring (1/3=33%)
	History of events is greater than 20% but less than or equal to 33% likely per year
	Event is "Likely" to occur
2 - Possible	Event is probable within the next five years
	Event has up to 1 in 5 years chance of occurring (1/5=20%)
	History of events is greater than 10% but less than or equal to 20% likely per year
	Event could "Possibly" occur
1 - Unlikely	Event is possible within the next 10 years
	Event has up to 1 in 10 years chance of occurring (1/10=10%)
	History of events is less than or equal to 10% likely per year
	Event is "Unlikely" but may possibly occur
Magnitude / Severity**	
4 - Catastrophic	Multiple deaths
	Complete shutdown of facilities for 30 or more days
	More than 50 percent of property is severely damaged
3 - Critical	Injuries and/or illnesses result in permanent disability
	Complete shutdown of critical facilities for at least two weeks
	25–50 percent of property is severely damaged
2 - Limited	Injuries and/or illnesses do not result in permanent disability
	Complete shutdown of critical facilities for more than one week
	10–25 percent of property is severely damaged
1 - Negligible	Injuries and/or illnesses are treatable with first aid
	Minor reduction in quality of life
	Shutdown of critical facilities and services for 24 hours or less
	Less than 10 percent of property is severely damaged
Warning Time	
4	Less Than 6 Hours
3	6-12 Hours
2	12-24 Hours
1	24+ Hours
Duration	
4	More Than 1 Week
3	Less Than 1 Week
2	Less Than 1 Day
1	Less Than 6 Hours

Source: MitigationPlan.com

* Based on history, using the definitions given, the likelihood of future events is quantified.

** According to the severity associated with past events or the probable worst case scenario possible in the state.

Using the levels described in the table above, the formula used to determine each hazard's CPRI, which includes weighting factors defined by MitigationPlan.com is as follows:

(Probability x .45) + (Magnitude/Severity x .30) + (Warning Time x .15) + (Duration x .10) = CPRI

Based on their CPRI, the hazards were separated into three categories of planning significance:
High (3.0-4.0), Moderate (2.0-2.9), and Low (1.1-1.9)

These terms relate to the level of planning analysis to be given to the particular hazard in the risk assessment process and are not meant to suggest that a hazard would have only limited impact. In order to focus on the most critical hazards, those assigned a level of significant or moderate were given more extensive attention in the remainder of this analysis (e.g., quantitative analysis or loss estimation), while those with a low planning significance were addressed in more general or qualitative ways.

HAZARD PROFILE SUMMARY

Hazard Type	Probability		Magnitude		Warning Time		Duration		CPRI	Planning Significance
Agricultural Infestation	Likely	3	Limited	2	24+ Hours	1	More than 1 Week	4	2.50	Moderate
Dam and Levee Failure	Unlikely	1	Limited	2	24+ Hours	1	More than 1 Week	4	1.60	Low
Drought	Likely	3	Critical	3	24+ Hours	1	More than 1 Week	4	2.80	Moderate
Expansive Soils	Likely	3	Critical	3	24+ Hours	1	More than 1 Week	4	2.80	Moderate
Earthquake	Unlikely	1	Limited	2	Less than 6 Hours	4	Less than 6 hours	1	1.75	Low
Extreme Temperatures	Highly Likely	4	Limited	2	24+ Hours	1	Less than 1 Week	3	2.85	Moderate
Flood	Likely	3	Limited	2	12-24 Hours	2	Less than 1 Week	3	2.55	Moderate
Hailstorm	Highly Likely	4	Limited	2	12-24 Hours	2	Less than 6 hours	1	2.80	Moderate
Land Subsidence	Unlikely	1	Negligible	1	24+ Hours	1	More than 1 Week	4	1.30	Low
Landslide	Unlikely	1	Negligible	1	6-12 Hours	3	Less than 6 hours	1	1.30	Low
Lightning	Highly Likely	4	Limited	2	12-24 Hours	2	Less than 6 hours	1	2.80	Moderate
Soil Erosion and Dust	Possible	2	Negligible	1	24+ Hours	1	More than 1 Week	4	1.75	Low
Tornado	Highly Likely	4	Critical	3	Less than 6 Hours	4	Less than 6 hours	1	3.40	High
Windstorm	Highly Likely	4	Critical	3	Less than 6 Hours	4	Less than 6 hours	1	3.40	High
Wildfire	Highly Likely	4	Limited	2	Less than 6 Hours	4	Less than 1 day	2	3.20	High
Winter Storm	Highly Likely	4	Critical	3	12-24 Hours	2	Less than 1 Week	3	3.30	High

Federal and/or state declarations may be granted when the severity and magnitude of an event surpasses the ability of the local government to respond and recover. Disaster assistance is supplemental and sequential. When the local government's capacity has been surpassed, a state disaster declaration may be issued, allowing for the provision of state assistance. Should the disaster be so severe that both the local and state governments' capacities are exceeded; a federal emergency or disaster declaration may be issued allowing for the provision of federal assistance.

The federal government may issue a disaster declaration through FEMA, the U.S. Department of Agriculture (USDA), and/or the Small Business Administration (SBA). FEMA also issues emergency declarations, which are more limited in scope and do not include the long-term federal recovery programs of major disaster declarations. The quantity and types of damage are the determining factors.

A USDA disaster declaration certifies that the affected county has suffered at least a 30 percent loss in one or more crop or livestock areas and provides affected producers with access to low interest loans and other programs to help mitigate the impact of the disaster. In accordance with the Consolidated Farm and Rural Development Act, all counties neighboring those receiving disaster declarations are named as contiguous disaster counties and, as such, are eligible for the same assistance. The following table shows all Federal Disaster Declarations for Kansas.

Kansas Presidential Declarations May 1955–March 2010

Declaration Number	Declaration Date*	Disaster Description	Counties Involved	Constant 2006 $**
Major Disaster Declarations				
1885	03/09/2010	Severe Winter Storms and Snowstorm	Allen, Anderson, Atchison, Bourbon, Brown, Butler, Cherokee, Cheyenne, Clay, Cowley, Crawford, Decatur, Doniphan, Elk, Franklin, Gove, Graham, Greenwood, Jackson, Jefferson, Jewell, Labette, Linn, Logan, Lyon, Marshall, Miami, Morris, Nemaha, Neosho, Norton, Osage, Phillips, Pottawatomie, Rawlins, Republic, Riley, Shawnee, Sheridan, Wabaunsee, Wallace, Washington, Wilson, Woodson, Wyandotte	
1860	09/30/2009	Severe Storms and Flooding	Anderson, Bourbon, Franklin, Linn, and Sedgwick	
1849	06/25/2009	Severe Storms, Flooding, Straight-line Winds, and Tornadoes	Anderson, Barber, Bourbon, Butler, Chase, Cherokee, Coffey, Cowley, Crawford, Elk, Finney, Greenwood, Harper, Harvey, Kingman, Labette, Linn, Lyon, Marion, Marshall, Montgomery, Morris, Neosho, Reno, Rice, Sumner, Wabaunsee, and Wilson	
1848	06/24/2009 (3/26-29/2009)	Severe Winter Storm and Record and Near Record Snow	Butler, Chase, Chautauqua, Coffey, Cowley, Dickinson, Elk, Grant, Greenwood, Harvey, Lyon, Marion, Morris, Sumner, and Woodson	
1808	10/31/2008	Severe Storms, Flooding, and Tornadoes	Anderson, Butler, Chase, Cowley, Greenwood, Harper, Harvey, Russell, and Sumner	
1776	07/09/2008	Severe Storms, Flooding, and Tornadoes	Barber, Barton, Bourbon, Brown, Butler, Chautauqua, Cherokee, Clark, Clay, Comanche, Cowley, Crawford, Decatur, Dickinson, Edwards, Elk, Ellis, Ellsworth, Franklin, Gove, Graham, Harper, Haskell, Hodgeman, Jackson, Jewell, Kingman, Kiowa, Lane, Linn, Logan, Mitchell, Montgomery, Ness, Norton, Osborne, Pawnee, Phillips, Pratt, Reno, Republic, Riley, Rooks, Rush, Saline, Seward, Sheridan, Smith, Stafford, Sumner, Thomas, Trego, Wallace and Wilson	

Declaration Number	Declaration Date*	Disaster Description	Counties Involved	Constant 2006 $**
Major Disaster Declarations				
1741	02/01/2008	Severe Winter Storms	Atchison, Barber, Barton, Brown, Butler, Chase, Cherokee, Clark, Clay, Cloud, Comanche, Crawford, Dickinson, Doniphan, Edwards, Ellis, Ellsworth, Ford, Geary, Graham, Gove, Harvey, Hodgeman, Jackson, Jefferson, Jewell, Kingman, Kiowa, Labette, Leavenworth, Lincoln, Logan, Lyon, Marion, Marshall, McPherson, Miami, Mitchell, Morris, Nemaha, Osage, Osborne, Ottawa, Pawnee, Phillips, Pottawatomie, Pratt, Reno, Republic, Rice, Riley, Rooks, Rush, Russell, Saline, Sedgwick, Shawnee, Sheridan, Smith, Stafford, Thomas, Wabaunsee, Wallace, Washington, and Woodson.	
1711	7/2/2007 (6/26-30/2007)	Severe Storms and Flooding	Allen, Anderson, Bourbon, Butler, Chautauqua, Cherokee, Coffey, Cowley, Crawford, Edwards, Elk, Franklin, Greenwood, Harper, Labette, Linn, Miami, Montgomery, Neosho, Osage, Pawnee, Wilson, Woodson	n/a
1699	5/6/2007 (5/4/2007)	Severe Storms, Tornadoes, and Flooding	Barton, Brown, Chase, Cherokee, Clay, Cloud, Comanche, Cowley, Dickinson, Doniphan, Douglas, Edwards, Ellsworth, Harper, Harvey, Jackson, Kingman, Kiowa, Leavenworth, Lincoln, Lyon, Marshall, McPherson, Morris, Nemaha, Osage, Osborne, Ottawa, Pawnee, Phillips, Pottawatomie, Pratt, Reno, Rice, Riley, Saline, Shawnee, Smith, Stafford, Sumner, Wabaunsee, Washington	65,979,498
1675	1/7/2007 (12/28-30/2006)	Severe Winter Storm	Cheyenne, Clark, Comanche, Decatur, Edwards, Ellis, Finney, Ford, Gove, Graham, Grant, Gray, Greeley, Hamilton, Haskell, Hodgeman, Jewell, Kearny, Kiowa, Lane, Logan, Meade, Morton, Ness, Norton, Osborne, Pawnee, Phillips, Rawlins, Rooks, Rush, Russell, Scott, Seward, Sheridan, Sherman, Smith, Stafford, Stanton, Stevens, Thomas, Trego, Wallace, Wichita	371,000,000
1626	1/26/2006 (11/27-28/2005)	Severe Winter Storm	Cheyenne, Decatur, Edwards, Gove, Graham, Hodgeman, Ness, Norton, Pawnee, Phillips, Rawlins, Rooks, Rush, Sheridan, Sherman, Thomas, Trego	32,700,820
1579	2/8/2005 (1/4-6/2005)	Severe Winter Storm, Heavy Rains, and Flooding	Anderson, Atchison, Barber, Brown, Butler, Chase, Chautauqua, Clark, Coffey, Comanche, Cowley, Crawford, Douglas, Elk, Franklin, Greenwood, Harper, Harvey, Jackson, Jefferson, Kingman, Kiowa, Leavenworth, Lyon, Marion, McPherson, Morris, Osage, Pratt, Reno, Rice, Sedgwick, Shawnee, Sumner, Wabaunsee, Woodson, Wyandotte	84,447,071
1535	8/3/2004 (6/12-7/25/2004)	Severe Storms, Flooding, and Tornadoes	Barton, Butler, Cherokee, Decatur, Ellis, Geary, Graham, Jewell, Labette, Lyon, Marion, Mitchell, Morris, Ness, Osborne, Pawnee, Phillips, Rooks, Rush, Russell, Shawnee, Sheridan, Smith, Thomas, Trego, Wabaunsee, Wallace, Woodson, Wyandotte	12,376,235
1402	2/6/2002 (1/29-2/15/2002)	Ice Storm	Allen, Anderson, Barber, Bourbon, Butler, Chautauqua, Cherokee, Coffey, Comanche, Cowley, Crawford, Douglas, Elk, Franklin, Greenwood, Harper, Jefferson, Johnson, Kingman, Kiowa, Labette, Leavenworth, Linn, Lyon, Miami, Montgomery, Neosho, Osage, Pratt, Sedgwick, Shawnee, Sumner, Wilson, Woodson, Wyandotte	65,347,119

Declaration Number	Declaration Date*	Disaster Description	Counties Involved	Constant 2006 $**
Major Disaster Declarations				
1366	4/27/2001 (4/21/2001)	Severe Storms and Tornado	Barton	5,303,272
1273	5/4/1999 (5/3/1999)	Tornadoes and Severe Storms	Reno, Sedgwick, Sumner	10,883,676
1273	5/4/1999 (5/3/1999)	Tornadoes and Severe Storms	Reno, Sedgwick, Sumner	10,883,676
1258	11/5/1998 (10/30-11/15/1998)	Severe Storms and Flooding	Butler, Chase, Coffey, Cowley, Douglas, Franklin, Greenwood, Harper, Harvey, Johnson, Leavenworth, Lyon, Marion, Neosho, Saline, Sedgwick, Sumner, Wilson, Woodson, Wyandotte	20,179,021
1000	7/22/1993	Flooding, Severe Storms	Atchison, Barton, Brown, Chase, Cherokee, Clay, Cloud, Crawford, Dickinson, Doniphan, Douglas, Edwards, Ellis, Ellsworth, Geary, Graham, Harvey, Hodgeman, Jackson, Jefferson, Jewell, Johnson, Lane, Leavenworth, Lincoln, Lyon, Marion, Marshall, McPherson, Mitchell, Morris, Nemaha, Ness, Osage, Osborne, Ottawa, Pawnee, Pottawatomie, Reno, Republic, Rice, Riley, Rooks, Rush, Russell, Saline, Sedgwick, Shawnee, Sheridan, Smith, Stafford, Sumner, Thomas, Trego, Wabaunsee, Washington, Wyandotte	137,038,990
903	4/29/1991	Severe Storm, Tornado	Butler, Cowley, Jefferson, Sedgwick, Wabaunsee, Washington	7,132,333
780	10/22/1986	Severe Storms, Flooding	Allen, Bourbon, Chautauqua, Cherokee, Cowley, Elk, Labette, Montgomery, Neosho, Wilson	4,214,319
644	7/18/1981	Severe Storms, Flooding, Tornadoes	Barton, Douglas	1,451,391
588	6/15/1979	Severe Storms, Flooding	Butler, Cowley	2,896,578
514	7/13/1976	Severe Storms, High Winds, Flooding	Butler, Cherokee, Crawford, Cowley, Elk, Greenwood, Labette, Neosho, Montgomery, Wilson	6,233,574
403	9/28/1973	Severe Storms, Tornadoes, Flooding	Atchison, Barber, Barton, Brown, Butler, Chase, Clay, Cloud, Coffey, Comanche, Cowley, Dickinson, Doniphan, Douglas, Edwards, Ellsworth, Franklin, Geary, Greenwood, Harper, Harvey, Jackson, Jefferson, Kingman, Kiowa, Leavenworth, Lincoln, Linn, Lyon, Marion, Marshall, McPherson, Miami, Morris, Nemaha, Osage, Ottawa, Pawnee, Pottawatomie, Pratt, Reno, Republic, Rice, Riley, Saline, Sedgwick, Shawnee, Stafford, Sumner, Wabaunsee, Washington, Woodson, Wyandotte	18,851,282
378	5/2/1973	Severe Storms, Flooding	Atchison, Barber, Barton, Bourbon, Brown, Butler, Chautauqua, Cherokee, Clark, Coffey, Crawford, Dickinson, Doniphan, Douglas, Edwards, Ellsworth, Ford, Franklin, Gray, Greenwood, Harper, Harvey, Haskell, Hodgeman, Jackson, Jefferson, Kingman, Kiowa, Labette, Leavenworth, Lincoln, Linn, Lyon, Marion, Marshall, McPherson, Meade, Miami, Montgomery , Morris, Nemaha, Ness, Osage, Osborne, Ottawa, Pawnee, Pottawatomie, Pratt, Reno, Republic, Rice, Rush, Russell, Saline, Sedgwick, Seward, Shawnee, Stafford, Stevens, Sumner, Wabaunsee, Washington, Woodson, Wyandotte	8,829,200

Declaration Number	Declaration Date*	Disaster Description	Counties Involved	Constant 2006 $**
Major Disaster Declarations				
267	7/15/1969	Tornadoes, Severe Storms, Flooding	Allen, Anderson, Bourbon, Crawford, Dickinson, Douglas, Ellsworth, Franklin, Johnson, Leavenworth, Linn, Lyon, McPherson, Miami, Morris, Neosho, Osage, Saline, Woodson, Wyandotte	3,952,657
229	7/18/1967	Tornadoes, Severe Storms, Flooding	Anderson, Atchison, Chase, Cloud, Coffey, Crawford, Doniphan, Douglas, Finney, Franklin, Harper, Jackson, Jefferson, Kingman, Leavenworth, Linn, Lyon, Marion, Miami, Mitchell, Nemaha, Ness, Osage, Pottawatomie, Republic, Washington, Wabaunsee	5,031,351
201	6/23/1965	Flooding	Barton, Butler, Chase, Edwards, Finney, Ford, Grant, Gray, Greenwood, Hamilton, Harvey, Kearny, Lyon, Marion, McPherson, Pawnee, Reno, Rice, Sedgwick, Stafford, Stanton	6,566,805
81	9/5/1957	Floods	n/a	468,181
34	5/27/1955	Tornado	Cowley	2,184,772
Emergency Declarations				
3282	12/12/2007	Severe Winter Storms	All	n/a
3236	9/1/0/2005	Hurricane Katrina Evacuation	All	0
3126	6/9/1998	Grain Elevator Explosion	Harvey, Sedgwick	1,182,763
Fire Management Assistance Declarations				
2632	3/30/2006 (3/30-4/6/2006)	Obee Fire	Reno	n/a

Sources: Federal Emergency Management Agency, www.fema.gov/; Public Entity Risk Institute, www.peripresdecusa.org

* Incident dates are in parentheses

** Costs include Public Assistance, Individual Assistance, and mitigation and are in constant 2006 dollars with the exception of the following:

-DR 1699, which includes Public Assistance and Individual Assistance as of August 14, 2007, according to the state.

-DR 1675, which includes Public Assistance and mitigation, according to the state.

21 HAZARDS AND ASSESSMENTS

21.1 AGRICULTURAL INFESTATION

Agricultural infestation is a naturally occurring infection of crops or livestock that renders them unfit for consumption or use. Typical causes can include insects, vermin, fungus, or diseases transferable amongst animals. The types and severity of agricultural infestations vary based on many factors, including cycles of heavy rains and drought. Because of the substantial importance of the agricultural industry in Kansas, agricultural infestation poses a risk to the economy of the entire state.

A certain level of agricultural infestation is normal for Kansas farmers and ranchers. The problem is when the level of an infestation escalates suddenly, or a new infestation appears that overwhelms local control efforts. The potential introduction of animal diseases, such as foot and mouth disease and bovine spongiform encephalopathy disease is a key concern.

Field crops are also subject to various types of infestation. Wheat is susceptible to leaf rust, wheat streak mosaic, barley yellow dwarf virus, strawbreaker, and tan spot. Significant wheat crop losses due to these diseases are well documented in Kansas. Sorghum losses can occur when a crop is infected with sooty stripe early in the growing season. Gray leaf spot is a growing problem for corn crops.

Infestation is not only a risk to crops in the field and livestock on the hoof. Insect infestation can cause major losses to stored grain. Estimated damage to stored grain by the lesser grain borer, rice weevil, red flour beetle, and rusty grain beetle costs the United States about $500 million annually.

The onset for an agricultural infestation can be rapid. Controlling its spread is critical to limiting the impacts of the infestation, through methods including quarantine, culling, premature harvest and/or crop destruction when necessary. Duration is largely affected by the degree to which the infestation is aggressively controlled, but is commonly more than one week. Warning time is typically more than 24 hours. Maximizing warning time is also critical for this hazard, and is most affected by methodical and accurate monitoring and reporting of livestock and crop health and vigor, including both private individuals and responsible agencies.

Crops

These economically important crops are also subject to various types of infestation. The following are brief descriptions of crop infestation common to Kansas.

Foliar Diseases

Barley Yellow Dwarf Virus (BYDV)

The disease affects all cereals and grasses. Barley and oats are usually more severely affected than wheat.

Symptoms

The initial symptoms of BYDV infection are normally seen as individual plants scattered through the crop with bright yellow upper leaves. Later, as infection spreads, larger areas of the crop become infected and affected plants can be yellow or reddish in appearance. BYDV is most damaging to plants infected in the early growth stages. The effects of BYDV may be exacerbated by other stress factors, including adverse weather conditions, soil acidity and other pests and diseases.

Brown (Leaf) Rust

Puccinia tritici is specific to wheat, other Puccinia spp. and pathotypes can affect barley, rye and triticale but do not cross-infect.

Symptoms

Symptoms of brown rust infection are often seen in the autumn on early-sown crops as individual orange to brown pustules. With early autumn infection individual pustules are frequently confused with yellow rust, being orange to brown and about 0.5 - 1.0 mm in diameter. Later in the season diagnosis is much easier as

the brown pustules tend to be scattered at random compared with the more stripped symptoms of yellow rust (*Puccinia striiformis*). Symptoms are usually seen on the leaves although in severe attacks symptoms can be seen on the stem and glumes. When leaves begin to senesce, a 'green island' develops around individual pustules. Towards the end of the season dark teliospores are sometimes produced.

Septoria Leaf Disease Complex

Pathogen: Fungus. Leaf and glume blotch: *Septoria nodorum (Leptosphaeria nodorum)*, and leaf blotch: *S. tritici (Mycosphaerella graminicola)*

Symptoms: Chlorotic (yellow) water-soaked flecks becoming dry, yellow, then red-brown lesions. *S. nodorum* lesions are round. *S. tritici* lesions are blocky with tiny black specks (pycnidia) visible in rows in mature lesions.

Conditions: Cool, wet, windy weather favors *S. tritici* development. Warm, wet weather favors *S. nodorum*.

Stripe Rust

Stripe Rust is caused by the fungus Puccinia striiformis. It is a serious problem on wheat in regions where cool temperatures prevail through the wheat growing season. It is especially prevalent in Europe and the Pacific Northwest of the USA. It is an occasional problem elsewhere, such as the Central Plains, during the early to mid- spring. It has been more common than usual in 1999, 2000, and 2001 crop years in Kansas

Symptoms

Symptoms of stripe rust are long stripes of small yellowish orange pustules on the leaves. These pustules consist of masses of rust spores. It can sometimes be confused with leaf rust or stem rust. (Note that stem rust can occur on both the stems and the leaves of susceptible varieties.) Stripe rust also goes by the name of yellow rust because it is a slightly lighter color than leaf rust or stem rust.

Sometimes stripe rust symptoms are confusing on moderately resistant varieties because pustules may be hard to see or absent. In that case, symptoms can resemble bacterial leaf streak (black chaff) or Septoria leaf blotch.

Scab

Pathogen: Fungus. *Fusarium graminearum*

Symptoms: Spikelets appear bleached often with a pale pink tint, tombstone kernels, seed light weight, sometimes infected spikelets are barren, can produce mycotoxin, seedling blight.

Conditions: Disease development is favored by warm, moist conditions during and shortly following flowering may be more severe where wheat follows corn because the pathogen also causes Giberella ear and stalk rot.

Powdery Mildew

There are several forms of the disease which are specific to individual crops and do not cross infect:

B. graminis f. sp tritici affects wheat.
B. graminis f. sp hordei affects barley.
B. graminis f. sp avenae affects oats.
B. graminis f. sp secalis affects rye.

Symptoms

Symptoms of powdery mildew can be found on leaves, stems and ears, but leaves are most commonly infected. Typically, white pustules appear which produce masses of spores and assuming a powdery appearance. As the mildew pustules become older, they darken to a grey or brown color. Eventually, black

spore cases (cleistothecia) can be found embedded in the mildew ***pustules*** - usually towards the end of the season

Take-all

Gaeumannomyces graminis var. *tritici* attacks wheat, barley, rye and may attack some grass species, particularly couch grass (*Elymus repens*). Oats are immune.

Gaeumannomyces graminis var. *avenae* attacks oats, wheat, barley, rye and many grass species.

Symptoms

The take-all fungus attacks the roots of plants as it is soil-borne. If diseased plants are pulled up, the roots can be seen to be blackened and rotten and have a "rat-tail" appearance. In severe outbreaks the base of infected plants may also show blackening. Above ground symptoms are seen as patches of stunted plants and white-heads ("bleached" ears) in mature plants. White-heads generally contain small grains or, occasionally, no grain at all.

Mosaic Viruses

- *Barley yellow mosaic virus* (BaYMV)
- *Barley mild mosaic virus* (BaMMV)
- *Oat mosaic virus*(OMV)
- *Oat golden stripe virus*(OGSV)
- *Soil-borne cereal mosaic virus* (SBCMV)
- *Soil-borne wheat mosaic virus* (SBWMV)

Each of these mosaic diseases is caused by a virus, transmitted by the soil-borne vector *Polymyxa graminis*. The viruses causing these diseases are closely related single stranded RNA (ribonucleic acid) rod or filamentous viruses belonging to the genus *Furovirus* or *Bymovirus*.

Hosts

The diseases affect only winter sown crops. All cereals are affected by their own form of the virus which does not cross-infect to other cereals.

Symptoms

Affected plants can be very stunted and pale in color. Typical symptoms are pale yellow streaks in the leaves which are most pronounced during the early spring, particularly following a prolonged cold spell. The yellow streaks may become brown or purple at the leaf tip and dark brown flecking may replace the yellow streaking.

Common Bunt

Hosts

The disease is specific to wheat.

Symptoms

No symptoms can be observed prior to ear emergence. The flag leaves of infected plants show yellow streaks and plants can be stunted, with 'squat', dark grey-green ears and slightly gaping glumes In infected ears the grain is replaced by seed-like 'blunt balls' each containing millions of greasy, black foul smelling spores. In severe cases, the whole field may smell of rotting fish. In wet weather conditions the ears may appear to be covered in a black ink-like substance as the spores are released and run out of the protective glumes onto the ear and stem.

Loose Smut

Hosts

- The disease affects wheat, barley and oats.
- There are distinct forms of the pathogen which are crop specific.

Symptoms

Loose smut is easily recognized at ear emergence as the each grain is usually completely replaced by a mass of black fungal spores. Partly affected ears are sometimes seen. The spores are released as soon as the ear emerges, leaving only the bare remains of the ear rachis. Because the blackened ears are so very obvious in the crop at ear emergence the disease appears to be very severe, even at very low incidence levels.

Gray Leaf Spot

Gray Leaf Spot is a foliar disease of corn (*Zeae mays)* caused by the fungus *Cercospora zeae-maydis*, has become of economic importance in many regions of the world over the past 10 years. Gray leaf spot was first described in the U.S.A. in 1925 on corn in Alexander County, IL. In the 1960s and 1970s, the disease became of concern in the eastern United States. As reduced tillage became more popular in the 1980s and 1990s, gray leaf spot became common in most of the corn growing areas of the Midwestern and eastern United States. Today the disease can be found as far west as eastern Colorado, Kansas and Nebraska in corn fields under irrigation and north into Wisconsin and Minnesota. The disease has become distributed internationally being reported in Africa, Asia, and South and Central America.

Strawbreaker

Strawbreaker (also known as foot rot or eyespot) is caused by a fungus called Pseudocercosporella herpotrichoides. Strawbreaker is common in cool, humid climates and is especially serious in the Pacific Northwest and Europe. Strawbreaker is an uncommon disease in Kansas. However, there was a severe outbreak in central and south-central Kansas in the spring of 2000. There were a few fields affected in 1999. The last big outbreaks of the disease were in 1984 and 1985. Strawbreaker causes direct yield losses due to shriveled seed on affected tillers. Losses in affected areas can exceed 50%. In addition, it causes lodging which makes harvest much more difficult.

Symptoms

Early spring symptoms of strawbreaker are elliptical or eye-shaped lesions on the leaf sheaths near the soil line. Lesions have light brown centers and dark margins. Lesions soon penetrate the leaf sheaths and expand until they girdle the stem (Fig. 1). Patches of dull, charcoal gray fungus may be visible on the outside of the stems. Stem bases become bleached and brittle and break over between the bottom node and the soil line. This is similar to Hessian fly damage, except Hessian fly usually causes breakage just above a node. Strawbreaker and Hessian fly can also be separated by looking at the stem bases. Hessian fly produces "flax seeds" just above the nodes. Strawbreaker produces dull, charcoal-gray patches of fungus on the lower stem. These patches may resemble the black signs of take-all root rot but they are not as black or shiny. Although both diseases cause white heads, strawbreaker does not cause root rot and severe stunting like take-all.

Lodging is most common in the low, lush portions of fields where moisture and fertility are high. Lodging is usually multi-directional. Affected tillers often have white heads and shriveled grain.

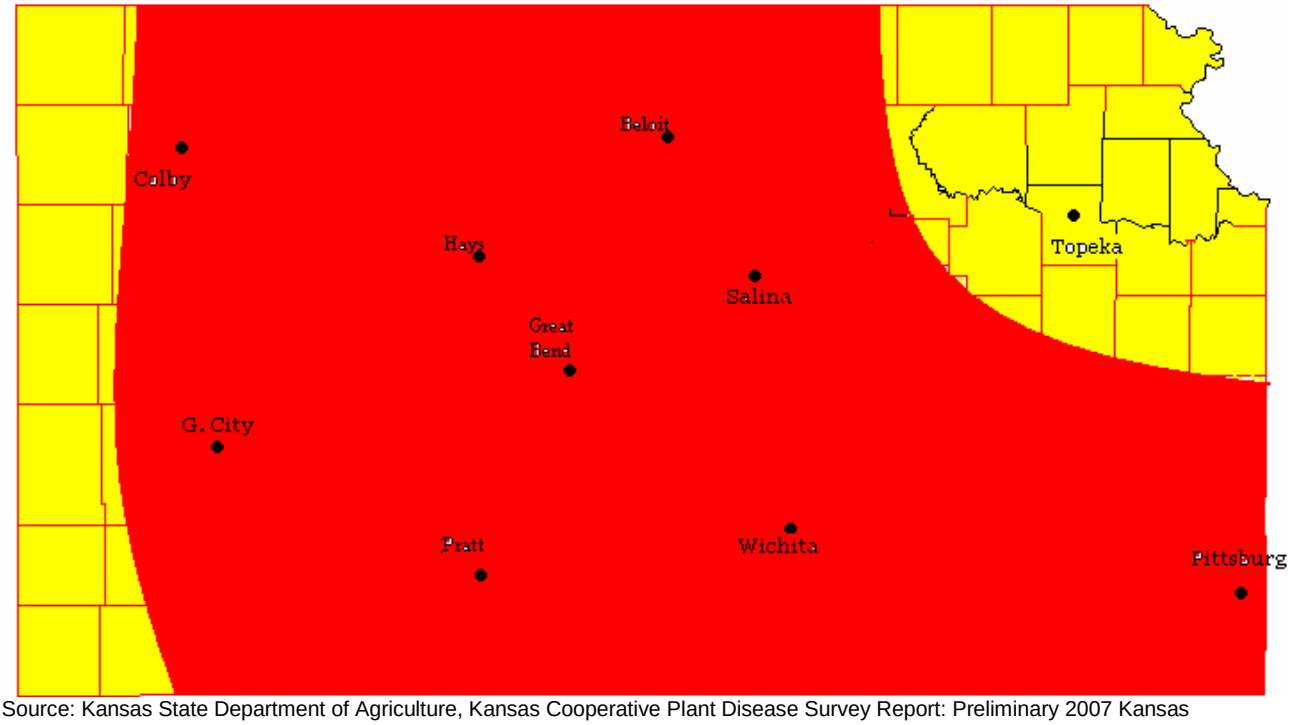
Wheat is particularly susceptible to leaf rust, wheat streak mosaic, barley yellow dwarf virus, strawbreaker, and tan spot. Significant wheat crop losses due to these diseases are well documented in various areas of Kansas. Sorghum losses can occur when a crop is infected with sooty stripe early in the growing season. Gray leaf spot is a growing problem for corn crops.

Infestation is not only a risk to crops in the field. Insect infestation can cause major losses to stored grain. It is estimated that damage to stored grain by the lesser grain borer, rice weevil, red flour beetle, and rusty grain beetle costs the United States about $500 million annually.

Geographic Location

As a hazard that is capable of affecting broad regions of the U.S., south central Kansas is susceptible to agricultural infestation. On a statewide basis, annual wheat yield loss in Kansas has averaged 4.0 percent over the previous 20 years according to the Kansas State University Department of Plant Pathology. This geographic distribution for leaf rust corresponds with areas of the state with somewhat lower utilization of the land for crops and rangeland, and fewer feedlots. The following figure shows areas of moderate (yellow) and severe (red) leaf rust disease pressure in 2007.

LEAF RUST DISEASE PRESSURE, KANSAS 2007



Source: Kansas State Department of Agriculture, Kansas Cooperative Plant Disease Survey Report: Preliminary 2007 Kansas Wheat Disease Loss Estimates, www.ksda.gov/plant_protection/content/183/cid/611
Notes: Red = High to Severe, Yellow = Moderate

The USDA Agricultural Research Service notes the most serious threat to wheat and cereal crops globally is stem rust race Ug99. This fungus is spreading across Africa, Asia, and most recently into the Middle East and is considered a serious threat to global food security.

Previous Occurrences

Cumulative losses for the Kansas wheat crop in 2007 are estimated at 17.8 percent of the crop (65.1 million bushels). This total exceeds the state's 20-year average loss (11.4 percent) and is the greatest cumulative loss since 1995 (foliar diseases and barley yellow dwarf virus, 20.4 percent loss).

In 2007, leaf rust was epidemic statewide and constituted 80 percent of the total disease loss. This same year *Septoria* leaf disease complex was responsible for 1.8 percent of the loss followed by tan spot with 1.3 percent. Production losses due to barley yellow dwarf, stripe rust, scab, and powdery mildew were estimated to be 0.2 percent each.

During 2007, several previously reported diseases were not found to any extent. Dominant in 2006, wheat streak mosaic was rarely reported. Take-all and other root and crown rots were almost nonexistent. Soil borne mosaic was reported in a few situations in western Kansas, while common bunt received a couple of reports in north central Kansas, and loose smut was reported infrequently during survey.

Warning Time: More than 24 hours
Duration: More than one week

Livestock

The world cattle population is estimated to be about 1.3 billion head; 30% in Asia, 20% in South America, 15% in Africa, and 10 % in Europe. There are 10 states in the U.S. with the largest cattle population: Texas, Missouri, Oklahoma, Nebraska, South Dakota, Montana, Kansas, Iowa, Kentucky and Florida.

One of the key concerns regarding this hazard is the potential introduction of a rapid and economically devastating foreign animal disease, such as foot and mouth disease or bovine spongiform encephalopathy (BSE) disease, to Kansas. With cattle raised locally, the potential for highly contagious diseases such as those, mentioned above is a continuing, significant threat to the economy of the region. The loss of milk production, abortion, decrease in production, and other lasting problems resulting from an outbreak could cause continuous and severe economic losses.

20.2 CONCENTRATED ANIMAL FEEDING OPERATIONS (CAFO)

A permitted facility is one that has man made waste control structures (ex. lagoon, pit, sediment basin, etc.). A certified facility is one that has an adequate natural grass buffer, crop ground, etc. to effectively prevent runoff and does not pose a significant pollution.

``Animal unit'' means a unit of measurement calculated by adding the following numbers: The number of beef cattle weighing more than 700 pounds multiplied by 1.0; plus the number of cattle weighing less than 700 pounds multiplied by 0.5; plus the number of mature dairy cattle multiplied by 1.4; plus the number of swine weighing more than 55 pounds multiplied by 0.4; plus the number of swine weighing 55 pounds or less multiplied by 0.1; plus the number of sheep or lambs multiplied by 0.1; plus the number of horses multiplied by 2.0; plus the number of turkeys multiplied by 0.018; plus the number of laying hens or broilers, if the facility has continuous overflow watering, multiplied by 0.01; plus the number of laying hens or broilers, if the facility has a liquid manure system, multiplied by 0.033; plus the number of ducks multiplied by 0.2.

Animal Feeding Operations (AFOs) are agricultural operations where animals are kept and raised in confined situations. AFOs congregate animals, feed, manure and urine, dead animals, and production operations on a small land area. Feed is brought to the animals rather than the animals grazing or otherwise seeking feed in pastures, fields, or on rangeland.

An operation is an AFO if:

- Animals are confined for at least 45 days in a 12-month period, and
- There's no grass or other vegetation in the confinement area during the normal growing season

Concentrated Animal Feeding Operations (CAFOs) are AFOs that meet certain EPA criteria. CAFOs make up approximately 15 percent of total AFOs.

An operation is a CAFO if:

- It meets the definition of an AFO, and
- The operation meets one of the Regulatory Definitions of Large CAFOs, Medium CAFO, and Small CAFOs

Foreign animal disease (FAD) is considered a threat to the United States when it significantly affects human health or animal production and when there is an appreciable cost associated with disease control and eradication efforts. The 37 identified diseases include: hog cholera, foot and mouth disease (FMD), bovine spongiform encephalopathy (BSE), and highly pathogenic avian influenza (HPAI) all of which can result in costly economic production losses.

"Catastrophic mortality, large animal disposal, pit," is a method of disposing of dead animals by placing the carcasses in successive layers in an excavated pit. The carcasses are spread, compacted, and covered daily with a thin layer of soil that is excavated from the pit. When the pit is full, a final cover of soil material at least 2 feet thick is placed over the burial pit.

"Catastrophic mortality, large animal disposal, trench," is a method of disposing of dead animals by placing the carcasses in successive layers in an excavated trench. The carcasses are spread, compacted, and covered daily with a thin layer of soil that is excavated from the trench. When the trench is full, a final cover of soil material at least 2 feet thick is placed over the filled trench area.

To protect the long-term health and profitability of U.S. animal agriculture, incursions of a FAD must be rapidly controlled. In the United States, control usually means disease eradication. According to guidance from the Kansas Animal Health Department, all animals are to be destroyed with 1.5 miles of the source of contamination, and up to six miles for a quarantine zone.

SOME COSTLY CATTLE DISEASES

BSE – Bovine Spongiform Encephalopathy Also known as Mad Cow Disease. It is a progressive degenerative disease that affects the central nervous system of cattle. There is no known cause or cure and is fatal. **BVD** – Bovine Virus Diarrhea The virus can cause numerous problems; damage to the digestive and immune systems, pneumonia, calf deformations, abortions and other complications. **Calf Scours** Calf Diarrhea. This causes more financial loss to cattle producers than any other related problem. Death usually occurs because of dehydration and changes in chemistry. **Coccidiosis** – One-celled parasite Causes sloughing of the intestinal lining. Usually affects calves i-6 months old. **Foot and Mo**uth – Highly communicable disease producing virus that causes blister like lesions that cause high fevers, stop eating and become lame.	**Foot Rot –** Bacteria that gains entrance from lesions on the foot producing immediate lameness – affects all breeds – most costly. **Grass Tetany –** Fatal metabolic disorder from lack of magnesium in the blood from high nitrogen fertilization. **IBR – "**Red Nose" An acute contagious virus in the air passages and head. Abortions occur about 20–45 days after infected. A vaccine is available. **External Parasites –** Horn flies, face flies, stable flies, ticks, lice and mites **Internal Parasites** – worm parasite infections causes a significant economic loss each year. Treatments exist **Cattle PinkEye –** common infection affecting the eyes in all breeds of cattle – most costly. **Wooden Tongue –** bacterium infection of the tongue. Can be fatal if not treated. Cattle are unable to eat or drink and become weakened and die.

Kansas Farm Facts 2007 provides the current inventory and value of cattle livestock in Kansas.

Cattle Inventory, Jan. 1, 2008

- All Cattle 45,400
- Cows That Have Calved 22,950
- Other Cattle 22,450
- Calves Born In 2007 20,600

Cattle Inventory Value

- Cattle & Calves, Jan. 1, 2008 $39,500,000

Ranchers are responsible for keeping statistics on the numbers of livestock lost for proof during tax preparation. There is much information on the programs available for ranchers and farmers to receive assistance that have lost crops and livestock to disaster, however, the percentage of loss by county does not appear to be readily available.

Warning Time: More than 24 hours

Duration: More than one week

Geographic Location

The central and western parts of the State, are somewhat more susceptible to agricultural infestation. This corresponds to areas of the State with heavier utilization of the land for crops and rangeland, as well as the location of numerous feedlots.

Previous Occurrences

Cattle diseases occur year round and natural disaster conditions that take the lives of livestock occur with severe winter storms. No data regarding issues with livestock was available because most losses are covered by private insurance.

Probability of Future Occurrences

While some degree of agricultural infestation occurs on an annual basis, this hazard's CPRI probability is "likely" (event is probable within the next three years) as the more significant events (foreign animal disease outbreaks) do not occur annually.

Magnitude/Severity

This hazard's CPRI magnitude/severity is "limited."

Calculated Priority Risk Index	Planning Significance
2.50	Moderate

20.3 FLOODS

Definition: Any high flow, overflow, or inundation by water that causes or threatens damage (*National Weather Service*).

Warning Time: 12 to 24 hours
Duration: Less than one week

Floods are among the most frequent and costly natural disasters in terms of human hardship and economic loss. There are several different types of likely flood events in Kansas including flash, riverine, and urban stormwater. Regardless of the type of flood, the cause can almost always be attributed to excessive rainfall, either in the flood area or upstream reach.

The term "flash flood" describes localized floods of great volume and short duration. In contrast to riverine flooding, this type of flood usually results from a heavy rainfall on a relatively small drainage area. Precipitation of this sort usually occurs in the spring and summer. Riverine floods result from precipitation over large areas. This type of flood occurs in river systems whose tributaries may drain large geographic areas and include many independent river basins. The duration of riverine floods may vary from a few hours to many days. Factors that directly affect the amount of flood runoff include precipitation, intensity and distribution, the amount of soil moisture, seasonal variation in vegetation, snow depth, and water-resistance of the surface areas due to urbanization.

Urban flood events result when land loses its ability to absorb rainfall as it is converted from fields or woodlands to roads, buildings, and parking lots. Urbanization increases runoff two to six times over what would occur on undeveloped terrain. During periods of urban flooding, streets can become swift moving rivers.

All flood events may result in upstream flooding due to downstream conditions such as channel restriction and/or high flow in a downstream confluence stream. This type of flooding is known as backwater flooding.

PREVIOUS OCCURRENCES

According to the National Climatic Data Center Storm Events database, there were 2,050 flood events in Kansas between 1996 and 2009. Total property and crop damage for these events is estimated at $465 million. There were 21 deaths and 24 injuries in this time period. This suggests that Kansas experiences an average of 157 floods, $35 million in flood losses, 2 flood related death, and 2 flood-related injuries each year.

Major floods impacted Kansas in 1844, 1903, 1935, 1951, 1965, 1973, 1976, 1981, 1986, 1993, 1998, 2001, 2007, and most recently in 2009. Details about some of these events can be found on the following pages. Section 3.2 Hazard Identification contains more detailed information about the counties that were included in presidential declarations. Additional presidential declarations for flooding are listed in the tornado section later in this chapter. These disasters were for both flooding and tornadoes.

FEMA-1860-DR: Severe Storms and Flooding – September 30th, 2009

On September 2, 2009, Governor Mark Parkinson requested a major disaster declaration because of severe storms, accompanied by large hail, lightning, high winds, and torrential rains during the period of July 8-14, 2009. The governor requested a declaration for Public Assistance for eight counties and hazard mitigation for all counties. During the period of August 3 to September 2, 2009, joint federal, state, and local Preliminary Damage Assessments (PDAs) were conducted in the requested counties. PDAs estimate damages immediately after an event and are considered, along with several other factors, in determining whether a disaster is of such severity and magnitude that effective response is beyond the capabilities of the state and the affected local governments, and that federal assistance is necessary. Affected counties included: Sedgwick, Franklin, Anderson, Linn, and Bourbon.

FEMA-1711-DR: Severe Storms and Flooding—July 2, 2007 (June 26–30)

Beginning June 26 and continuing through June 30, 2007, strong storms across south central and southeast Kansas produced torrential rainfall and subsequent flooding/flash flooding. Some counties, which were still recovering from flooding in mid-May, received over a foot of rain. Up to 21 inches of rain was reported near Fredonia (Wilson County). As of the morning of June 30, 16½ inches had fallen in 48 hours in Moline (Elk County), 12½ of which fell in 24 hours. Nine inches fell in four hours in Winfield (Cowley County) on the afternoon of June 29. Wilson County was one of the hardest hit counties. Initially, Neodesha was only accessible by boat and air. Both the water and sewer plants were compromised by the flooding, which resulted in a boiling water order for the area. Approximately 3,000 people were without power in Fredonia for several days. In Miami County, the Kansas National Guard was sent to help with a mandatory evacuation of Osawatomie, one of the hardest hit communities in eastern Kansas. The town evacuated 40% of its 4,600 residents after Pottawatomie Creek and the Marais des Cygnes rose out of their banks.

FEMA-1258-DR: Severe Storms and Flooding— October/November 1998 (October 30–November 15)

From October 30 to November 15, storms generated by Hurricane Mitch impacted south central Kansas with heavy rains and flooding. The Arkansas, Cottonwood, Whitewater, and Walnut Rivers recorded all-time record levels. Major flooding occurred through west Wichita along the Cowskin Creek. Augusta, in western Butler County, was especially hard hit. Flooding was widespread, inundating many roads. There were 5,300 people evacuated. There were two injuries, one fatality, and $37.8 million dollars in damage.

FEMA-644-DR: Severe Storms, Flooding, Tornadoes—July 18, 1981 (June 14)

On the afternoon of June 14, a series of intense thunderstorms produced 5 to 20 inches of precipitation in about 12 hours near Great Bend. The storm affected about 300 square miles of tributaries to the Arkansas River upstream from Great Bend and caused approximately $42 million in damage. The recurrence interval was likely greater than 100 years.

Other Notable Flood Events

- April 26, 2009 - Heavy rainfall from numerous thunderstorms during the afternoon, evening, and overnight hours on the 26th produced widespread flooding across much of Harper County. Rainfall amounts across the county ranged from 3 to 6 inches. Numerous roads were closed countywide. It is estimated that around 100 homes were flooded or received some form of water damage in the Anthony area, along with several other homes and businesses across the county. Portions of the elementary school and hospital in Harper were flooded. Three water rescues took place, one of which produced an injury near Third Lake Road when a vehicle attempted to cross a flooded roadway. Crop damage estimates are unknown, and property damage values are rough estimates. The Wichita Eagle, Harper Advocate, Anthony Republican and the Hutchinson News contributed to this report.

- September 12, 2008 - Nine to twelve inches of rainfall during the morning commute hours caused widespread street flooding of roadways up to 2 to 3 feet deep on the west side of the city of Wichita. Law enforcement officials reported 150 people were rescued from vehicles or evacuated because of the high water. There were 114 homes reported to have some type of surface flooding because of the heavy rainfall and sewers and sump pumps backed up into 141 more homes. This unprecedented amount of rainfall mainly fell during a five-hour period, reminding some of the Halloween Flood of 1998. The large amount of rainfall caused the Cowskin/Calfskin Creek to once again come out of its banks, flooding homes in the Dells and Hidden Lakes Subdivision. Thirty-five people were evacuated from the Park West Retirement home along the banks of the creek. Calls about stalled vehicles overwhelmed towing businesses across the city.

- May 5, 2007 - Flash flooding was reported throughout Barton County. Highway 96, nine miles west of Great Bend was closed as water started flowing over the road. An observer in the area reported 3.22 inches of rain in just 3 hours. Highway 56 in Pawnee Rock was closed because of flood water. In Hoisington the intersection of 3rd Street and Main was closed because of high water. An observer reported approximately 3 inches of rain in 3 hours in that part of Barton County. Seventy to eighty homes were flooded on the north side of Ellinwood. According to Barton County Emergency

Management, the county documented roughly 30 million dollars in damage. This includes damages to private property including crop damage, damage to farm equipment, farmsteads and public roads. The Great Bend Tribune contributed to this narrative.

- June 8-9, 2005—Ten to fifteen inches of rain caused widespread flash flooding in Harvey, Butler, and northern Sedgwick Counties. Receiving 12-15 inches of rain in a 10-hour period, Harvey County was inundated with flash flooding that left most roads and highways barricaded. Damage was estimated at $1.5 million. The flash flooding in Harvey County spread south across the county border into northern Sedgwick County, where 19 homes, 12 of them mobile variants, were flooded. Damage was estimated at $150,000.

- June 3-15, 2005—Cheyenne, Edwards, Harper, Haskell, Linn, Rush, and Stanton Counties were designated as primary disaster areas by the U.S. Department of Agriculture because of losses caused by excessive rain, flash flooding, and flooding. Twenty-nine contiguous counties were also eligible for assistance.

Probability of Future Occurrences

Floods have a 1% chance of occurrence in any given year in identified special flood hazard areas. At least one Kansas stream experiences severe flooding, on average, every year, thus, this hazard's CPRI probability is "**Highly Likely**" within the calendar year. Annualized losses, based on data on flood events from 1993 through 2010 from the National Climatic Data Center, are estimated at $46 million.

Magnitude/Severity

The vulnerability of Kansas to flooding is significant. While health and safety impacts of flooding can be devastating, loss of life to floods during the last 50 years has declined while economic losses (e.g., property, crop, and infrastructure) have continued to rise (USGS 2006). This increase in losses can be attributed in part to encroachment of urban and agricultural development onto floodplains, which increases the potential for flood damage. Kansas' environmental and cultural resources are also susceptible to flooding. Prolonged flood conditions, such as experienced in 1993, can kill wildlife, contaminate recreational areas, remove vegetation, and saturate the ground for months.

Top 10 Counties for Flood Insurance Dollars Paid (Historical), 1978–2010

County	Dollars Paid ($ Historical)	Flood Claims	Current Policies	Coverage ($)
Sedgwick	10,963,389	877	2,382	386,220,900
Wyandotte*	9,937,539	398	308	77,449,600
Butler	9,379,825	436	462	73,975,400
Johnson	8,002,388	944	944	231,828,900
Montgomery	5,054,230	262	319	43,856,200
Saline	4,469,450	223	437	60,414,700
Shawnee	2,995,298	253	956	151,397,200
Harvey	2,797,116	354	474	51,711,000
Allen	2,713,350	84	176	$14,090,700
Barton	2,439,165	519	236	$19,714,400

Source: FEMA, "Policy and Loss Data by Community with County and State Data," May 26, 2010
*Wyandotte County has been suspended from the NFIP since 1989, but Kansas City, Bonner Springs, and Edwardsville are participants.

Regulatory

The Legislature of the state has, pursuant to K.S.A. 12-707 and all acts amendatory thereof and supplemental thereto, delegated the responsibility to local governmental units to adopt zoning regulations designed to protect the health, safety and general welfare of its citizenry.

Calculated Priority Risk Index	Planning Significance
2.55	Moderate

20.4 TORNADOES

Definition: According to the *Glossary of Meteorology* (AMS 2000), a tornado is *"a violently rotating column of air, pendant from a cumuliform cloud or underneath a cumuliform cloud, and often (but not always) visible as a funnel cloud."* Literally, in order for a vortex to be classified as a tornado, it must be in contact with the ground *and* the cloud base. Tornadoes can travel over the ground at 20 to 40 mph, been known to reach 2.5 miles in width, and have ground level wind speeds up to 318 mph.

Although tornadoes have been documented on every continent, they occur most frequently in the United States east of the Rocky Mountains. Kansas is situated in an area that is generally known as "Tornado Alley." Climatological conditions are such that warm and cold air masses meet in the center of the country to create conditions of great instability and fast moving air at high pressure that can ultimately result in the formation of tornado funnels.

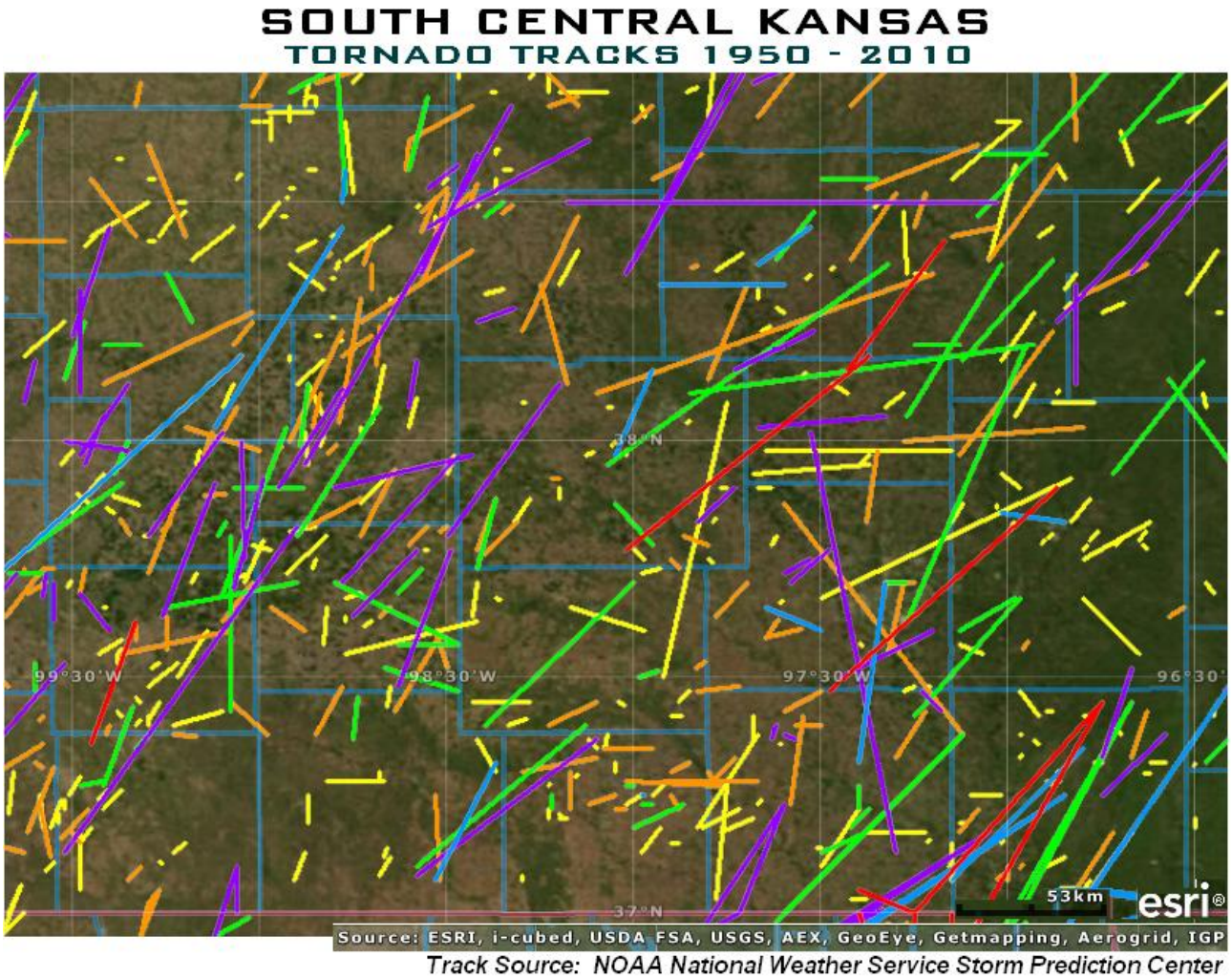
In Kansas, most tornadoes and tornado-related deaths and injuries occur during the months of April, May, and June. However, tornadoes have struck in every month. Similarly, while most tornadoes occur between 3:00 and 9:00 p.m., a tornado can strike at any time.

Prior to February 1, 2007, tornado intensity was measured by the Fujita (F) scale. This scale was revised and is now the Enhanced Fujita scale. Both scales are sets of wind estimates (not measurements) based on damage. The new scale provides more damage indicators (28) and associated degrees of damage, allowing for more detailed analysis and better correlation between damage and wind speed. It is also more precise because it takes into account the materials affected and the construction of structures damaged by a tornado. The table below shows the wind speeds associated with the original and enhanced Fujita scale ratings and the damage that could result at different levels of intensity. The Enhanced Fujita Scale's damage indicators and degrees of damage can be found online at www.spc.noaa.gov/efscale/ef-scale.html.

Comparison of Fujita and Enhanced Fujita Scales

FUJITA SCALE			DERIVED EF SCALE		OPERATIONAL EF SCALE	
F Number	Fastest 1/4-mile (mph)	3 Second Gust (mph)	EF Number	3 Second Gust (mph)	EF Number	3 Second Gust (mph)
0	40-72	45-78	0	65-85	0	65-85
1	73-112	79-117	1	86-109	1	86-110
2	113-157	118-161	2	110-137	2	111-135
3	158-207	162-209	3	138-167	3	136-165
4	208-260	210-261	4	168-199	4	166-200
5	261-318	262-317	5	200-234	5	Over 200

Source: http://www.spc.noaa.gov/faq/tornado/ef-scale.html



Track Source: NOAA National Weather Service Storm Prediction Center

DAMAGE SCALE (ENHANCED FUJITA)

EF-0 **EF-1** **EF-2** **EF-3** **EF-4** **EF-5**

Wind Zones

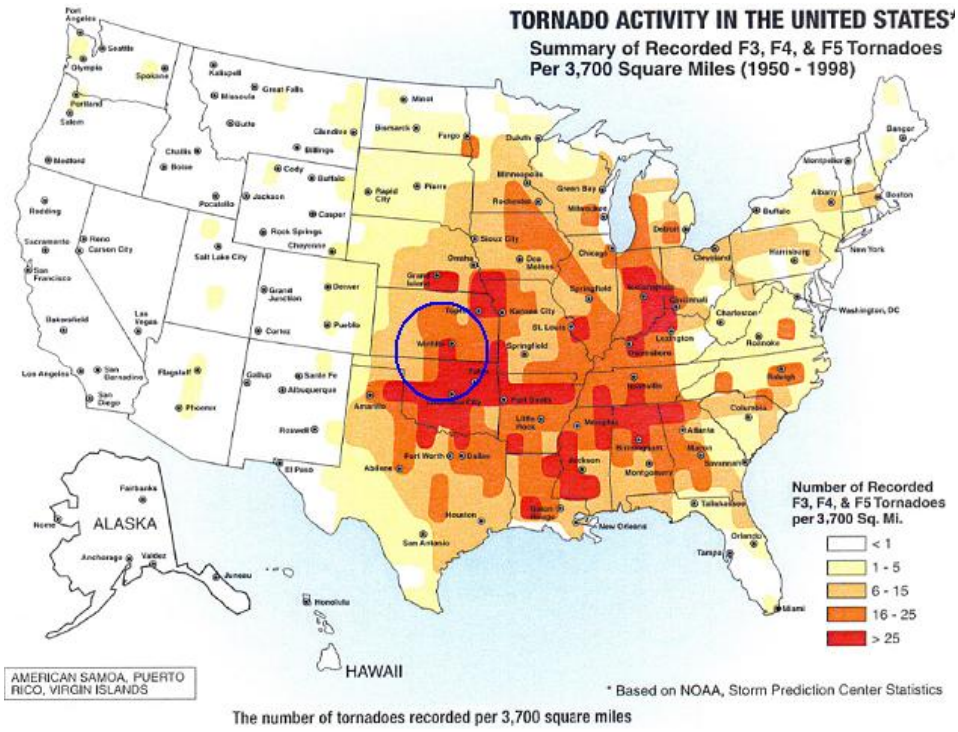
Number of Tornadoes Per 3,700 square miles	Wind Zone			
	I	II	III	IV
<1	Low Risk	Low Risk	Low Risk	Moderate Risk
1-5	Low Risk	Moderate Risk	High Risk	High Risk
6-10	Low Risk	Moderate Risk	High Risk	High Risk
11-15	High Risk	High Risk	High Risk	High Risk
>15	High Risk	High Risk	High Risk	High Risk
Source: *Taking Shelter from the Storm*, FEMA, 2004				

About 59% of tornadoes occur during the months of May and June. Historical information was obtained from the NOAA's National Climatic Data Center (NCDC), the National Weather Service, and the book entitled *"Significant Tornadoes 1680-1991"* by Thomas P. Grazulis.

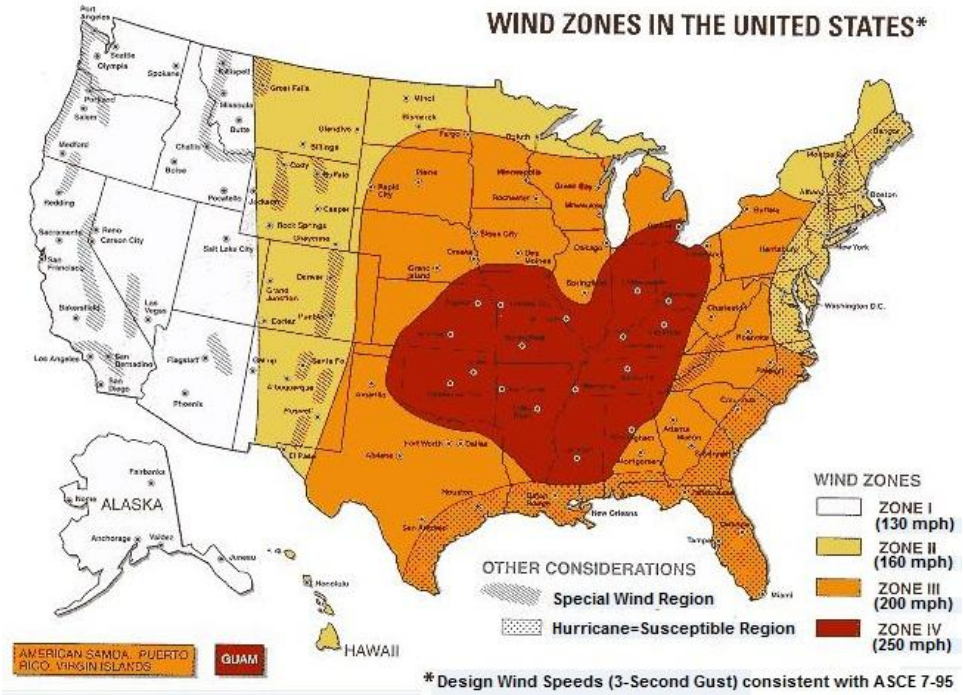
Warning Time: Less than 10 minutes (sighting)
Duration: Minutes to less than one hour

Geographic Location

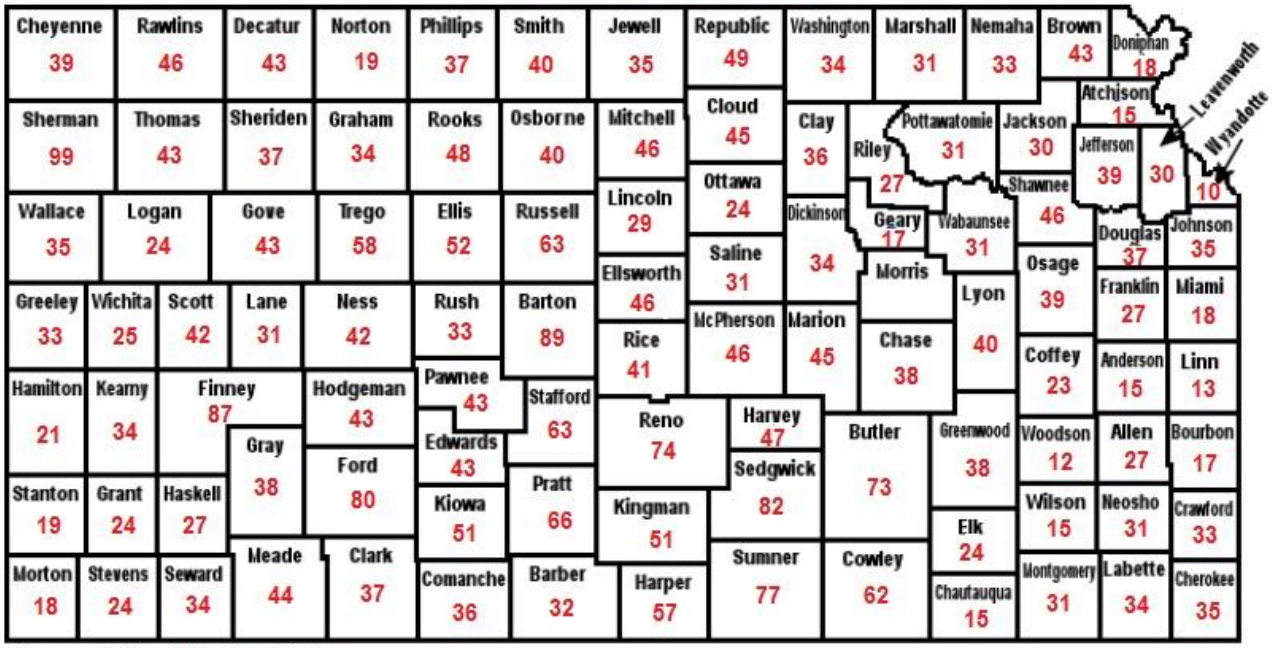
While tornadoes can occur in all areas of the State of Kansas, historically, some areas of the state have been more susceptible to this type of damaging storm.



Source: *Taking Shelter from the Storm*, FEMA, 2004

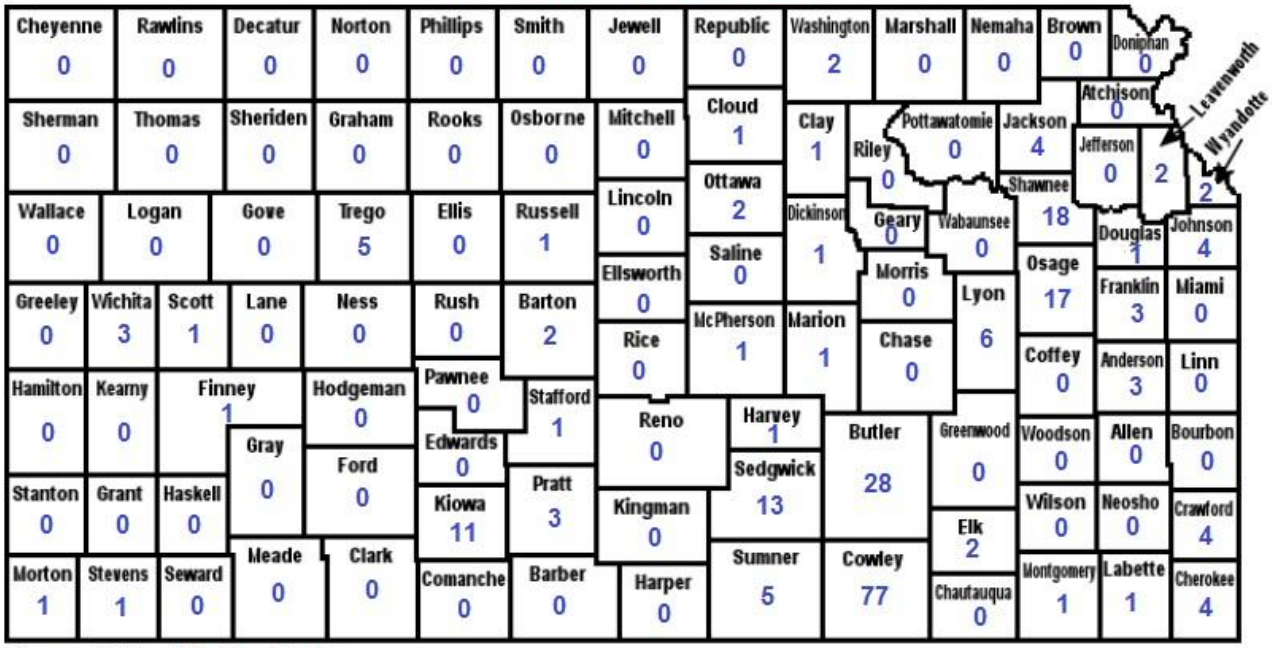


Kansas Tornado Statistics by County
(1950 to 2010)

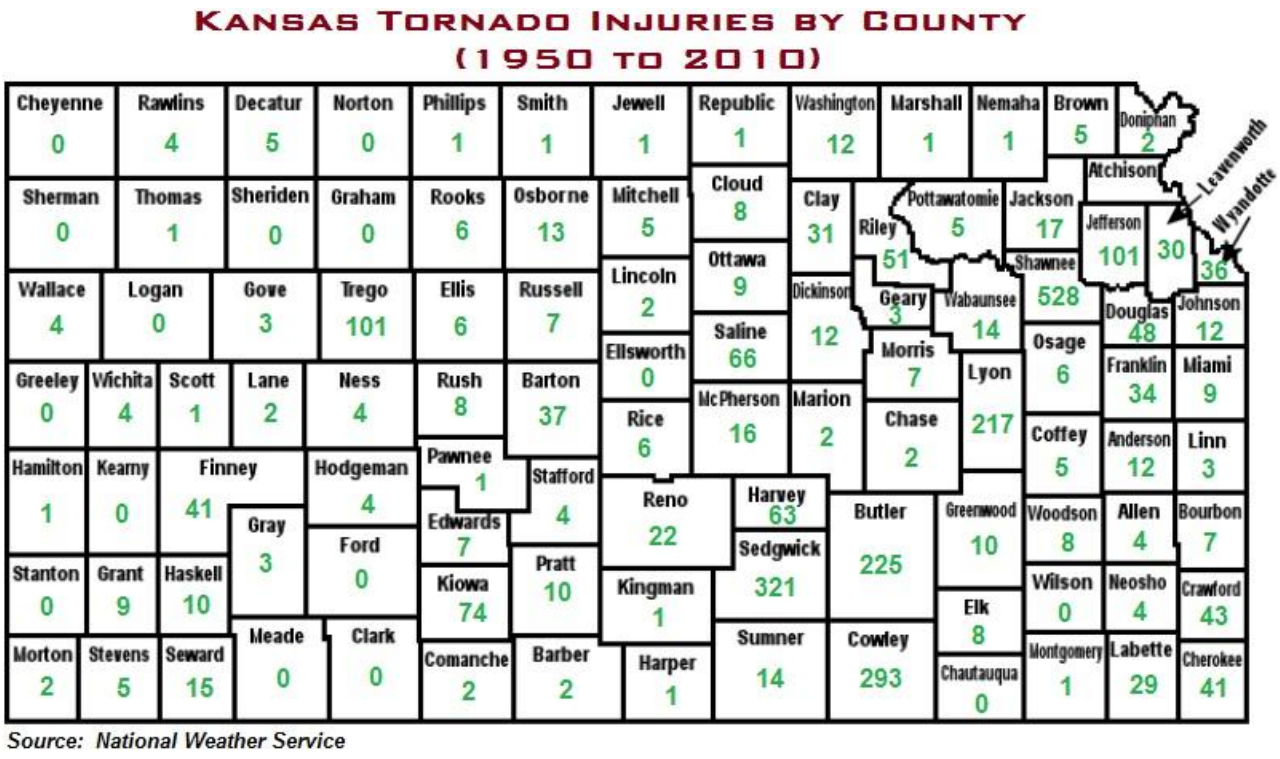


Source: National Weather Service

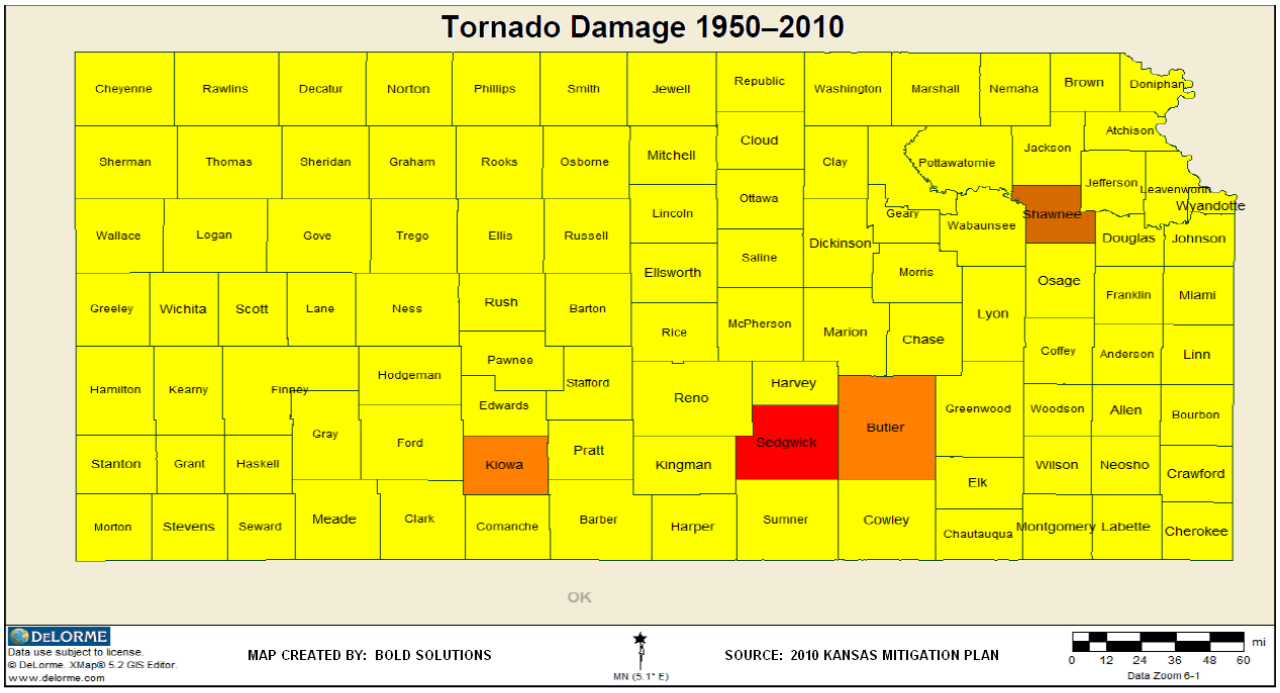
Kansas Tornado Deaths by County
(1950 to 2010)



Source: National Weather Service



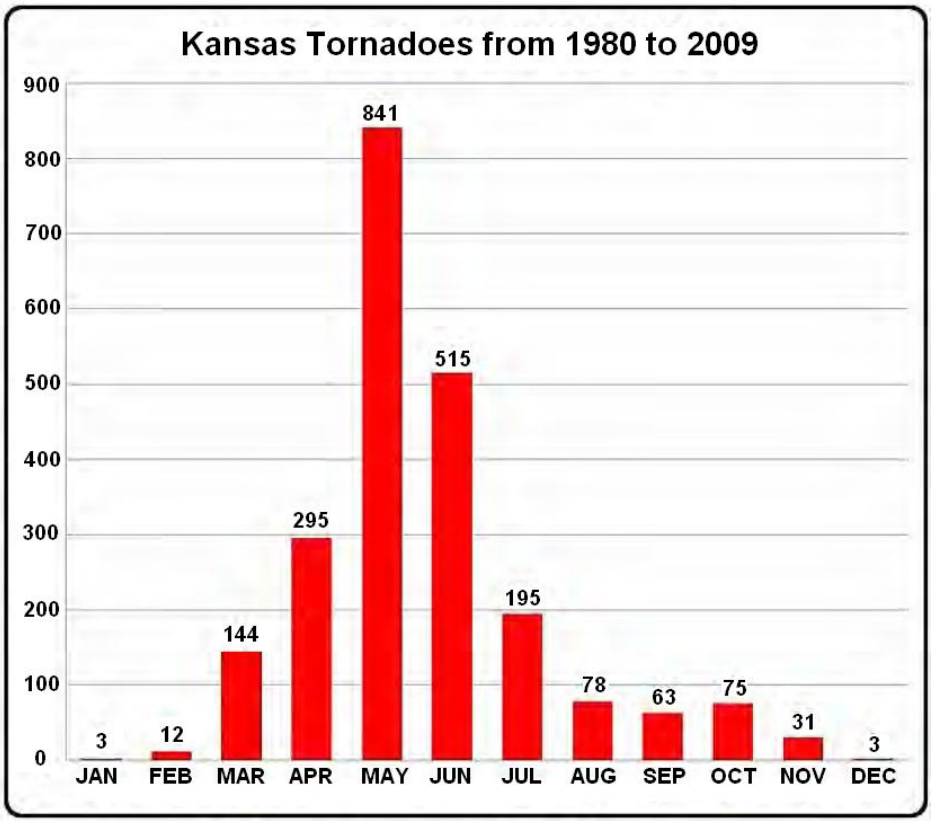
Source: National Weather Service



Previous Occurrences

Tornadoes have caused substantial property damage, injury, loss of life, and economic disruption in Kansas. Based on data from the National Climatic Data Center's *2005 Annual Summaries*, Kansas ranks second in the nation for the overall number of tornadoes, third for the number of tornadoes per 10,000 square miles, and eighth for the total number of tornado caused fatalities. Tornadoes in Kansas occur most often between

March and July, which has come to be known as “tornado season” in Kansas and other areas. The chart below is a breakdown of tornadoes in Kansas by month from 1980 to 2009. The month of May experiences the most tornados.



Probability of Occurrences

According to the National Climatic Data Center Storm Events database, there were 3,812 tornadoes in Kansas between 1950 and 2010. Tornadoes reported in the database are in segments. One tornado can have multiple segments as the database counts a new segment when county boundaries are crossed. So, the number of past occurrences is really a reflection of the number of past tornado segments. Of these events, 17 were rated F5, and 61 were rated F4. Based on the data collected by the sub-committee it would appear that South Central Kansas is more prone to tornado events with a large majority of this area having between 43 and 90 tornadoes. Also it should be noted that of the 17 F5 events recorded in Kansas, 10 were recorded in the South Central area. This hazard’s CPRI probability is “highly likely” (event is probable within the calendar year).

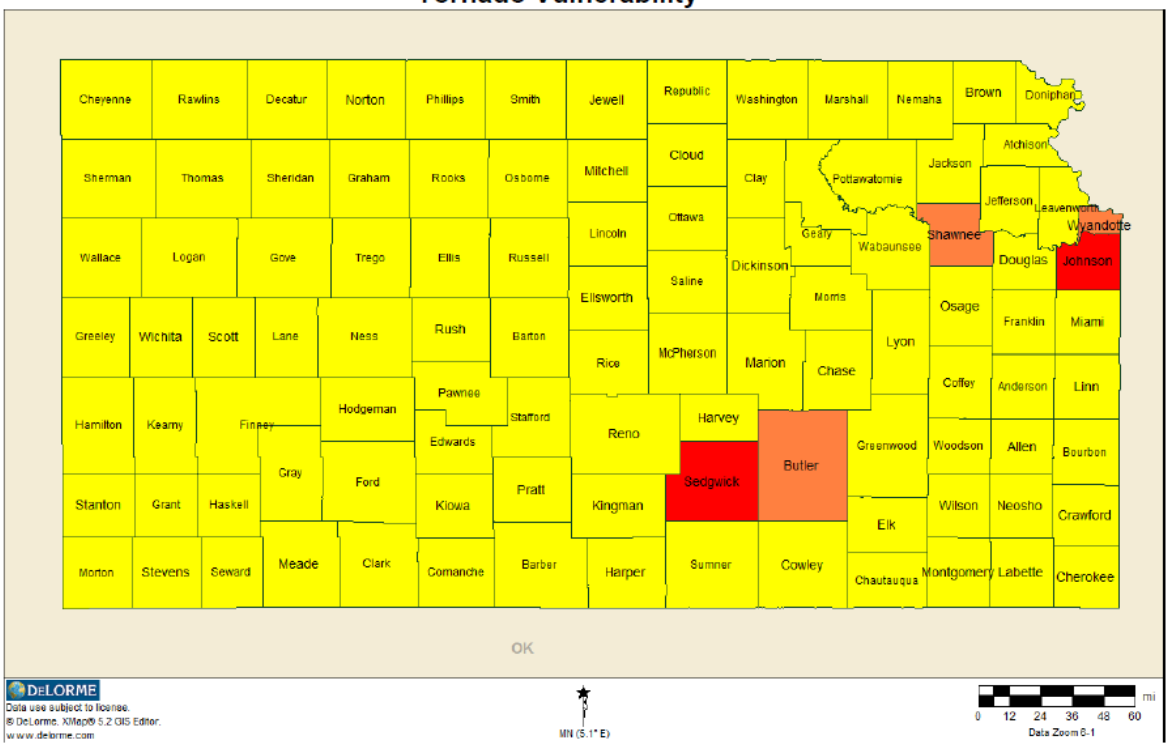
Magnitude/Severity

Total property and crop damage for these events is estimated at $2.646 billion. There were 233 deaths and 2,714 injuries in this time period. This suggests that Kansas experiences 64 tornadoes, $44 million in tornado losses (property and crop), 4 deaths, and 45 injuries each year. This hazard’s CPRI magnitude/severity is “critical.”

Vulnerability Overview

As previously indicated, the potential for a strong, damaging event is likely. All above-ground buildings, infrastructure, and critical facilities are at risk of damage. The following map shows Sedgwick and Butler counties as having high or very high vulnerability in south central Kansas.

Tornado Vulnerability



Source: Bold Planning Solutions

- Very High Vulnerability - High Vulnerability - Moderate Vulnerability

To estimate potential losses to tornadoes, historic loss data was analyzed. According to the data gathered, there were 3,910 tornado segments in Kansas between 1950 and 2010. Total property and crop damage statewide for these events is estimated at $6.911 billion in 2010 dollars. There were 214 deaths and 2,617 injuries in this time period. This suggests that Kansas experiences 65 tornadoes, $115,186,916 million in tornado losses (property and crop), 4 deaths, and 46 injuries each year. The total historic losses and annualized losses by county in south central Kansas are presented below. (Data for the areas with FEMA approved local plans)

Annualized Losses from Tornadoes (1950–2010)

County	# of Events	Property Damage ($)	Annual Property Damages ($)	Crop Damage ($)	Annual Crop Damages ($)
Barber	32	$588,000.00	$9,800.00	$0.00	$0.00
Barton	82	$49,380,000.00	$823,000.00	$10,000.00	$166.67
Comanche	36	$285,000.00	$4,750.00	$0.00	$0.00
Edwards	37	$4,505,000.00	$75,083.33	$50,000.00	$833.33
McPherson	41	$83,564,000.00	$1,392,733.33	$0.00	$0.00
Pawnee	34	$1,935,000.00	$32,250.00	$0.00	$0.00
Rice	35	$25,995,000.00	$433,250.00	$5,000.00	$83.33
Stafford	62	$1,725,000.00	$28,750.00	$0.00	$0.00
Sumner	75	$28,008,000.00	$466,800.00	$325,000.00	$5,416.67

Source: 2010 Kansas Hazard Mitigation Plan

Historical Disasters

FEMA-1849-DR: Severe Storms, Flooding, Straight-line Winds, and Tornadoes – June 25, 2009

On June 11, 2009, Governor Mark Parkinson requested a major disaster declaration because of severe storms accompanied by large hail, lightning, high winds, tornadoes, and torrential rains during the period of April 25 to May 16, 2009. The governor requested a Declaration for Public Assistance for 28 counties and hazard mitigation for all counties. During the period of May 18-22, 2009, joint federal, state, and local Preliminary Damage Assessments (PDAs) were conducted in the requested counties and are summarized below. PDAs estimate damages immediately after an event and are considered, along with several other factors, in determining whether a disaster is of such severity and magnitude that effective response is beyond the capabilities of the state and the affected local governments, and that federal assistance is necessary.

FEMA-1808-DR: Severe Storms, Tornadoes, and Flooding—October 31, 2008

On October 22, 2008, Governor Kathleen Sebelius requested a major disaster declaration because of severe storms accompanied by tornadoes, lightning, and torrential rains resulting in flooding and flash flooding during the period of September 11-18, 2008. The governor requested a Declaration for Public Assistance for 10 counties and hazard mitigation for all counties. During the period of October 13-17, 2008, joint federal, state, and local Preliminary Damage Assessments (PDAs) were conducted in the requested counties.

FEMA-1776-DR: Severe Storms, Flooding, and Tornadoes- July 9, 2008

On June 26, 2008, Governor Kathleen Sebelius requested a major disaster declaration because of severe storms accompanied by large hail, lightening, high winds, tornadoes, and torrential rains during the period of May 22 to June 16, 2008. The governor requested a Declaration for Public Assistance for 49 counties and hazard mitigation for all counties. During the period of June 16-17, 2008, joint federal, state, and local Preliminary Damage Assessments (PDAs) were conducted in the requested counties.

FEMA-1699-DR: Severe Storms, Tornadoes, and Flooding—May 6, 2007 (May 4)

A 1.7 mile-wide EF5 tornado with wind estimated at 205 mph struck Greensburg in Kiowa County, destroying approximately 90% of the town and severely damaging the remaining 10%. Tornado sirens sounded in the city twenty minutes before the tornado struck, and a tornado emergency was issued, undoubtedly saving many lives in the town of 1,580. Nevertheless, the storm killed 12 people, 10 in Greensburg, one in Pratt, and one in Stafford, and hospitalized 13 others. Initial assessment results indicated that Greensburg sustained extraordinary losses to housing, business, hospital, schools, and all other public facilities. Electric and water distribution systems were also seriously damaged. The town's entire population was displaced throughout surrounding counties. Farmsteads and farm properties throughout Kiowa County and surrounding areas were also impacted. According to the insurance commissioner, 1,900 insurance claims were filed as of August 14, 2007, totaling approximately $153 million dollars in estimated storm losses in Kiowa County.

FEMA-1366-DR: Severe Storms and Tornado—April 2, 2001 (April 21)

On April 21, an F4 tornado touched down in Hoisington in Barton County, damaging many buildings, vehicles, and power and telecommunications systems of the city. There was one fatality and 28 injuries. The storm destroyed 182 homes and caused major damage to 52 homes and minor damage to 180 more residences. A hospital, three schools, and several businesses were damaged. Damage approximated $43 million.

FEMA-1273-DR: Tornadoes and Severe Storms—May 4, 1999 (May 3)

On May 3, severe thunderstorms and as many as four dozen tornadoes swept through south central Kansas, causing 6 deaths and 154 injuries in Haysville and Wichita. Damage exceeded $150 million. Damage summary for Sedgwick County: 8,480 buildings (all types) damaged or destroyed. Of these, 2,456 were at least 50% destroyed and 1,109 totally destroyed. The number of customers that lost power was 52,000.

FEMA-903-DR: Severe Storm, Tornado—April 29, 1991 (April 26)

A tornado touched down in Harper County then skipped across Sedgwick and Butler Counties. In Sedgwick County it grew to F3 intensity and tore through parts of south and east Wichita, making a direct hit on McConnell Air Force Base. Four people were killed in Sedgwick County. The tornado then grew to F5 intensity and went through the community of Andover in Butler County. Major damage was incurred and 13 people were killed. At the same time, another tornado developed in Cowley County that grew to F4 intensity and killed one person east of Winfield and another near Howard in Elk County. Total property damage from these tornadoes was in excess of $272 million.

March 13, 1990

This F5 tornado struck Hesston, killing two people, injuring 60, and damaging or destroying about 226 homes and 21 businesses in the western sections of town. It caused nearly 25 million dollars in damage in Harvey County alone. In Burrton, a six-year-old boy was killed by a crumbling chimney as he huddled in a basement with his family.

June 10, 1958

A tornado passed through El Dorado, devastating a section of newer homes in the southwest part of El Dorado. About 200 homes were destroyed as a 45-block area was torn apart. This tornado took the lives of 15 people and injured 50.

FEMA-34-DR: Tornado—May 25, 1955

This F5 tornado killed five children in a home northeast of Oxford before moving on to Udall and completely devastating a large portion of the town. Seventy-five people were killed in Udall, and many of the 270 injuries were serious. Damage in this small town was listed at over 2.2 million. This remains Kansas' deadliest tornado.

May 7, 1927

This tornado ranged from one-half to two miles wide and was on the ground for nearly 100 miles. It traveled from Barber County through Kingman and Reno Counties before dissipating in McPherson County. Ten people were killed and 300 injured.

May 25, 1917

This tornado touched down near Cheney and moved through the southeastern parts of Andale, across the southern edge of Sedgwick to three miles northeast of Florence. Along the path, 118 farms, homes, and businesses were destroyed, many of them completely swept away. Twenty three people were killed and 70 injured. Twelve of the deaths were in Andale, where half the town was damaged or destroyed. The funnel was reportedly over a mile wide.

November 10, 1995

Two different tornadoes affected portions of central and south-central Kansas on this day. The first one moved across Barton County, causing one million dollars in damage. One hundred and sixty homes were destroyed, and at least 1,000 sheep were killed. Debris was carried 85 miles and hundreds of dead ducks fell from the sky 25 miles northeast of the end of the tornado path. Another tornado moved across portions of Sumner and Sedgwick Counties, destroying at least 10 homes. The total number of deaths for these tornadoes was 15.

Other Notable Tornadoes

- June 15, 2009 - This tornado turned over four pivot irrigation sprinklers and destroyed two 80,000 bushel grain bins in Edwards County. In addition, a 500,000 bushel bin was heavily damaged. One of the 80k bins traveled nearly a mile. There was extensive rear flank downdraft damage in the vicinity of this tornado.

- October 26, 2006—Twenty-eight tornadoes were reported in southwest Kansas, specifically the counties of Ford, Grant, Clark, Gray, Comanche, and Meade. Only two of the storms caused damage, which was relatively minor.
- August 19, 2005—A tornado caused an estimated $500,000 damage to Great Bend Airport where hangars were unroofed and an unspecified number of aircraft were overturned. A second touchdown in the Great Bend area caused $250,000 in damage to two farmsteads.
- August 27, 2004—Three tornadoes hit Sumner and Cowley Counties. The most significant of the three, an F2, damaged two homes and snapped four utility poles.
- June 12, 2004—Sumner and Cowley Counties experienced five tornadoes. An F3 caused $575,000 in damage to property and crops. Two people were injured.
- May 29, 2004—Five tornadoes were reported in Harper County. An F2 caused $375,000 in damage to property and crops. One F3 storm destroyed 15 farm buildings, 25 pieces of farm equipment, many miles of transmission line, and crops. Damage was estimated at nearly $2 million. A second F3 caused $1 million damage, which was largely to two homesteads.
- May 12, 2004—Sixteen tornadoes were reported in Harper County. An F4 storm destroyed a farm house, five barns, and five cars with damage to property and crops approximating $350,000. Three F2 tornadoes caused an additional $380,000 in damage.
- June 15, 1992—This day set Kansas' record for the most tornadoes on one day: 39.

Identifying Structures and Estimating Potential Losses

For the 2010 update, the Kansas Hazard Mitigation Plan Committee reviewed all of the FEMA-approved local plans in the State of Kansas. The data gathered from south central Kansas local plans are shown in the table below:

Local Plan Statistics for Tornado Events

County	Hazard Ranking	# of Events	Damages (Prop)	Damages (Crop)	Injuries	Fatalities
Butler	High	59	$254,216,000.00	N/A	170	28
Cowley	High	59	$39,716,000.00	N/A	290	77
Harper	High	53	$3,265,000.00	$425,000.00	1	N/A
Harvey	High	46	$53,986,000.00	N/A	62	1
Kingman	High	43	$396,000.00	N/A	1	N/A
Kiowa	High	44	$251,103,000.00	N/A	74	11
Marion	High	45	$20,000,000.00	N/A	10	5
Pratt	Moderate	54	$21,366,000.00	$150,000.00	5	1
Reno	High	67	$60,000,000.00	N/A	17	N/A
Sedgwick	High	75	$430,000,000.00	N/A	303	13

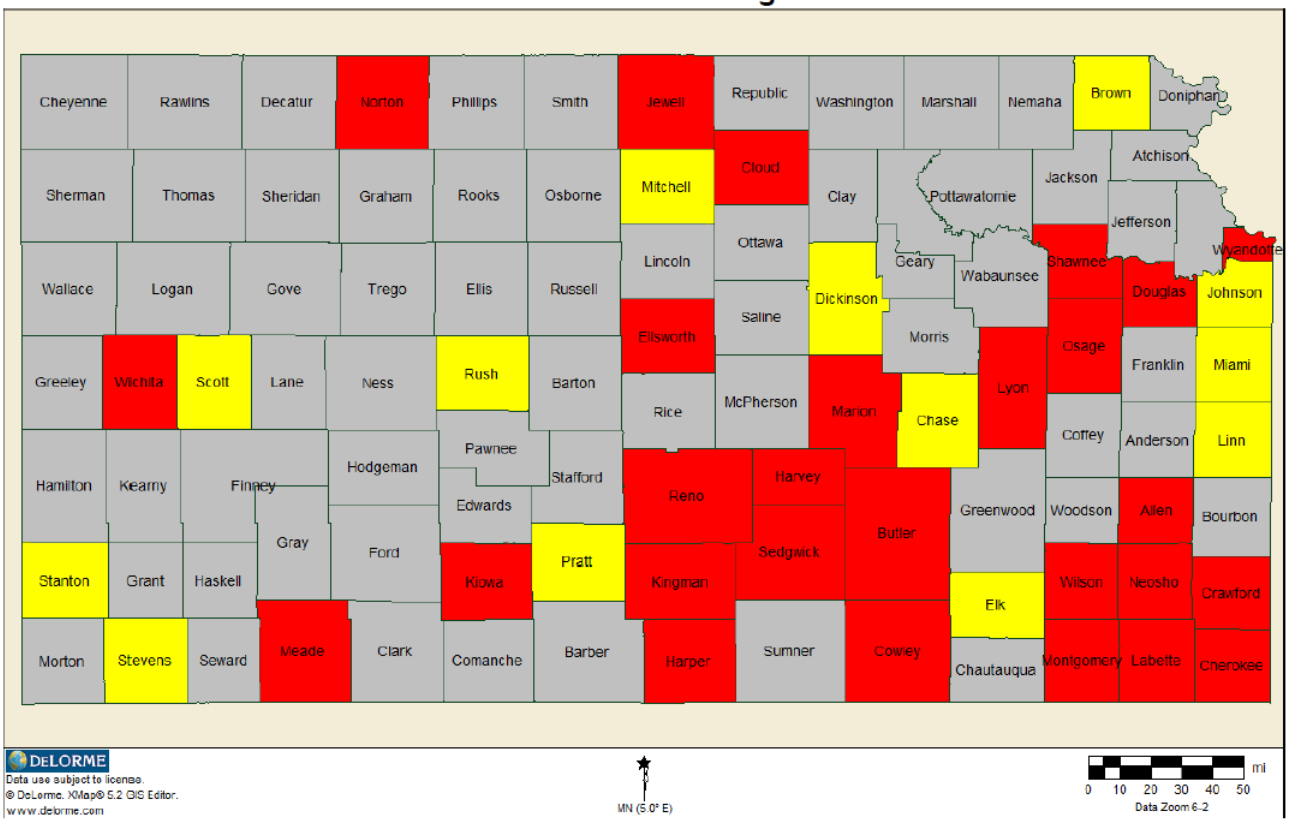
Source: 2010 Kansas Hazard Mitigation Plan

After reviewing the data from the local plans throughout the State of Kansas, the committee calculated averages for tornadoes, as shown in the table located below. The state can expect an average of roughly one injury and $1,281,875 in damages from a single tornado event.

Local Plan Averages for Tornado Events

	Deaths	Injuries	Total Damages
Totals	200	2034	$1,821,545,498
Average per County	5	50.85	$45,538,637
Average Per Event	0.14	1.43	$1,281,875

Local Plan Hazard Rating for Tornado



Source: Bold Planning Solutions

Red – High Risk – 27 Jurisdictions

Yellow – Moderate Risk – 13 Jurisdictions

Gray – No Plan or Rating – 65 Jurisdictions

REGULATORY

Although there are no regulatory requirements for building protection, the Federal Emergency Management Agency (FEMA) does provide guidance under FEMA 361 "Design and Construction Guidance for Community Shelters" for new construction. This guidance manual is for engineers, architects, building officials, and prospective shelter owners. It presents important information about the design and construction of community shelters that will provide protection during tornado and hurricane events. For the purpose of this manual, a community shelter is defined as a shelter that is designed and constructed to protect a large number of people from a natural hazard event. This differs slightly from FEMA 320 "*Taking Shelter from the Storm: Building a Safe Room Inside Your House*" which is a guidance manual for homeowners.

20.5 STORMS (WINTER-SUMMER)

Definition: An atmospheric disturbance manifested in strong winds accompanied by rain, snow, or other precipitation and often by thunder and lightning.

20.5.1 STORM CLASSIFICATIONS

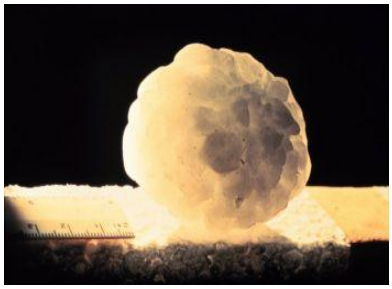
- ***Single cell (pulse) storms*** are rare and typically last 20-30 minutes and can produce severe weather elements such as downbursts, hail, some heavy rainfall and occasionally weak tornadoes.
- ***Multicell cluster storms*** are a group of cells moving as a single unit, with each cell in a different stage of the thunderstorm life cycle and can produce moderate size hail, flash floods and weak tornadoes.
- ***Multicell line storms (squall lines)*** consist of a line of storms with a continuous, well developed gust front at the leading edge of the line and can produce small to moderate size hail, occasional flash floods and weak tornadoes.
- ***Supercells*** are thunderstorms with a rotating updraft, and can produce strong downbursts, large hail, occasional flash floods and weak to violent tornadoes.
- ***Severe Thunderstorms*** are defined any thunderstorm which produces tornadoes, hail 0.75 inches or more in diameter, or winds of 50 knots (58 mph) or more.
- ***Winter storm or heavy snow event*** consists of a snowfall of at least four inches in 12 hours or six inches in 24 hours.
- ***Blizzard*** consists of winds exceeding 56 km (35 mph) and the temperature at -7° C (20° F) or lower combining with either falling snow or snow on the ground reducing visibilities to 1/4 mile or less for at least three hours.

20.5.2 STORM DAMAGE EVENTS

Downdrafts associated with thunderstorms can be very strong and localized, with damaging winds that can reach over 100 mph. A downburst is a strong downdraft that includes an outburst of potentially damaging winds on or near the ground (straight-line winds). Downbursts with a diameter of less than 2.5 miles are called microbursts whereas macrobursts are greater than 2.5 miles in diameter.

A derecho is a widespread and long-lived windstorm that is associated with a band of rapidly moving thunderstorms that are often "curved" in shape and can appear on radar with a single bow echo or multiple bow echoes. They have sustained winds greater than 57 mph and can exceed over 100 mph in intensity.

Gustnado (or Gustinado) is slang for a gust front tornado. It is a small tornado (F0 or F1), usually weak and short-lived, that occurs along the gust front of a thunderstorm. Often it is visible only as a debris cloud or dust whirl near the ground. Gustnadoes are not associated with storm-scale rotation (i.e. mesocyclones); they are more likely to be associated visually with a shelf cloud than with a wall cloud.



Hail is produced by intense thunderstorms as water droplets are picked up by strong updrafts and can be carried well above the freezing level. As the frozen droplets fall, the updraft can carry them back up to the top of the storm adding more ice layers. Typically the stronger the updraft, the more times a hailstone repeats this cycle and consequently, the larger it grows. Once the hail stone becomes too heavy to be supported by the updraft, it falls out of the cloud toward the surface. The hailstone reaches the ground as ice.

20.5.3 EXTREME TEMPERATURES

EXTREME HEAT

Based on information from FEMA, extreme heat is defined as several weeks of temperatures 10 degrees or more above the average high temperature for the region. Ambient air temperature is one component of heat conditions, with relative humidity being the other. The relationship of these factors creates what is known as the apparent temperature. The Heat Index chart shown below considers both of these factors to produce a guide for the apparent temperature or relative intensity of heat conditions:

HEAT INDEX (HI) CHART

Temperature (°F)

Relative Humidity (%)	80	82	84	86	88	90	92	94	96	98	100	102	104	106	108	110
40	80	81	83	85	88	91	94	97	101	105	109	114	119	124	130	136
45	80	82	84	87	89	93	96	100	104	109	114	119	124	130	137	
50	81	83	85	88	91	95	99	103	108	113	118	124	131	137		
55	81	84	86	89	93	97	101	106	112	117	124	130	137			
60	82	84	88	91	95	100	105	110	116	123	129	137				
65	82	85	89	93	98	103	108	114	121	128	136					
70	83	86	90	95	100	105	112	119	126	134						
75	84	88	92	97	103	109	116	124	132							
80	84	89	94	100	106	113	121	129								
85	85	90	96	102	110	117	126	135								
90	86	91	98	105	113	122	131									
95	86	93	100	108	117	127										
100	87	95	103	112	121	132										

Likelihood of Heat Disorders with Prolonged Exposure or Strenuous Activity

Caution Extreme Caution Danger Extreme Danger

Source: National Weather Service (NWS)

Note: Exposure to direct sun can increase Heat Index values by as much as 15°F. Note on the HI chart the shaded zone above 105°F. This corresponds to a level of HI that may cause increasingly severe heat disorders with continued exposure and/or physical activity.

According to the Centers for Disease Control and Prevention, 8,015 people died in the United States from excessive heat exposure between 1979 and 2003. During this period, more people in the United States died from extreme heat than from hurricanes, lightning, tornadoes, floods, and earthquakes combined. Those at greatest risk for heat-related illness include infants and children up to four years of age, people 65 years of age and older, people who are overweight, and people who are ill or on certain medications. However, even young and healthy individuals are susceptible if they participate in strenuous physical activities during hot weather. Also, during extreme heat events, infrastructure, energy sources in particular, can be stressed, and long-term extreme heat can stress water sources, particularly if occurring during a period of drought.

EXTREME COLD

Extreme cold can immobilize an entire region. Even areas that normally experience mild winters can be hit with a major snowstorm or extreme cold. Winter storms can result in many secondary impacts to the

environment such as; flooding, storm surge, closed highways, blocked roads, downed power lines; and for people and animals, hypothermia, a condition in which an organism's temperature drops below that required for normal metabolism and bodily functions can be serious. In warm-blooded animals, core body temperature is maintained near a constant level through biologic homeostasis. But, when the body is exposed to cold, its internal mechanisms may be unable to replenish the heat that is being lost to the organism's surroundings. Other extreme cold concerns include, frostbite and associated complications, snow blindness, confusion and disorientation, which can lead to permanent damage or death. Some terms that can warn of oncoming extreme cold weather situations include:

Freezing Rain

Rain that freezes when it hits the ground, creating a coating of ice on roads, walkways, trees, and power lines.

Sleet

Rain that turns to ice pellets before reaching the ground. Sleet also causes moisture on roads to freeze and become slippery.

Winter Storm Watch

A winter storm is possible in your area. Tune in to NOAA Weather Radio, commercial radio, or television for more information.

Winter Storm Warning

A winter storm is occurring or will soon occur in your area.

Blizzard Warning

Sustained winds or frequent gusts to 35 miles per hour or greater and considerable amounts of falling or blowing snow (reducing visibility to less than a quarter mile) are expected to prevail for a period of three hours or longer.

Frost/Freeze Warning

Below freezing temperatures are expected. Vulnerability to extreme cold include, but are not limited to, infants and the elderly. Anyone can be affected depending on the situation. It is estimated that 25,000 older adults die from hypothermia each year. The National Institute on Aging estimates that more than 2.5 million Americans are especially vulnerable to hypothermia, with the isolated elderly being most at risk. About 10 percent of people over the age of 65 have some kind of temperature-regulating defect, and 3-4 percent of all hospital patients over 65 are hypothermic. The percentage of the State's elderly population is slightly higher than the national average. To keep residents informed, communities keep the public informed through outreach programs for the elderly and public service announcements through their local media channels. Raising the awareness of the dangers of extreme cold can assist those susceptible with being more prepared. Others at risk are those without shelter, the homeless, stranded or those who live with inadequate home insulation or without heat. Some secondary impacts to those vulnerable to extreme cold include asphyxiation (unconsciousness or death from a lack of oxygen) caused by toxic fumes from kerosene or propane heaters and the use of small area coil heaters, which can be a fire danger while sleeping.

Warning Time: More than 24 hours

Duration: Less than one week

Geographic Location: All of south central Kansas is susceptible to extreme temperatures

PREVIOUS OCCURRENCES

The High Plains Regional Climate Center (HPRCC) archives National Weather Service (NWS) surface observations including daily measurements of high temperature, low temperature, precipitation, snowfall, and

evaporation for first order (NWS forecast offices) and second order (cooperative observer network) sites. The following selected sites are provided to give a general overview of the south central Kansas region with a summary table at the end:

Greensburg (Period of Record : 1/ 1/1893 to 12/31/2010)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Average Max. Temperature (F)	43.4	48.7	57.8	68.4	76.9	86.9	93.1	91.8	83.2	71.5	56.6	45.7	68.7
Average Min. Temperature (F)	19.4	22.9	30.7	41.2	51.5	61.7	66.8	65.3	56.6	44.4	30.9	21.9	42.8

Larned (Period of Record : 6/ 1/1903 to 7/31/2008)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Average Max. Temperature (F)	42.7	48.2	57.7	68.6	77.2	87.5	93.2	91.9	83.5	71.7	56.6	45.1	68.7
Average Min. Temperature (F)	18.8	22.8	30.7	41.4	52.0	62.0	67.1	65.8	57.0	44.6	30.9	21.8	42.9

Great Bend (Period of Record : 4/ 1/1909 to 12/31/2010)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Average Max. Temperature (F)	42.5	48.4	57.4	69.2	78.2	88.4	93.6	91.7	83.1	72.1	56.1	45.0	68.8
Average Min. Temperature (F)	19.6	24.0	32.0	42.9	53.6	63.3	68.2	66.4	57.3	45.6	32.3	22.8	44.0

Geneseo (Period of Record : 3/ 1/1939 to 12/31/2010)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Average Max. Temperature (F)	39.8	45.8	53.8	66.4	76.0	87.1	92.3	91.7	83.3	72.2	53.9	44.2	67.2
Average Min. Temperature (F)	19.0	23.4	29.5	41.4	51.7	62.5	66.6	66.1	57.0	46.3	31.0	23.0	43.1

McPherson (Period of Record : 1/ 1/1893 to 12/31/2010)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Average Max. Temperature (F)	40.3	45.5	57.0	68.2	76.8	87.1	93.1	92.3	83.4	71.3	55.6	43.3	67.8
Average Min. Temperature (F)	19.6	23.0	31.8	42.8	52.7	62.8	67.8	66.7	58.0	46.1	32.7	23.0	43.9

Florence (Period of Record : 10/1/1925 to 4/30/2009)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Average Max. Temperature (F)	41.2	47.6	57.4	68.7	77.3	86.2	92.4	91.5	82.9	71.8	56.3	44.6	68.2
Average Min. Temperature (F)	19.0	23.5	32.4	43.3	53.5	62.9	67.9	66.3	57.1	45.5	32.4	22.6	43.9

Augusta (Period of Record : 1/ 1/1896 to 12/31/2010)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Average Max. Temperature (F)	43.8	43.6	55.2	70.1	78.9	85.7	89.8	92.4	85.1	73.2	56.1	44.2	68.2
Average Min. Temperature (F)	23.9	21.4	30.9	45.3	56.2	63.8	66.9	66.6	57.2	47.0	33.1	23.2	44.6

Arkansas City (Period of Record : 7/ 1/1916 to 12/31/2010)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Average Max. Temperature (F)	48.3	52.3	60.1	70.5	78.0	87.3	93.1	93.7	86.1	72.5	58.0	47.5	70.6
Average Min. Temperature (F)	24.2	26.7	35.2	45.9	55.0	65.6	67.9	67.3	60.5	46.3	35.3	27.2	46.4

Kingman (Period of Record : 12/1/1907 to 12/31/2010)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Average Max. Temperature (F)	43.5	48.7	58.7	69.8	78.4	88.5	94.1	92.9	83.9	72.1	57.2	45.5	69.4
Average Min. Temperature (F)	20.5	24.5	32.8	43.7	54.0	63.5	68.5	67.0	58.0	45.8	33.1	23.3	44.6

Wichita (Period of Record : 1/ 1/1954 to 12/31/2010)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Average Max. Temperature (F)	41.0	47.1	57.1	68.2	77.0	86.9	92.7	91.3	82.1	70.5	55.7	44.1	67.8
Average Min. Temperature (F)	20.5	25.0	33.7	44.7	55.0	64.6	69.8	68.3	59.5	47.0	34.1	24.1	45.5

Medicine Lodge (Period of Record : 1/ 1/1893 to 12/23/1998)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Average Max. Temperature (F)	45.8	51.4	61.0	71.6	79.6	89.4	95.1	94.3	86.0	74.5	59.6	48.2	71.4
Average Min. Temperature (F)	20.4	24.0	32.5	43.7	53.8	63.4	67.5	66.4	58.0	45.5	32.2	23.1	44.2

Record Temperatures (^{o}F) by Month – South Central Kansas

Month	Max Temp	Min Temp	Month	Max Temp	Min Temp
January	48.3	18.8	July	95.1	66.6
February	52.3	21.4	August	94.3	65.3
March	61.0	30.9	September	86.1	56.6
April	71.6	41.2	October	74.5	44.4
May	79.6	51.5	November	59.6	30.9
June	89.4	61.7	December	48.2	21.8

Source: High Plains Regional Climate Center, http://www.hprcc.unl.edu/index.php

PROBABILITY OF FUTURE OCCURRENCES

This hazard's CPRI probability is "highly likely." An extreme heat event is more likely to occur in the months of May, June, July, August, September, and October. Accordingly, extreme cold events are more likely to occur in the months of November, December, January, February, and March.

MAGNITUDE/SEVERITY

The most recent extreme temperature event recorded by the NCDC on July 16, 2006, noted that the prolonged heat claimed five lives across south-central and southeast Kansas, most of them elderly men. This hazard's CPRI magnitude/severity is "limited.

Calculated Priority Risk Index	Planning Significance
2.85	Moderate

20.5.4 LIGHTNING

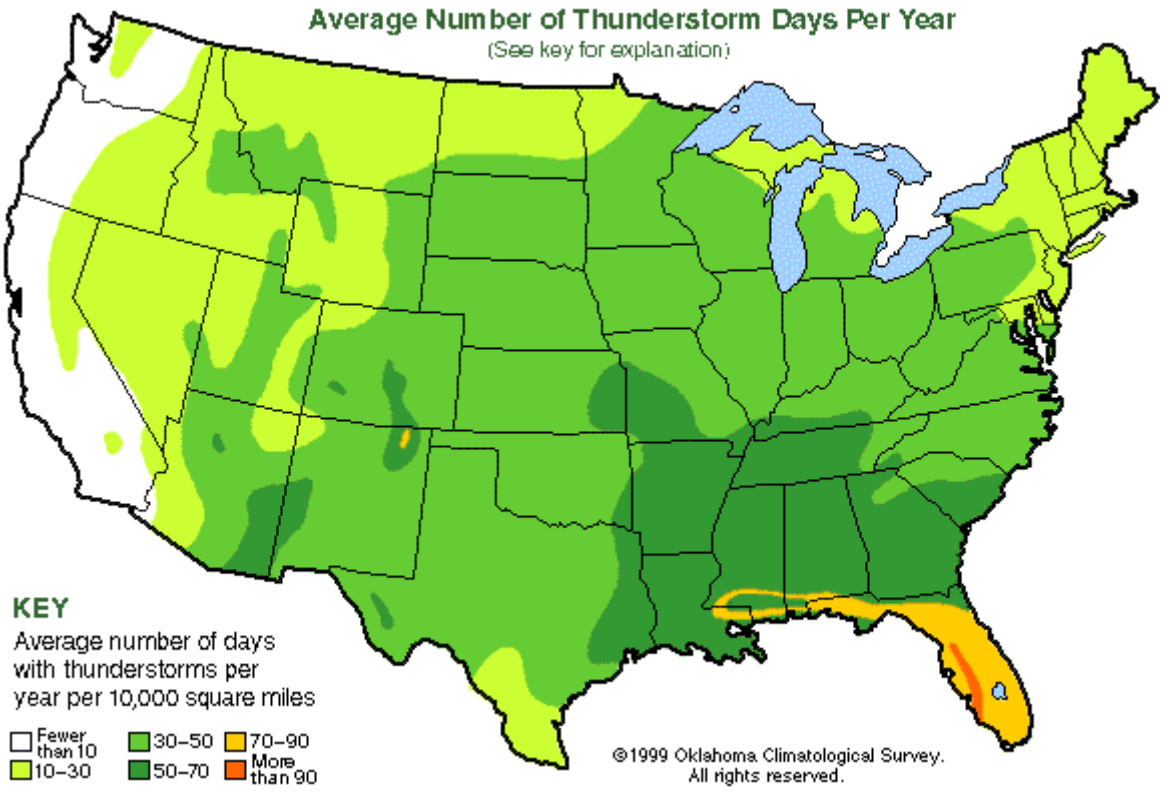
Description

According to the National Weather Service, lightning is one of the most underrated severe weather hazards. The second deadliest weather killer in the United States, it ranks above hurricanes or tornadoes causing an average of 73 deaths and 300 injuries each year. Severe thunderstorms strike Kansas on a regular basis. In addition to the heavy rains that cause floods, high winds, tornadoes, and thunderstorms, lightning often accompanies thunderstorms and can cause injury, death property damage, and wildland fires. With the widespread and frequent nature of thunderstorms, lightning is a relatively common occurrence. Of particular concern in Kansas is protection of facilities and communications systems that are critical to emergency response operations, protection of public health, and maintenance of the State's economy. The threat to communications systems includes tornado sirens, which could get knocked out just when they are needed most.

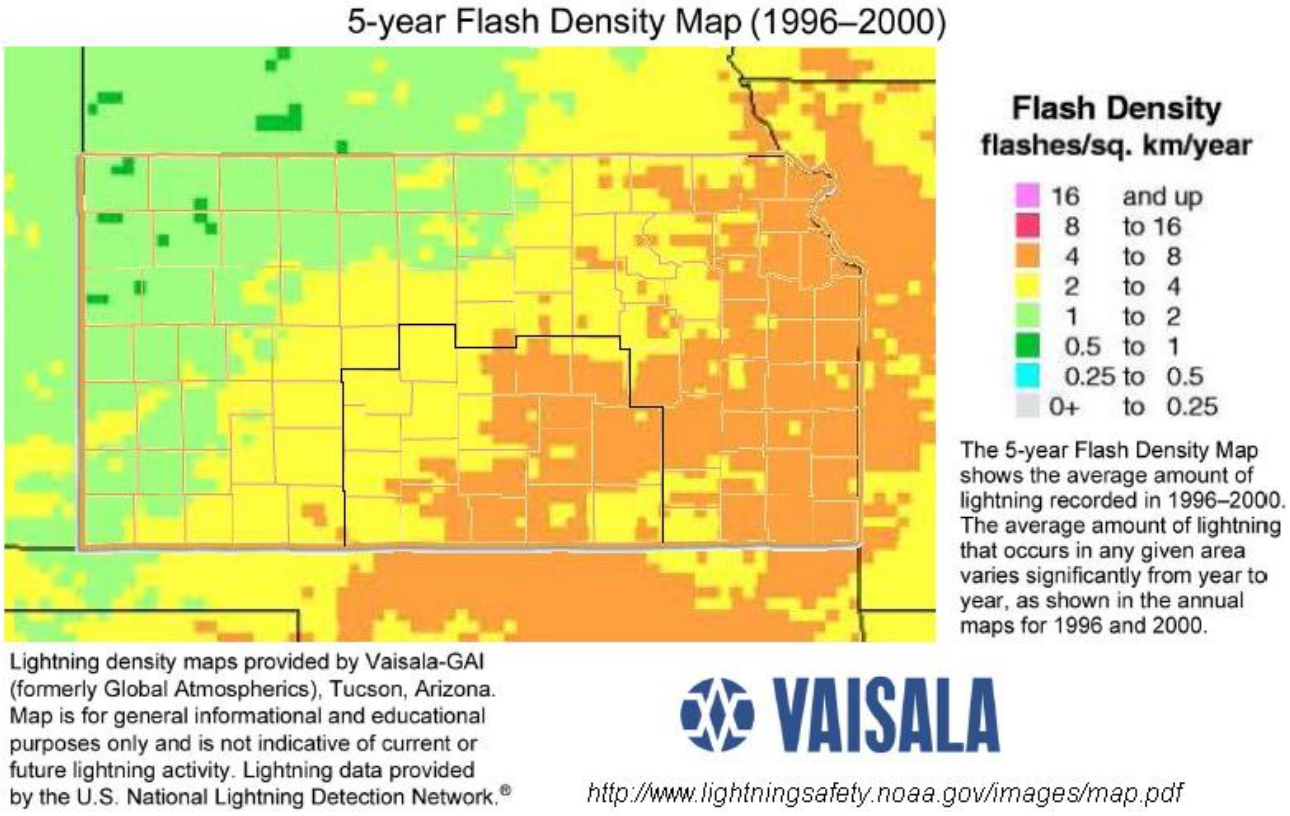
Warning Time: 12 to 24 hours
Duration: Less than 6 hours

Geographic Location

South central Kansas has an average of 30 to 50 thunderstorm days each year as shown below:



In addition, south central Kansas has approximately two to eight lightning strikes per square kilometer per year as shown below.



Previous Occurrences

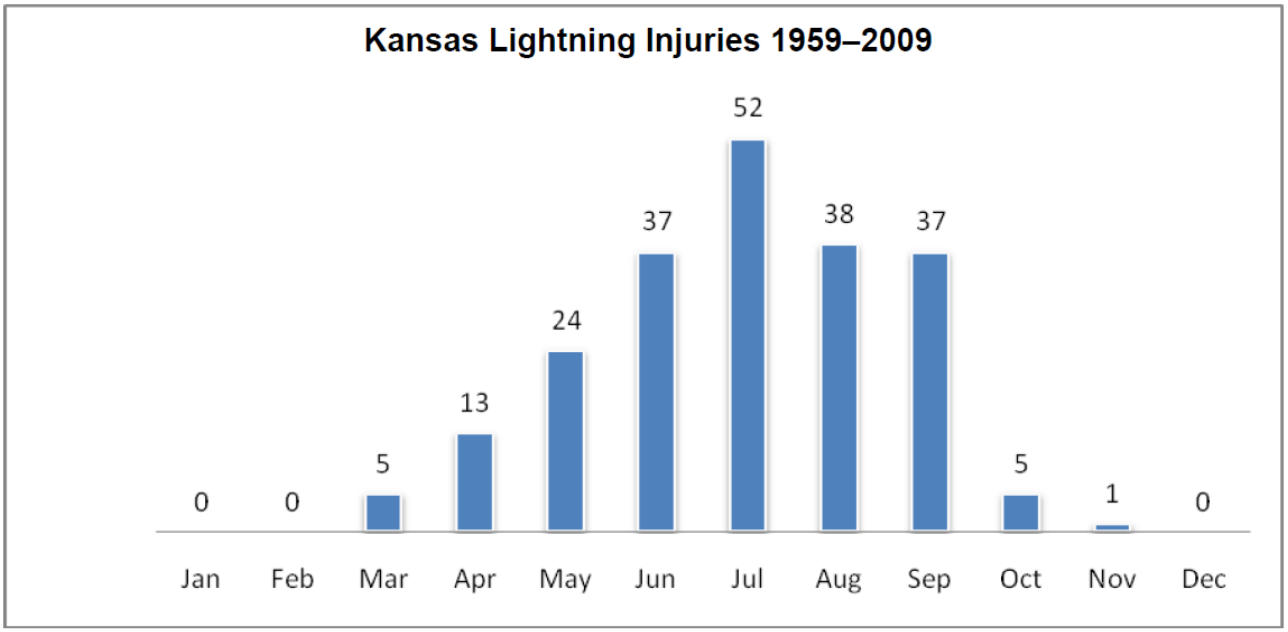
Information measured by the National Lightning Detection Network between 1996 and 2005 ranks Kansas 18th among the continental states in terms of cloud-to-ground flash densities with 851,520 flashes per year (10.4 flashes per square mile). According to the National Climatic Data Center Storm Events database, there were 334 lightning events in Kansas between 1993 and 2010 that resulted in fatality, injury, and/or property and crop damage (events that do not cause fatalities/injuries or damage are not reported). Total property and crop damage for these events is estimated at $20 million. There were eight deaths and 39 injuries in this time period.

Notable Lightning Events:

- August 27, 2009 - A rural home a few miles east of Arkansas City was destroyed by fire after being hit by lightning during the early morning hours. No one was injured. The Winfield Daily Courier contributed to this report**.**
- August 25, 2006 - A lightning strike set a 14-unit building on fire at Twin Lakes Apartment Complex. The fire destroyed the roof and top floors of the building. Fortunately, no one was injured from the blaze. Information courtesy of the Wichita Eagle.

Probability of Future Occurrences

This suggests that Kansas experiences an average of 19 damaging lightning events, $1.17 million in lightning-related losses, and two lightning-related injuries each year. Based on this data, there is roughly one death and four injuries as a result of lightning in Kansas per year, on average (based on 61 deaths and 197 injuries in a 48-year time period). Additionally, the National Weather Service reports two to eight flashes of lightning per square kilometer per year in south central Kansas. This hazard's CPRI probability is "highly likely" (event is probable within the calendar year).



Source: National Weather Service, NCDC, graph prepared by Bold Planning Solutions

In 2010, the Kansas Hazard Mitigation Committee reviewed all of the FEMA-approved local plans in the State of Kansas. The data gathered from the local plans in south central Kansas are shown below:

Local Plan Statistics for Lightning Events

County	Hazard Ranking	# of Events	Damages (Prop)	Damages (Crop)	Injuries	Fatalities
Butler	Moderate	4	$100,000.00	N/A	2	N/A
Cowley	High	8	$106,000.00	N/A	N/A	N/A
Harper	Low	2	N/A	N/A	1	N/A
Harvey	Moderate	9	$273,000.00	N/A	N/A	N/A
Kingman	Moderate	14	$50,000.00	N/A	N/A	N/A
Kiowa	Moderate	8	$158,776.00	$147,814.00	N/A	N/A
Marion	Moderate	N/A	N/A	N/A	N/A	N/A
Pratt	Low	N/A	N/A	N/A	N/A	N/A
Reno	Low	7	$146,000.00	N/A	1	N/A
Sedgwick	High	9	$2,300,000.00	N/A	3	2

Source: 2010 Kansas Hazard Mitigation Plan

Magnitude/Severity

Based on NCDC data, Kansas can expect approximately $1.3 million in lightning-related losses and two lightning related injuries each year. The eastern and central portions of the state are more likely to experience lightning impacts, but the entire state is susceptible. More injuries and deaths can be expected as a result of lightning strikes during the months of May-September, with the greatest risk to people outdoors for work or recreation. Risk to specific communications, power and warning infrastructure are best conducted on a facility-by-facility basis. This hazard's CPRI magnitude/severity is "moderate."

Calculated Priority Risk Index	Planning Significance
2.80	Moderate

20.5.5 Soil Erosion and Dust

Description

Soil erosion and dust are ongoing problems for Kansas. Both can cause significant loss of valuable agricultural soils, damage crops, harm environmental resources, and have adverse economic impacts. Soil erosion in Kansas is largely associated with periods of drought, when winds are able to move tremendous quantities of exposed dry soil (wind erosion), and flooding (stream bank erosion). Improper agricultural and grazing practices can also contribute to soil erosion.

The United States is losing soil 10 times faster than the natural replenishment rate, and related production losses cost the country about $37.6 billion each year. On average, wind erosion is responsible for about 40 percent of this loss and can increase markedly in drought years. Wind erosion physically removes the lighter, less dense soil constituents such as organic matter, clays and silts. These are the most fertile parts of the soil; their removal lowers soil productivity, resulting in lower crop yields or poorer grade pastures and increase economic costs.

Stream bank erosion, which can remove agricultural land and damage or destroy transportation systems and utility lines, occurs each year, particularly in the spring, and can occur along any stream bank. A large proportion of all eroded soil ends up in rivers, streams, and lakes, which makes waterways more prone to flooding and contamination. One type of stream bank erosion occurs after heavy rains when water is released from reservoirs causing water levels to rise in rivers and streams. The dry soil at the top of embankments becomes saturated. When reservoir gates are closed and flows return to normal, water levels suddenly drop and the heavy wet soil at the top of the embankments falls into the rivers and streams below.

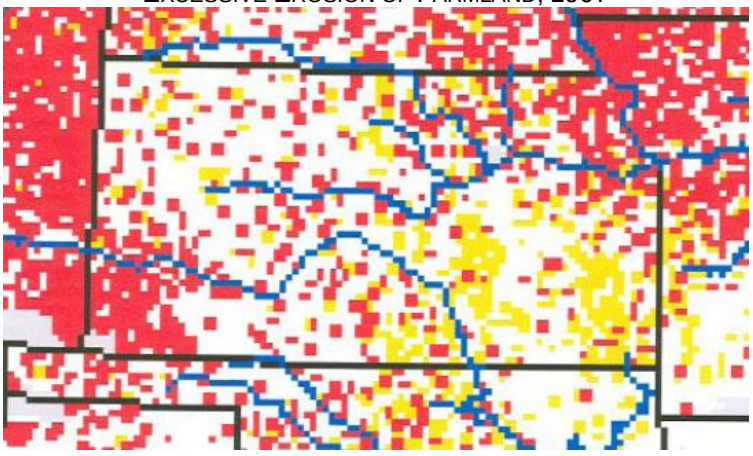
Erosion increases the amount of dust carried by wind. Dust can also cause economic impacts by reducing seedling survival and growth, increasing the susceptibility of plants to certain stressors, and damaging property and equipment (e.g., clogging machinery parts). It is also a threat to health and safety. Dust acts as an abrasive and air pollutant and carries about 20 human infectious disease organisms (including anthrax and tuberculosis). There is evidence that there is an association between dust and asthma.. Some studies indicate that as much as 20 percent of the incidence of asthma is related to dust. Blowing dust can be severe enough to necessitate highway closures because of low visibility, which can cause vehicle accidents.

Warning Time: More than 24 hours
Duration: More than one week

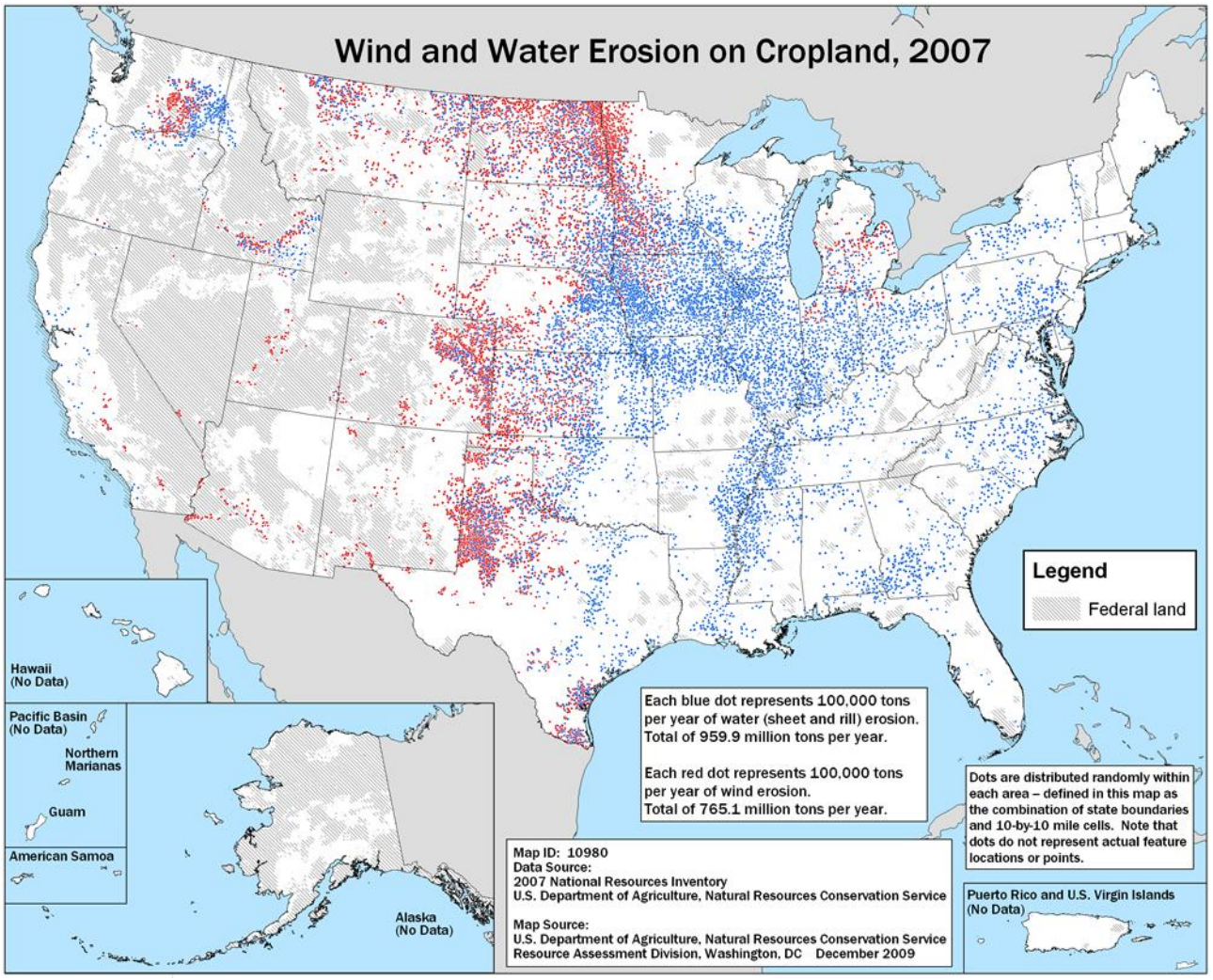
Geographic Location

The following map shows areas of excessive erosion of farmland in Kansas based on a 1997 analysis. Each red dot represents 5,000 acres of highly erosive land, and each yellow dot represents 5,000 acres of non-highly erosive land with excessive erosion above the tolerable soil erosion rate. South central Kansas generally has less highly erosive land with some sections of land that are considered highly erosive as well as non-highly erosive.

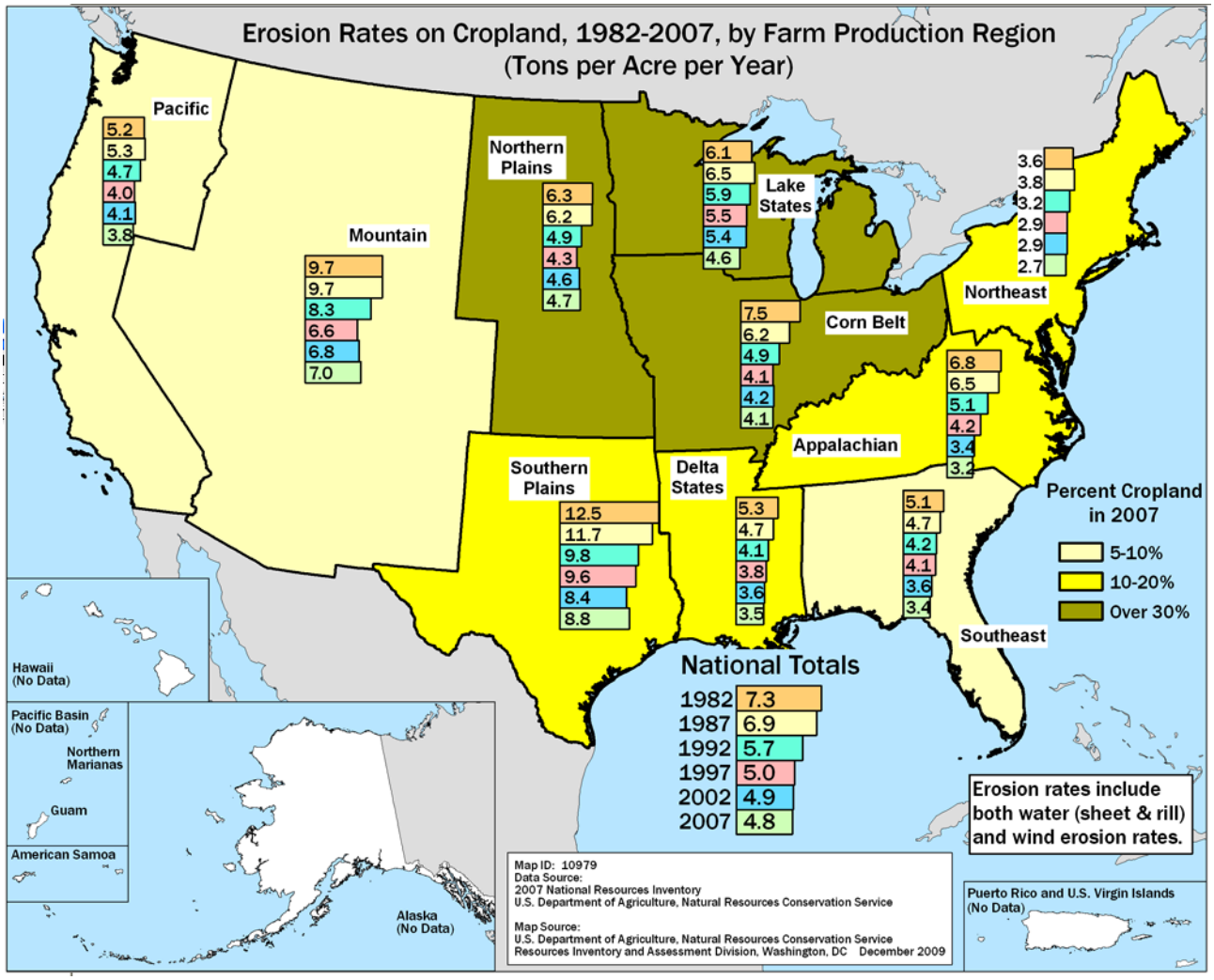
Excessive Erosion of Farmland, 1997



The U.S. Department of Agriculture Natural Resources Conservation Service (NCRS) report on soil erosion on cropland for 2007 indicates that while erosion appears to be reduced from the 1982 report, there is still considerable wind and water erosion effects on cropland as shown on the next two national maps. For Kansas, the western half of the state appears to have more wind erosion than the central and eastern portions.



According to the 2003 Natural Resources Inventory (NRI) by the Natural Resources Conservation Service, Kansas losses 55,211,000 tons of cropland (2.1 tons per acre) to water erosion and 35,449,000 tons (1.3 tons per acre) to wind erosion each year. The NRI also found that of the state's highly erodible cropland (8,100,700 acres, 31% of the state's cropland), 27% of it was eroding above soil loss tolerance rates. Additionally, 11% of the state's non-highly erodible cropland was eroding above soil loss tolerance rates. There were no reported events from the USGS for this hazard and no major events in the state.



In 2001, the Kansas Water Office completed a report that projected the affect of sedimentation on state-owned storage in federal reservoirs. By the year 2040, sedimentation was projected to reduce the total amount of state-owned storage from 1.2 million acre-feet to roughly 857,000 acre-feet, a rate of loss of 6,260 acre-feet per year.

Previous Occurrences

Kansas is well known for its role in the 1930s Dust Bowl, in which the Central Plains states suffered drought and resulting wind erosion for about a decade. It is estimated that 21.5 million acres were lost during this time. In the spring of 1996, wind erosion severely damaged agricultural land throughout the Great Plains.

Probability of Future Occurrences

While soil erosion and dust occur annually as part of natural processes, the adverse effects of erosion are only fully realized as a cumulative function. Therefore, the probability of notable effects from soil erosion and dust events is considered “possible,” meaning the cumulative effect of annual events reaches a notable level on the average of every five years.

Magnitude/Severity

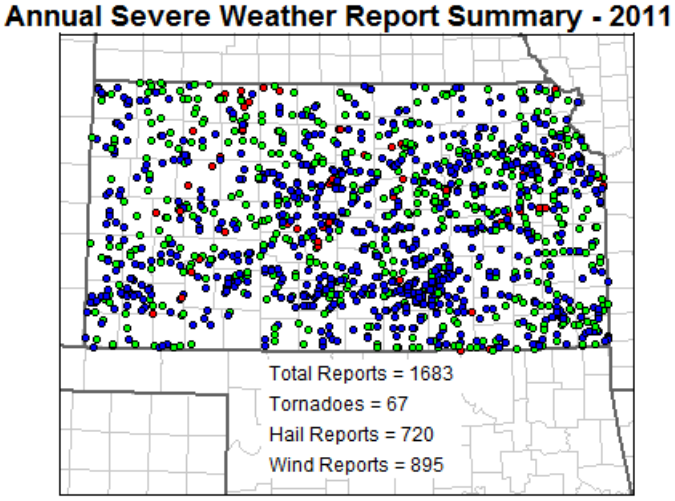
This hazard’s CPRI magnitude/severity is “negligible.”

Calculated Priority Risk Index	Planning Significance
1.75	Low

20.5.6 HAILSTORMS

Description

Hailstorms in Kansas cause damage to property, crops, and the environment and kill and injure livestock. Because of Kansas' large agricultural industry, crop damage and livestock losses due to hail are of great concern to the state. In the United States, hail causes more than $1 billion in damage to property and crops each year. Between 1989 and 2008, hurricanes and tropical storms made up 46.9% of total catastrophic losses, followed by tornado losses (27.0%), winter storms (7.6%), terrorism (6.9%), earthquakes and other geologic events (5.9%), wind/hail/flood (2.9%) and fire (2.4%).



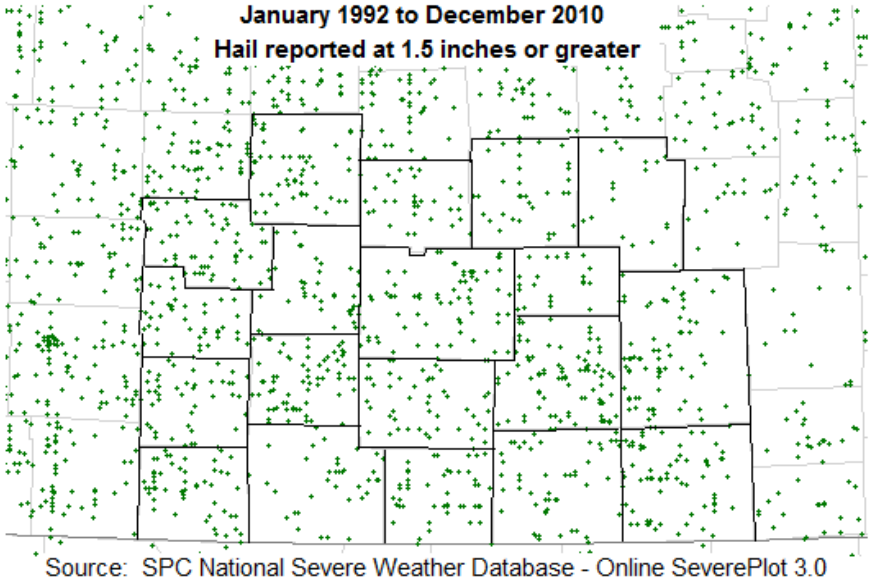
Civil disorders, water damage and utility services disruption combined represented less than 1%. Each year about 6% of homeowners file claims. Hail is associated with thunderstorms that can also bring high winds and tornadoes. It forms when updrafts carry raindrops into extremely cold areas of the atmosphere where they freeze into ice. Hail falls when it becomes heavy enough to overcome the strength of the updraft and is pulled by gravity toward the earth.

The map to the left shows reports of tornadoes (red), hail (green) and wind (blue) for 2011. *Source: National Oceanic and Atmospheric Administration (NOAA) National Weather Service's Storm Prediction Center.*

Warning Time: 12 to 24 hours
Duration: Less than 6 hours

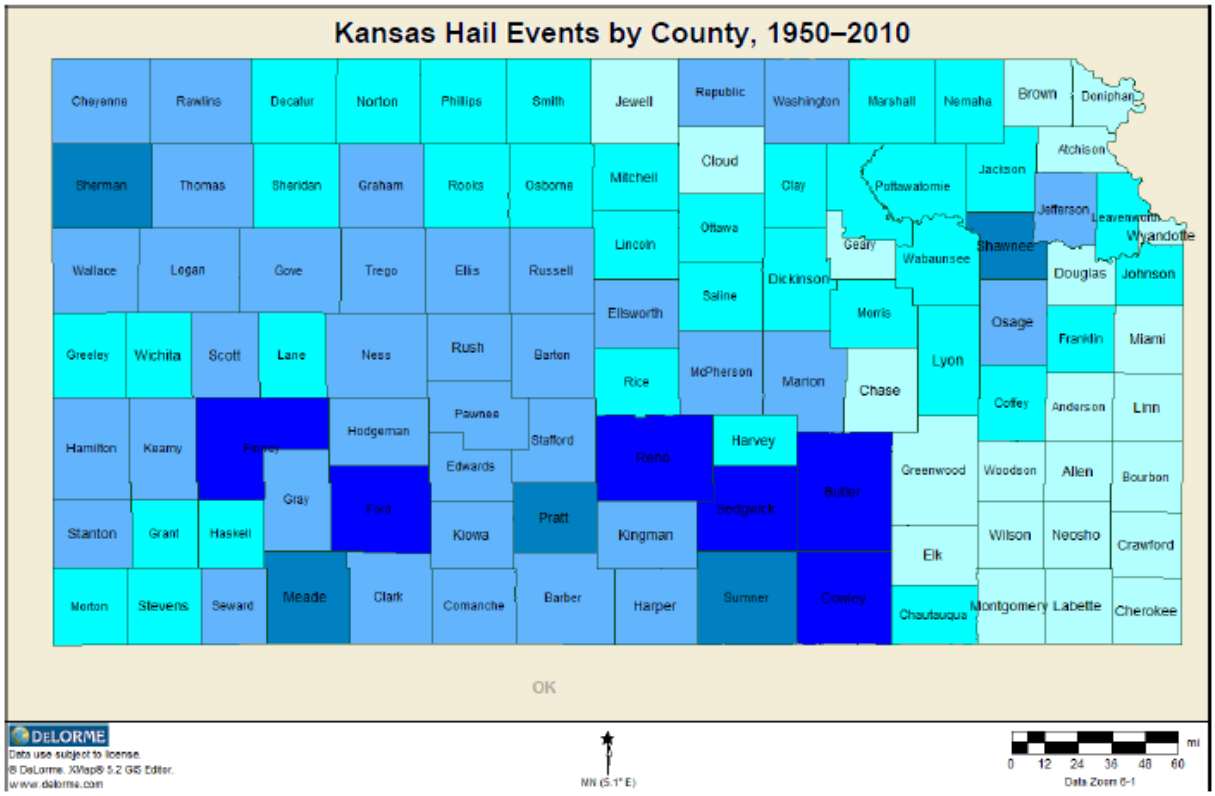
Geographic Location

Atmospheric conditions and weather patterns over long periods of time can suggest whether an area may be more likely to experience dryer than normal or moister than normal seasons. However, forecast reliability is unpredictable. The following map shows reported location of hail 1.5 inches in size and greater in south central Kansas.



Previous Occurrences

According to the National Climatic Data Center's (NCDC) Storm Events database, there were 15,772 hail events and 99 hail-related injuries, when hail was at least one inch in diameter, between 1950 and 2010.



Source: Bold Planning Solutions

452 – 550 Events	High Risk Rating	7 Counties
346 – 451 Events	Moderate Risk Rating	5 Counties
240 – 345 Events	Low Risk Rating	35 Counties
134 – 239 Events	Limited Risk Rating	23 Counties
28 – 133 Events	No Risk Rating	35 Counties

The events between 1950 and 2010 caused approximately $740.495 million in damage. This information suggests that Kansas could experience 263 one-inch-size hail events, $12 million in hail-related property and crop damage, and two hail-related injuries each year. (Data limitation: NCDC receives storm data from the National Weather Service (NWS), which receives information from a variety of sources, which include but are not limited to county, state, and federal emergency management officials, local law enforcement officials, Skywarn spotters, NWS damage surveys, newspaper clipping services, the insurance industry, and the general public. The hail events represent hail reports, not necessarily individual storms, and thus likely over count the actual number of hailstorms.)

Notable Hail Events

- September 15, 2010 – Two supercell thunderstorms left a destructive swath of very large hail across portions of Sedgwick County. The swath of hail was approximately 5 miles wide and 15 miles long, stretching from northwest of Goddard, Kansas through the western and southern half of Wichita, Kansas to near Rose Hill, Kansas. Hail as large as softball and grapefruit size pounded roofs and cars along its path with over 35,000 claims turned into insurance agencies. One hail stone fell in Southwest Wichita near 119th and Pawnee. It measured 7.75 inches in diameter (breaking the previous state record) and weighed 1.1 pounds 15 hours after the diameter was measured. A few

weak tornadoes were also produced, with all the tornadoes moving across open country. Total was estimated at $150 million from this storm event.

- July 20, 2009 – A supercell moved southeast across northern and eastern portions of Harper County, producing a swath of golf ball to baseball size hail and 60 to 70 mph winds from just east of Runnymede, southeast through the Danville and Freeport areas. A narrow swath of intense damage occurred, including uprooted trees, shattered car and building windows. At least three damaged irrigation systems, a damaged stock show trailer, structural and roof damage to several barns and homes, damage to various sheds and outbuildings, and devastating crop damage to soybeans, milo and corn occurred. Additionally, a camper trailer was thrown into a field near Danville, and a railroad crossing traffic barrier was blown down just east of Danville.
- April 24, 2006 – An early morning severe thunderstorm pounded western and central portions of Sedgwick County with destructive hail as large as three inches in diameter. Widespread property damage to automobiles, homes, and businesses was reported across the Wichita area. Damage was estimated at $70 million.

Probability of Future Occurrences

According to the National Climatic Data Center Storm Events database, there were 15,772 hail events in Kansas between 1955 and 2010 (55 years). Based on this information, the probability that at least one hail event could occur in Kansas in any given year is 100%. Kansas can expect approximately $13,463,545 million in hail-related losses each year. This hazard's CPRI probability is "**Highly Likely**" within the calendar year.

Magnitude/Severity

According to the 2010 Kansas Hazard Mitigation Plan, while every Kansas county is vulnerable to hail, only Sedgwick has a very high vulnerability. Johnson and Finney Counties have high vulnerabilities. The remainder of the counties, 97%, has moderate vulnerabilities.

Calculated Priority Risk Index	Planning Significance
2.80	Moderate

20.5.7 SNOW & ICE STORMS

Description

Winter storms in Kansas usually come in the form of heavy snow or freezing rain (ice storms). Regardless of the form they take, they can have significant impacts to the state and its residents for days, weeks, or months. They can immobilize a region, blocking roads and railways and closing airports, which can disrupt emergency and medical services, hamper the flow of supplies, and isolate homes and farms, possibly for days. Heavy snow can collapse roofs and knock down trees and power lines. Unprotected livestock may be lost. Economic impacts include cost of snow removal, damage repair, business and crop losses, and power failures. It is these impacts which are of greatest concern to Kansas.

A major winter storm can last for several days and be accompanied by high winds, freezing rain or sleet, heavy snowfall, and cold temperatures. The National Weather Service describes different types of winter storm events as follows:

- **Blizzard—**Winds of 35 mph or more with snow and blowing snow reducing visibility to less than 1/4 mile for at least three hours

- **Blowing Snow—**Wind-driven snow that reduces visibility, blowing snow may be falling snow and/or snow on the ground picked up by the wind

- **Snow Squalls—**Brief intense snow showers accompanied by strong, gusty winds, accumulation may be significant

- **Snow Showers**—Snow falling at varying intensities for brief periods of time, some accumulation is possible

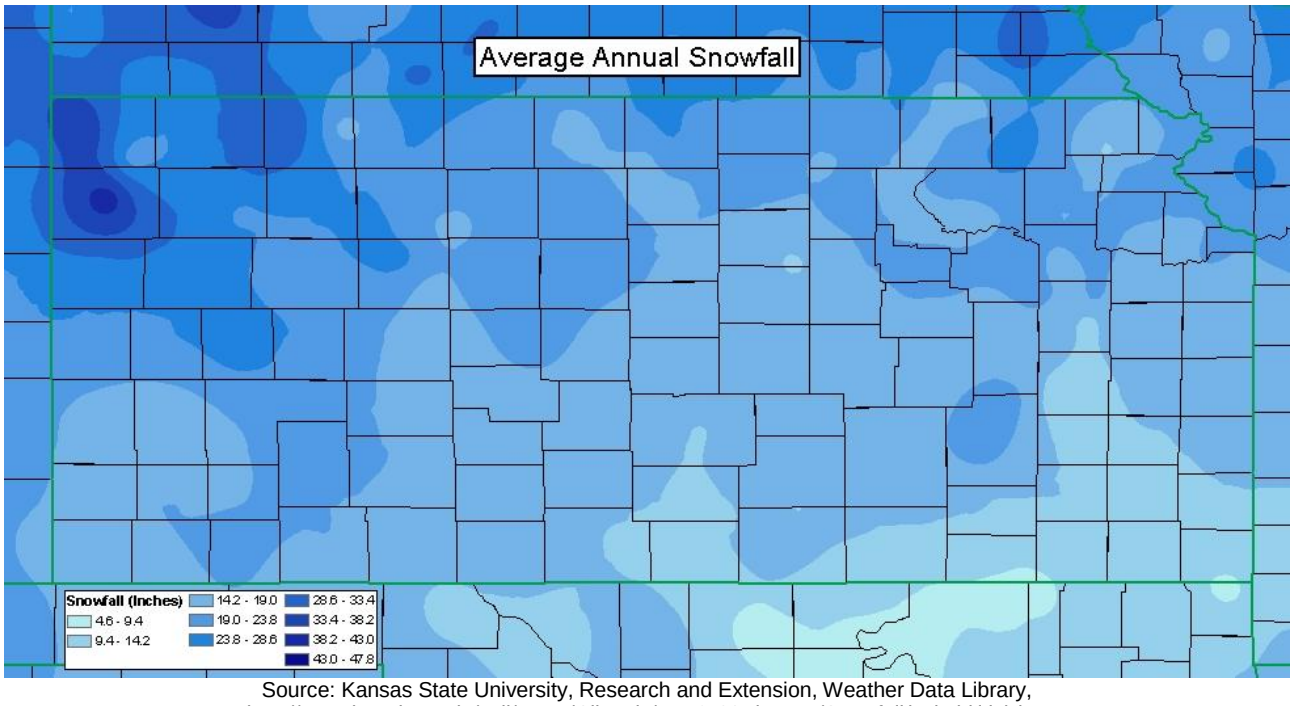
- **Freezing Rain—**Measurable rain that falls onto a surface whose temperature is below freezing. This causes it to freeze to surfaces, such as trees, cars, and roads, forming a coating or glaze of ice. Most freezing-rain events are short lived and occur near sunrise between the months of December and March.

- **Sleet—**Rain drops that freeze into ice pellets before reaching the ground, sleet usually bounces when hitting a surface and does not stick to objects Heavy accumulations of ice, often the result of freezing rain, can bring down trees, utility poles, and communications towers, and disrupt communications and power for days. Even small accumulations of ice can be extremely dangerous to motorists and pedestrians.

Warning Time: 12 to 24 hours
Duration: Less than one week

Geographic Location

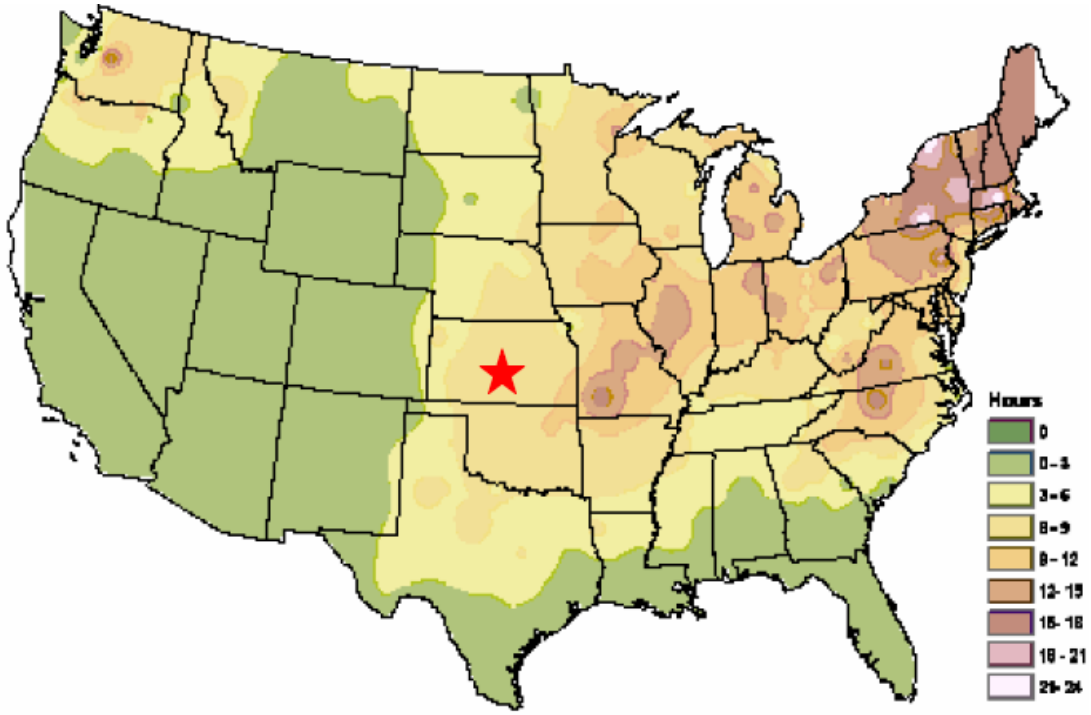
The entire State of Kansas is vulnerable to heavy snow and freezing rain. Northwestern Kansas receives the greatest average annual snowfall and the southeast receives the least The map on the following page shows the distribution of snowfall throughout the state.



Source: Kansas State University, Research and Extension, Weather Data Library, http://www.ksre.ksu.edu/wdl/Maps/Climatic/Map%20Pictures/Snowfall(color)(title).jpg

Conversely, freezing rains occurs most frequently in southeastern Kansas and least frequently in western Kansas. On this map, south central Kansas is shown to receive between 8-12 hours per year of freezing rain.

AVERAGE NUMBER OF HOURS PER YEAR WITH FREEZING RAIN IN THE UNITED STATES

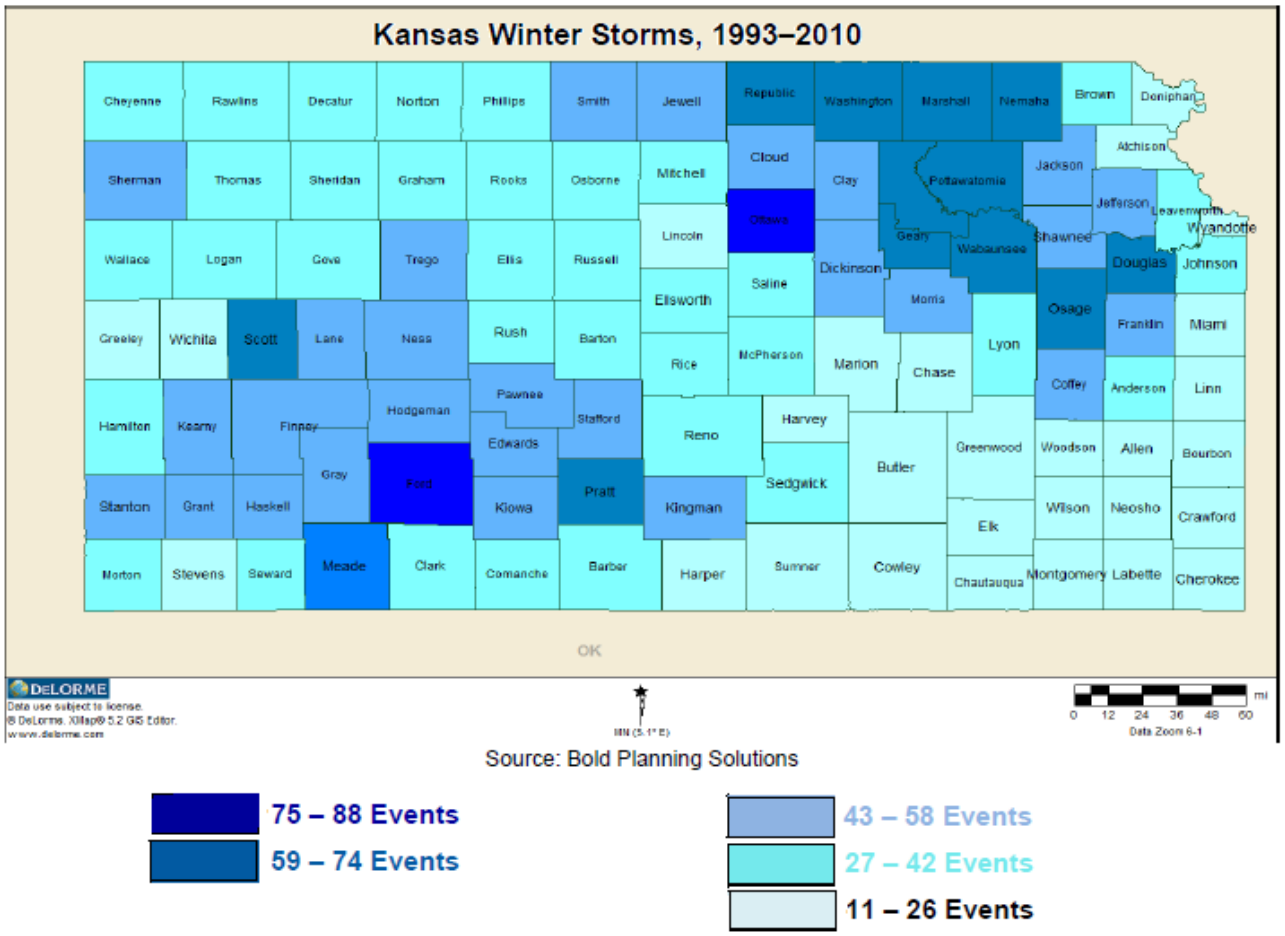


Source: American Meteorological Society. "Freezing Rain Events in the United States." http://ams.confex.com/ams/pdfpapers/71872.pdf.

Previous Occurrences

According to the National Climatic Data Center Storm Events database, there were 807 winter storms (snow and ice events) in Kansas between 1993 and 2010. Total property damage for these events is estimated at

just under $308 million. This suggests that Kansas experiences 47 winter storms and $18.1 million in winter storm losses each year. There were 47 deaths and 117 injuries in this time period, which averages out to approximately 3 deaths and 7 injuries each year.



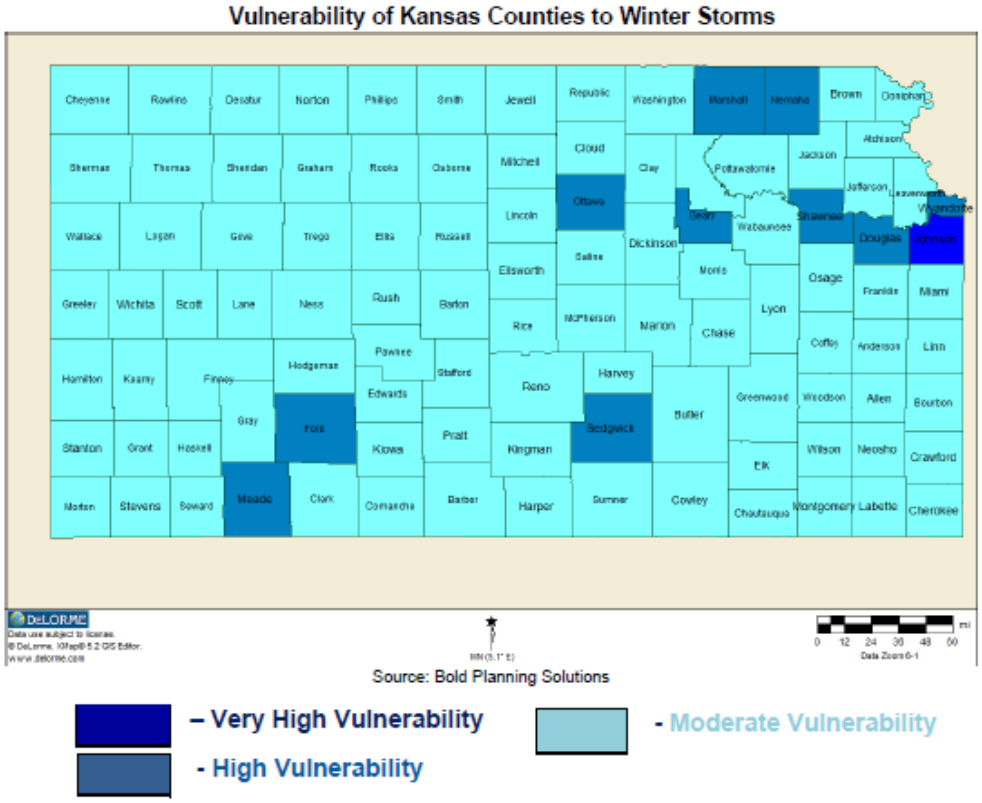
FEMA-1868-DR—December, 2009
On December 10, 2009, Governor Mark Parkinson requested a major disaster declaration because of a severe winter storm during the period of November 14-16, 2009. The governor requested a Declaration for Public Assistance for three counties and hazard mitigation statewide. During the period of December 1-5, 2009, joint federal, state, and local Preliminary Damage Assessments (PDAs) were conducted in the requested counties and are summarized below. PDAs estimate damages immediately after an event and are considered, along with several other factors, in determining whether a disaster is of such severity and magnitude that effective response is beyond the capabilities of the state and the affected local governments, and that federal assistance is necessary.

FEMA-1741-DR—February, 2008
On January 22, 2008, Governor Kathleen Sebelius requested a major disaster declaration because of severe winter storms during the period of December 6-19, 2007. The governor requested a Declaration for Public Assistance, including direct federal assistance, for 60 counties and hazard mitigation for all counties. Beginning on December 28, 2007, through January 16, 2008, joint federal, state, and local Preliminary Damage Assessments (PDAs) were conducted in the requested counties and are summarized below. PDAs estimate damages immediately after an event and are considered, along with several other factors, in determining whether a disaster is of such severity and magnitude that effective response is beyond the capabilities of the state and the affected local governments, and that federal assistance is necessary**.**

FEMA-1675-DR—December 28-31, 2006
A county sheriff and State Project Officer Cecily Jimenez inspected one of numerous communications towers that were knocked out during the winter snow and ice storms The storms left up to 30 inches of snow and 1/4 inch of ice on guide wires that brought several towers down. Affected Counties included: Cheyenne, Clark,

Comanche, Decatur, Edwards, Ellis, Finney, Ford, Gove, Graham, Grant, Gray, Greeley, Hamilton, Haskell, Hodgeman, Jewell, Kearny, Kiowa, Lane, Logan, Meade, Morton, Ness, Norton, Osborne, Pawnee, Phillips, Rawlins, Rooks, Rush, Russell, Scott, Seward, Sheridan, Sherman, Smith, Stafford, Stanton, Stevens, Thomas, Trego, Wallace, Wichita Counties.

FEMA-1579-DR—February 8, 2005 (January 4-6)
This was one of the worst ice storms on record to hit central, south-central, and southeast Kansas. Although freezing rain was the primary culprit, sleet also played a vital role in coating nearly the entire region with one-two inches of ice, which caused incredible damage to trees, power lines, and power poles. Roads and highways were blocked by tree debris and downed power poles and lines. Many areas were without power for more than a week. Between three and five inches of snow accumulated in Russell, Lincoln, and Saline Counties. The storm caused an estimated $30 million damage. Particularly hard hit were Butler and Sedgwick Counties, which sustained an estimated $8.5 million and $15 million damage, respectively. Three deaths were attributed to the storm.



Probability of Future Occurrences

According to the National Climatic Data Center Storm Events database, there were 807 winter storms (snow and ice events) in Kansas between 1993 and 2010 (17 years). Based on this information, the probability that at least one winter storm will occur in Kansas in any given year is 100%. Kansas can expect approximately $181 million in winter storm losses each year. This hazard's CPRI probability is "**Highly Likely**" within a calendar year.

Magnitude/Severity

After reviewing the data from the local plans throughout the State of Kansas the Kansas Hazard Mitigation Committee calculated averages for winter storms, as shown in the table below. The state can expect an average of $357,948 in damages from a single winter storm event. This hazard's CPRI magnitude/severity is "critical."

Calculated Priority Risk Index	Planning Significance
3.30	High

20.5.8 WINDSTORMS

Relatively frequent strong winds are a weather characteristic of Kansas. High winds, often accompanying severe thunderstorms, can cause significant property and crop damage, threaten public safety, and have adverse economic impacts from business closures and power loss. Straight-line winds are generally any thunderstorm wind that is not associated with rotation (i.e., is not a tornado). It is these winds, which can exceed 100 mph that represent the most common type of severe weather and are responsible for most wind damage related to thunderstorms.

Since thunderstorms do not have narrow tracks like tornadoes, the associated wind damage can be extensive and affect entire (and multiple) counties. Objects like trees, barns, outbuildings, high-profile vehicles, and power lines/poles can be toppled or destroyed, and roofs, windows, and homes can be damaged as wind speeds increase. In 2005, hail and wind damage made up 45% of homeowners' insurance losses. One type of straight-line wind is the downburst, which can cause damage equivalent to a strong tornado and can be extremely dangerous to aviation.

Thunderstorms over Kansas typically happen between late April and early September, but, given the right conditions, they can develop as early as March. They are usually produced by supercell thunderstorms or a line of thunderstorms that typically develop on hot and humid days.

Location

The following map shows the wind zones of the United States based on maximum wind speeds; Kansas is located within wind zones III and IV, the highest inland categories. South central Kansas is located within zone IV which is the highest rating.

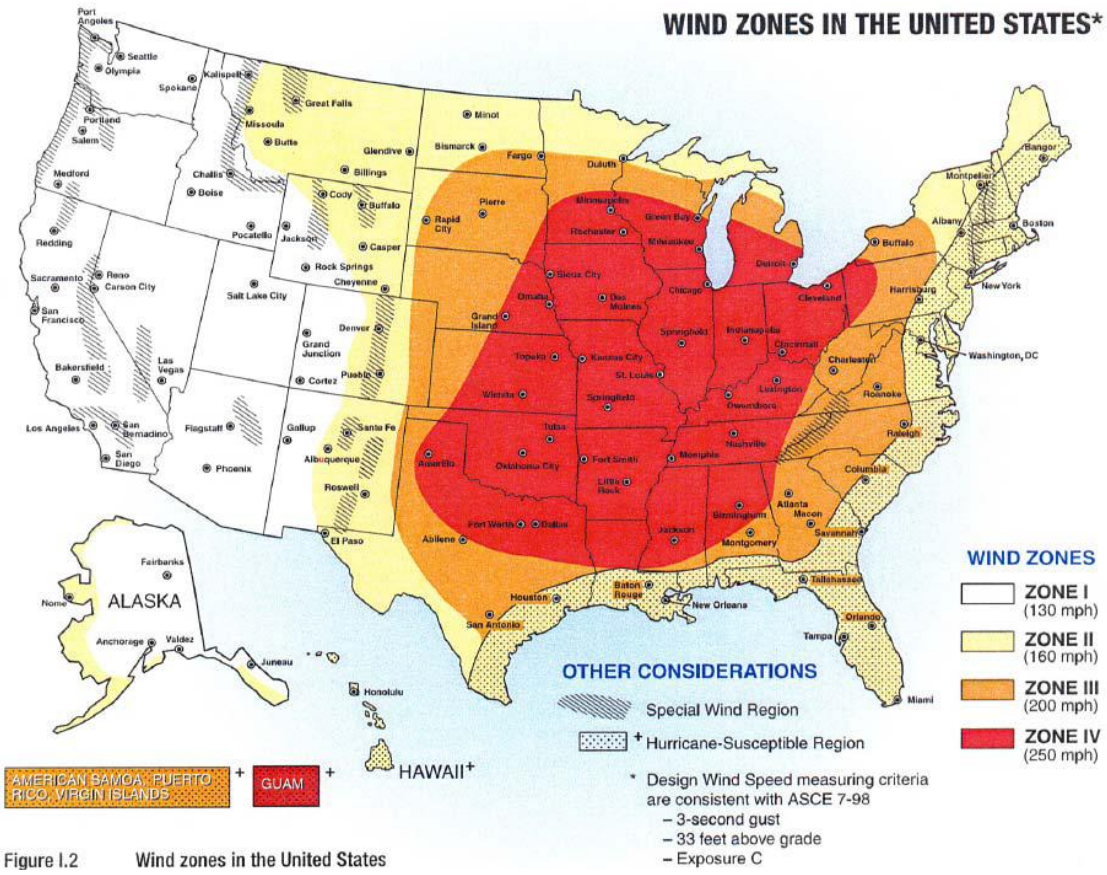
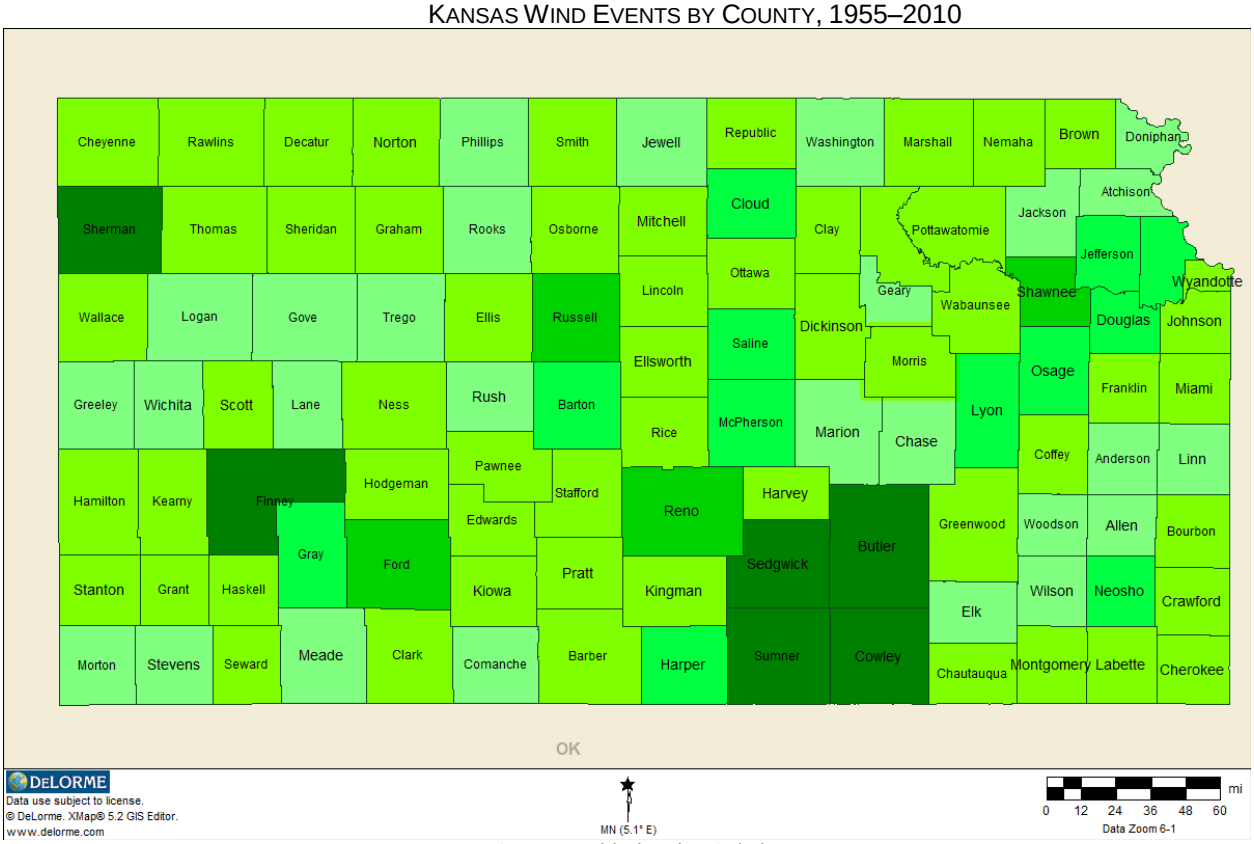


Figure I.2 Wind zones in the United States

Straight-line winds are generally any thunderstorm wind that is not associated with rotation (i.e., is not a tornado). It is these winds, which can exceed 100 mph that represent the most common type of severe weather and are responsible for most wind damage related to thunderstorms.

KANSAS WIND EVENTS BY COUNTY, 1955–2010



Source: Bold Planning Solutions

- 304 – 374 Events
- 230 – 303 Events
- 156 – 229 Events
- 82 – 155 Events
- 0 – 44 Events

PAST OCCURRENCES

- May 8, 2009 - A large swatch of damaging winds moved across the area from Benton to Rosalia including the city of El Dorado with winds measured at 80 mph at the Jefferson Elementary School in El Dorado. Numerous large trees were knocked down in Benton, with a mobile home trailer rolled over east of town. The damaging winds destroyed the historic stone silo bearing the name of the town of Towanda. The damaging winds estimated at 70 to 80 mph moved into El Dorado damaging roofs to numerous businesses in downtown and knocking down numerous large trees. Two or three schools in El Dorado had their roofs partially peeled off. The refinery in El Dorado had some large storage tanks dented. The damaging winds continued to move east downing almost every one of the large transmission lines along US 54 highway from El Dorado to Rosalia.
- August 19, 2005—The severe thunderstorms that brought a tornado to Great Bend were also packed with 75-80 mph winds, which caused an estimated $5 million in damage in and around the city. Many buildings sustained major roof and structural damage. Numerous vehicles sustained smashed or shattered windows. Twelve people were injured. Wind damage in McPherson County was estimated at $150,000.
- July 3, 2005—Severe thunderstorms struck central and south-central Kansas. Winds between 70 and 100 mph caused extensive damage at Cheney Lake State Park, where the marina, around 125

boats, and 35 campers and mobile homes were either heavily damaged or destroyed. One person was killed when his boat overturned; six others were injured. Estimated damage from these storms was $2 million to property and $12.5 million to agriculture. The governor issued a state of disaster emergency for Reno County. In Harper County, a few buildings were unroofed in Bluff City by winds estimated around 85 mph.

- April 23, 2004—Strong winds in excess of 60 mph caused significant damage over Harper County. Three people were injured when the Historic Fairground Barn collapsed.
- August 11, 2003—A pair of severe thunderstorms struck south-central Kansas. The first left thousands of residents without power in the Wichita area after 70-80 mph winds snapped power poles. The area hardest hit by the second storm was El Dorado Lake, where winds estimated at 70-80 mph caused two minor injuries at the campgrounds along with wind damage to the marina docks. The storm continued to produce straight-line wind damage as it tracked across Cowley County.
- July 10, 2003—Straight-line winds from a downburst occurred near the Wichita Greyhound Park north of Wichita. Portions of the roof were peeled off, numerous vehicles were damaged, and power lines were blown down. Significant wind damage also occurred around El Dorado, where trees and power lines were blown down and shingles were blown off a Pizza Hut. Another long swath of wind damage started near Douglass and continued through Atlanta and on into southeast Kansas. A hangar was blown over at the airport in Eureka, and considerable tree damage was observed around Independence.
- August 13, 2002—Winds up to 100 mph impacted northern Reno County. In Nickerson, many trees were knocked down, some sheds were damaged or destroyed, and power was lost in the city. In South Hutchinson, 25 train box cars were blown over, three mobile homes were destroyed, several homes lost their roofs, and several large trees were snapped or uprooted.
- March 9, 2002—Winds in south-central Kansas gusted up to 87 mph in Cowley County. Large power poles were knocked down and a semi was overturned on the Kansas Turnpike in Butler County. Significant wind damage occurred in Coffeyville in Montgomery County. A large section of roof was blown off a church onto an adjacent building, and part of a stadium was damaged. A few downtown buildings also had windows broken as a result of the strong wind gusts.
- April 11, 2001—There were no thunderstorms to be found as mostly sunny skies prevailed. Still, $750,000 in damage occurred in central and south-central Kansas as an unusually strong area of low pressure brought prolonged wind gusts reaching 65 mph. Two people were injured as a result of these winds.

STORM LOSSES

Since thunderstorms do not have narrow tracks like tornadoes, the associated wind damage can be extensive and affect entire (and multiple) counties. Objects like trees, barns, outbuildings, high profile vehicles, and power lines/poles can be toppled or destroyed, and roofs, windows, and homes can be damaged as wind speeds increase. In 2005, hail and wind damage made up 45 percent of homeowners insurance losses. One type of straight-line wind is the downburst, which can cause damage equivalent to a strong tornado and can be extremely dangerous to aviation.

Estimated storm loss data consist of windstorm, tornado and hail damage or other weather-related claim losses for insured real and personal property in Kansas reported for each calendar year and monthly during the calendar year. No other insured perils are included in the data.

The data shown below includes only estimated storm losses reported at the request of the Insurance Commissioner by the private insurance companies selling and servicing property insurance coverage in Kansas. (Kansas Insurance Department)

Kansas Estimated Storm Losses*		
Year	**No. Storm Claims**	**Estimated Storm Losses***
1996	46,150	$100,000,000
1997	53,600	$87,950,300
1998	30,250	$103,700,000
1999	80,925	$350,000,000
2000	35,344	$118,000,000
2001	103,149	$256,700,000
2002	82,872	$248,800,000
2003	63,778	$275,000,000
2004	50,250	$199,550,000
2005	63,875	$184,000,000
2006	133,285	$394,287,000
2007	32,290	$325,100,000
2008	131,485	$595,800,000
2009	137,400	$602,000,000
2010	94,400	$370,000,000

***Estimated** storm loss data consist of windstorm, tornado, and hail damage or other weather-related claim losses for insured real and personal property in Kansas reported for each calendar year and monthly during the calendar year. Estimated flood losses and other insured perils **are not** included in the data. The data include only **estimated** storm losses reported at the request of the Insurance Commissioner by the private insurance companies selling and servicing property insurance coverage in Kansas.

There is no Kansas state law requiring the collection of the storm loss data. This reporting of **estimated** insured storm losses is a service provided by the Insurance Commissioner to the insuring public and news media.

Estimated storm loss data are collected from insurance companies by the Commissioner, usually on a monthly basis and through special calls to report particularly significant tornado damage in cities, counties, or other affected areas. Data are reported to the public through news releases and on the website.

20.6 DROUGHT

Drought is generally defined as a condition of moisture levels significantly below normal for an extended period of time over a large area that adversely affects plants, animal life, and humans. It can also be defined in terms of meteorology, agriculture, and hydrology. Although drought is not predictable, long-range outlooks may indicate an increased chance of drought, which can serve as a warning (P.L. 109-430 established a National Integrated Drought Information System within the National Oceanic and Atmospheric Administration to improve drought monitoring and forecasting capabilities). A drought period can last for months, years, or even decades. It is rarely a direct cause of death, though the associated heat, dust, and stress can all contribute to increased mortality.

Each year, an estimated 18% of the United States is impacted by drought and the nation incurs an estimated $6 to $8 billion in drought-related losses. The 1988–89 drought damage was estimated at $40 billion nationally. It is believed, that the drought in the 1930s could have exceeded this damage level.

Periods of drought are normal occurrences in all parts of Kansas. Drought in Kansas is caused by severely inadequate amounts of precipitation that adversely affect farming and ranching, surface and ground water supplies, and uses of surface waters for navigation and recreation. Because of these impacts, drought can have significant economic and environmental impacts. Drought can also create favorable conditions for wildfires and wind erosion.

According to the United States Geological Survey (USGS), five droughts were identified for the State of Kansas that has directly or indirectly impacted south central Kansas. The following information is provided by the USGS on each of these drought periods:

1929-42: Regional in scale and affected many of the Midwestern/Western States. The recurrence interval was greater than 25 years throughout Kansas. Although the number of stream flow records long enough to include the entire drought was insufficient, data from adjoining States confirmed the severity. Agricultural losses during the **1929-41** droughts were extreme, many farms abandoned.

1952-57: This drought also was regional with a recurrence interval greater than 25 years statewide except in the Big Blue River Basin, where the recurrence interval was 10-25 years. Because of its severity and areal extent, the drought of **1952-57** is used as the base period for studies of reservoir yields in Kansas.

1962-72: Regional drought duration varied considerably across the State. Many of the stream flow records indicated alternating less-than-average and greater-than-average flows, whereas others indicated a steady deficit throughout the entire period. Similarly, the drought of **1974-82** appeared to be a series of relatively short-duration droughts at several gauging stations but sustained or long-term droughts at others.

1962-72: This drought recurrence interval generally was greater than 25 years. However, in parts of the northwestern, northeastern, southern, and southeastern areas of the State, recurrence intervals were 10-25 years. The recurrence interval of the **1974-82** droughts was greater than 25 years in the north-central and southeastern parts but was between 10 and 25 years across the remaining eastern two-thirds of the State.

1988: The severity of this drought varied across the State. The drought was most severe in the southwestern, central, and northeastern parts of the State but minimal in the northwestern and southeastern parts. At the beginning of the drought, reservoir storage was near or above average; hence, surface-water supplies were sufficient to meet demands through the end of water year 1988. Rainfall during the period generally was less than 50 percent of the long-term average, and quantities were insufficient to maintain soil moisture or contribute to ground-water supplies. The decreased soil moisture resulted in considerable damage to maturing grain crops, decreased the growth of forage grasses, and threatened the germination of the winter wheat crop. Estimated losses to 1988 crops resulting from the effects of the drought were $1 billion (Wichita Eagle and Beacon, June 7, 1989). Water levels in the shallow aquifers declined rapidly, which resulted in the abandonment of many domestic water wells. At the end of 1988, the effects of the drought

were continuing to worsen. As a result, State and local officials were considering measures to decrease water use and were requesting financial relief for the agricultural industry.

The following is a summary of county-level drought stage declarations by the governor for 2003-2007. It uses a simple stage and frequency point scheme to try to compare the incidence of drought among counties in South Central Kansas during this five-year period. Five seasons is too short a period of record to base any conclusions on other than to say the northwest counties have seen the most severe drought conditions over this period, while the east central counties have experienced the least severe conditions.

DROUGHT STAGE DECLARATIONS 2003-2007

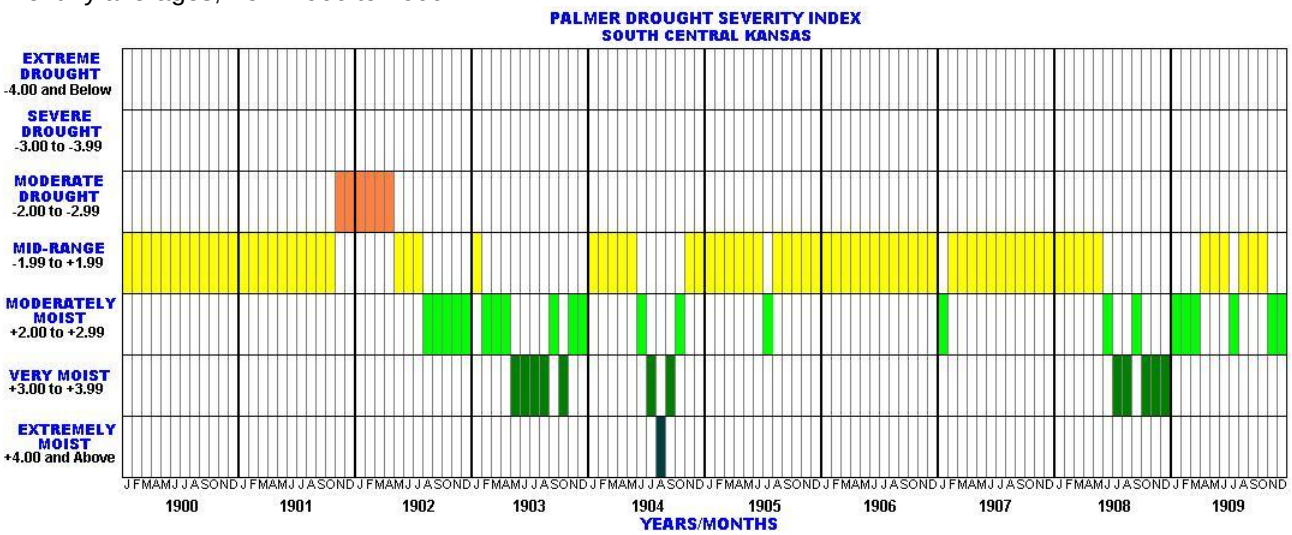
County	Number of Times Declared*			
	Watch	Warning	Emergency	Total
South Central Climate Division				
Barber	2	5	0	7
Comanche	2	5	0	7
Edwards	1	5	0	6
Harper	2	5	0	7
Harvey	2	4	0	6
Kingman	3	4	0	7
Kiowa	2	5	0	7
Pawnee	1	5	0	6
Pratt	2	5	0	7
Reno	2	4	0	6
Sedgwick	2	4	0	6
Stafford	3	4	0	7
Sumner	2	5	0	7

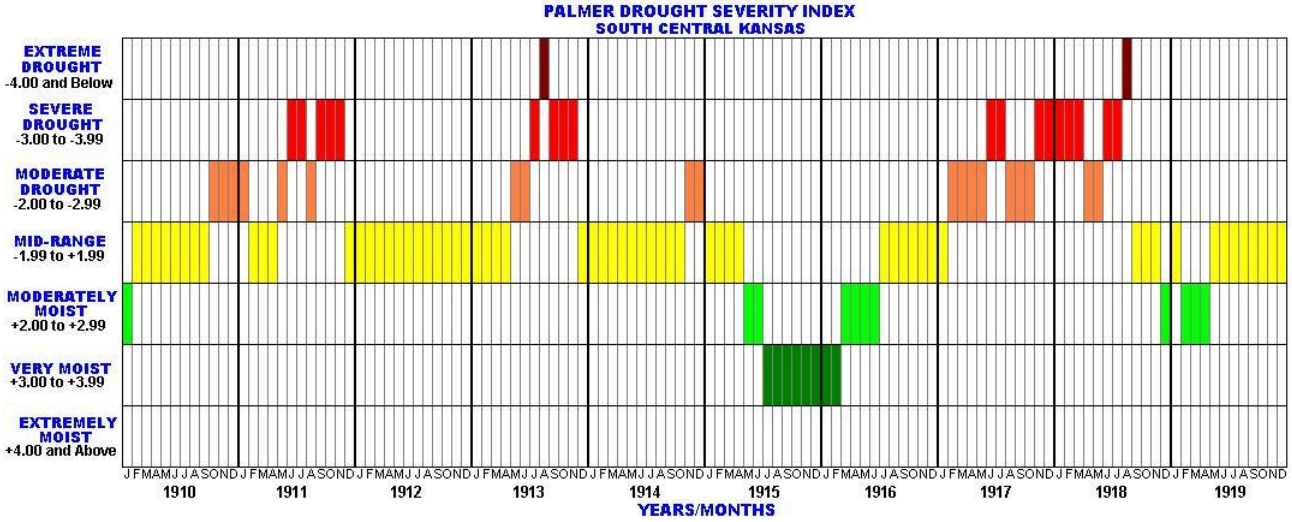
Source: Kansas Water Office

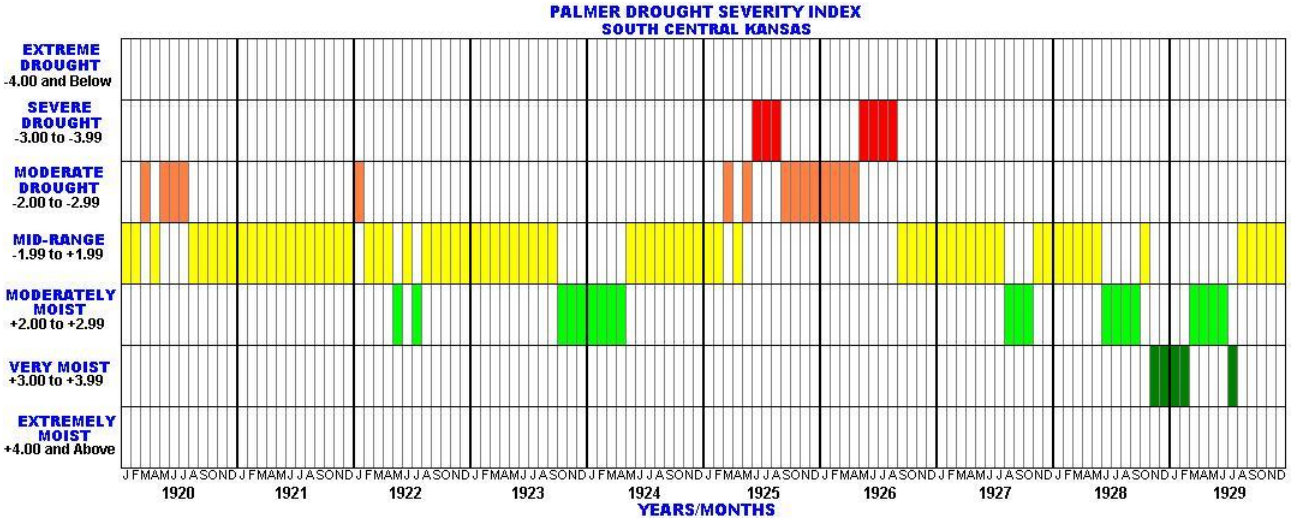
** By Governor's Executive Order (03-15, 03-16, 03-18, 03-19, 03-22, 04-08, 04-09, 06-03, 06-04, 06-09, 07-04, and 07-13) per guidelines approved by the Kansas Water Authority on April 10, 2003. Declarations were not assumed to carry-over from one year to the next, regardless of whether they were formally rescinded or not. The maximum total number of declarations is 9.*

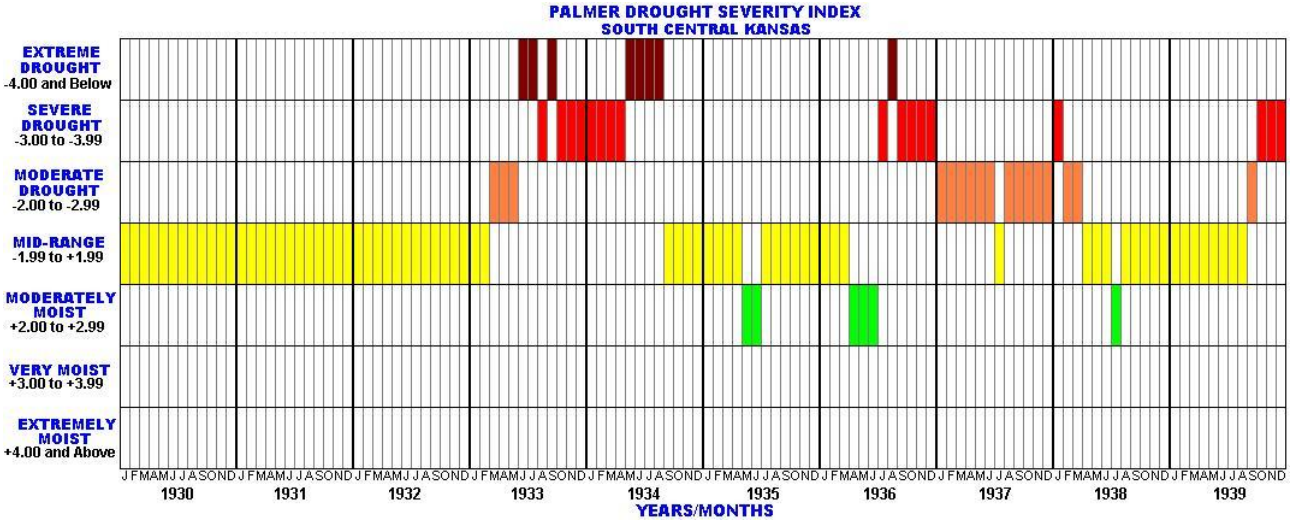
PALMER DROUGHT INDEX

The following Historic Palmer Drought Indices tables were derived from the National Oceanic and Atmospheric Administration – National Climatic Data Center for south central Kansas and are shown with monthly averages, from 1900 to 2009:




PALMER DROUGHT SEVERITY INDEX
SOUTH CENTRAL KANSAS
EXTREME DROUGHT -4.00 and Below
SEVERE DROUGHT -3.00 to -3.99
MODERATE DROUGHT -2.00 to -2.99
MID-RANGE -1.99 to +1.99
MODERATELY MOIST +2.00 to +2.99
VERY MOIST +3.00 to +3.99
EXTREMELY MOIST +4.00 and Above
J F M A M J J A S O N D J F M A M J J A S O N D J F M A M J J A S O N D J F M A M J J A S O N D J F M A M J J A S O N D J F M A M J J A S O N D J F M A M J J A S O N D J F M A M J J A S O N D J F M A M J J A S O N D J F M A M J J A S O N D
1910 1911 1912 1913 1914 1915 1916 1917 1918 1919
YEARS/MONTHS


PALMER DROUGHT SEVERITY INDEX
SOUTH CENTRAL KANSAS
EXTREME DROUGHT -4.00 and Below
SEVERE DROUGHT -3.00 to -3.99
MODERATE DROUGHT -2.00 to -2.99
MID-RANGE -1.99 to +1.99
MODERATELY MOIST +2.00 to +2.99
VERY MOIST +3.00 to +3.99
EXTREMELY MOIST +4.00 and Above
J F M A M J J A S O N D J F M A M J J A S O N D J F M A M J J A S O N D J F M A M J J A S O N D J F M A M J J A S O N D J F M A M J J A S O N D J F M A M J J A S O N D J F M A M J J A S O N D J F M A M J J A S O N D
1920 1921 1922 1923 1924 1925 1926 1927 1928 1929
YEARS/MONTHS


PALMER DROUGHT SEVERITY INDEX
SOUTH CENTRAL KANSAS
EXTREME DROUGHT -4.00 and Below
SEVERE DROUGHT -3.00 to -3.99
MODERATE DROUGHT -2.00 to -2.99
MID-RANGE -1.99 to +1.99
MODERATELY MOIST +2.00 to +2.99
VERY MOIST +3.00 to +3.99
EXTREMELY MOIST +4.00 and Above
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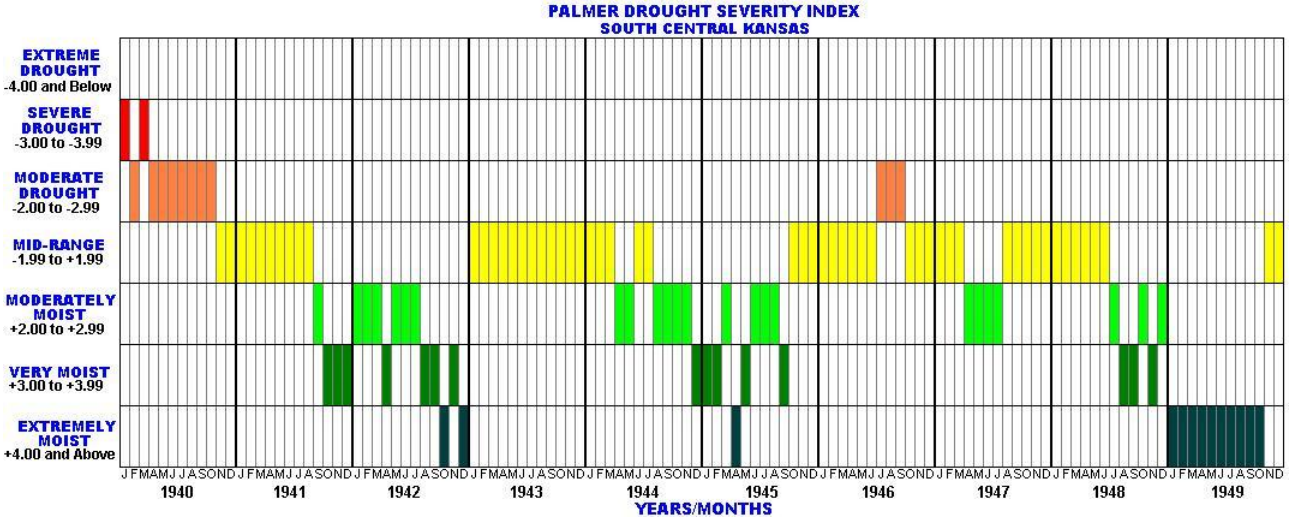
PALMER DROUGHT SEVERITY INDEX
SOUTH CENTRAL KANSAS
EXTREME DROUGHT -4.00 and Below
SEVERE DROUGHT -3.00 to -3.99
MODERATE DROUGHT -2.00 to -2.99
MID-RANGE -1.99 to +1.99
MODERATELY MOIST +2.00 to +2.99
VERY MOIST +3.00 to +3.99
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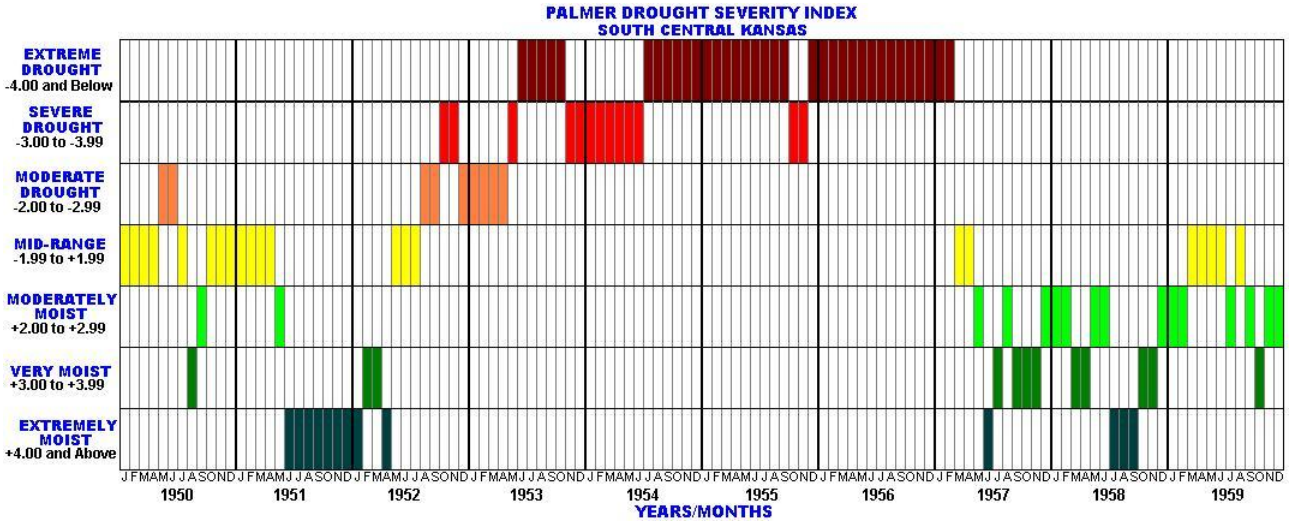
PALMER DROUGHT SEVERITY INDEX
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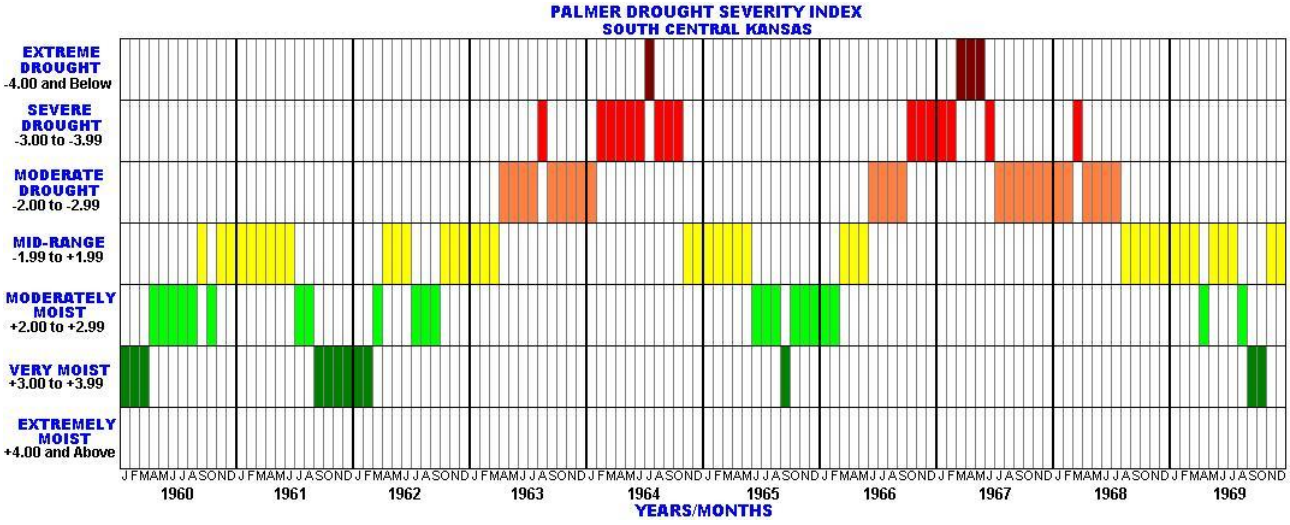
YEARS/MONTHS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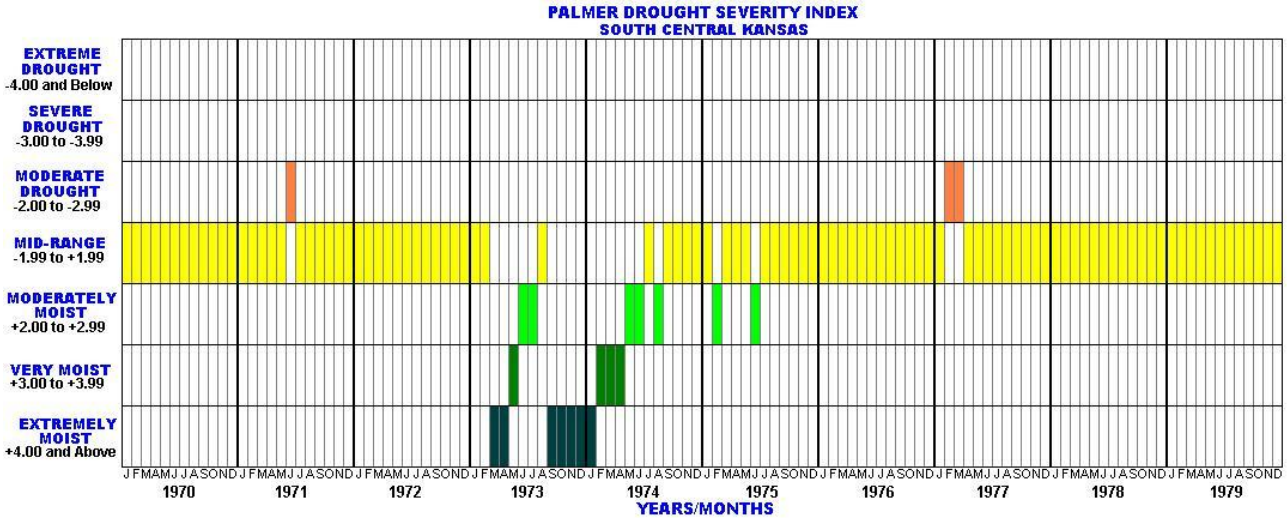
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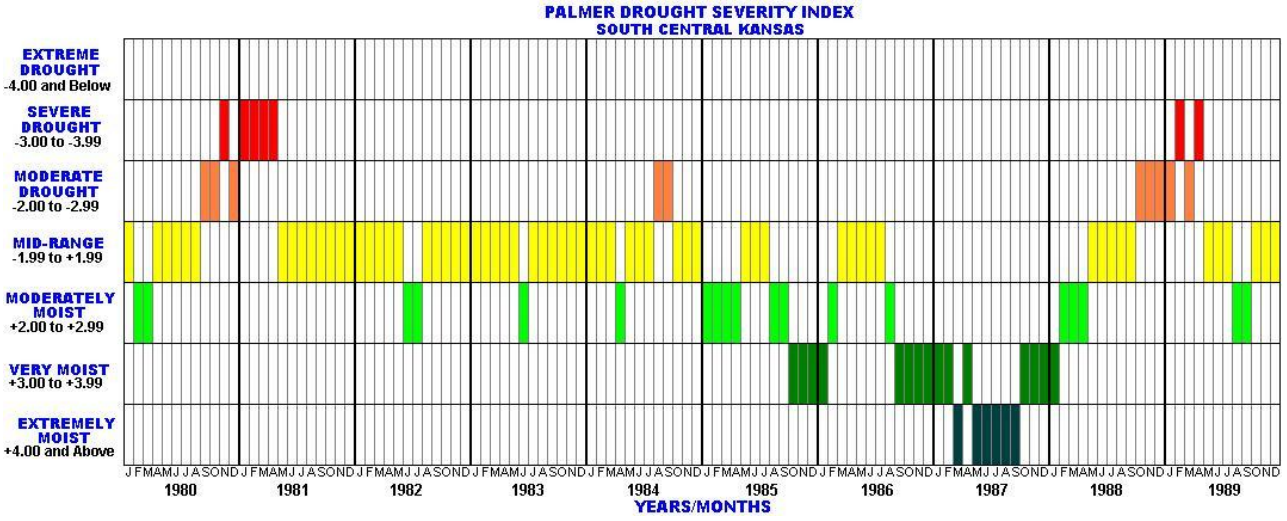
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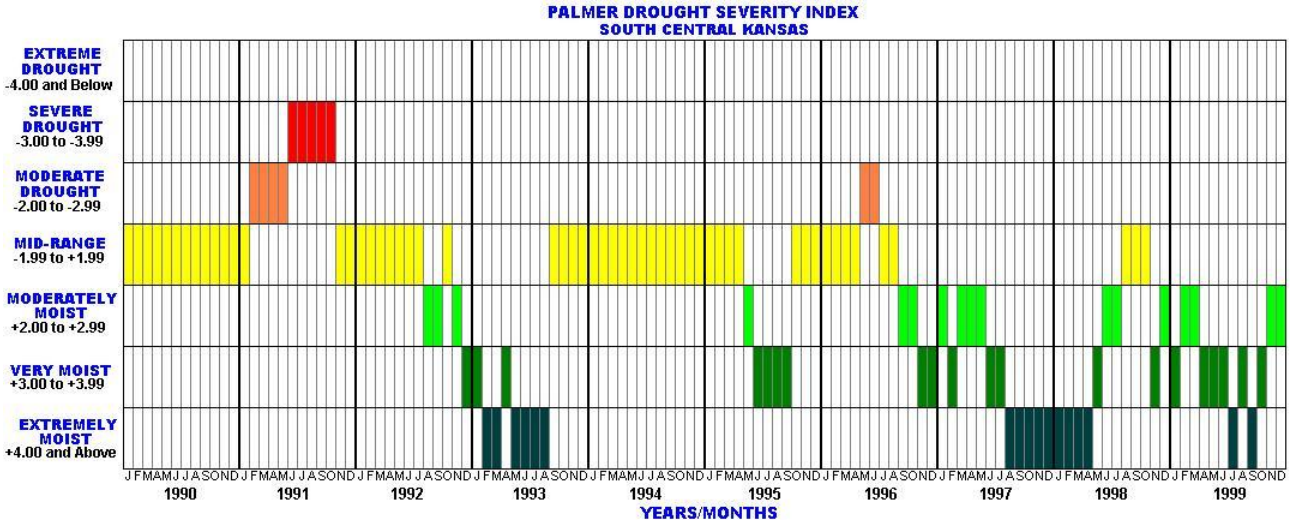
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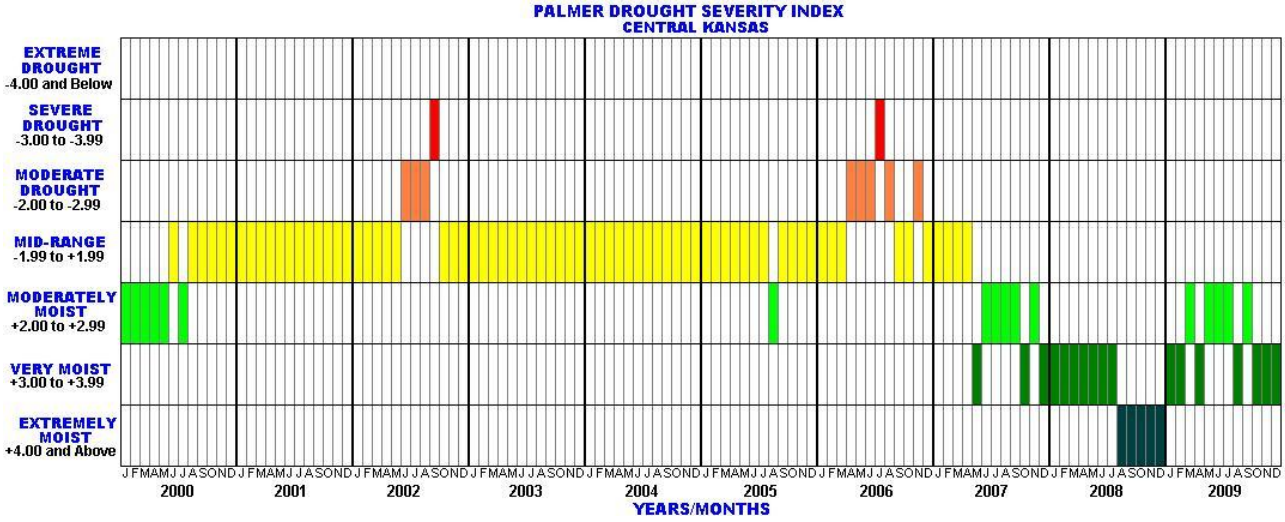
YEARS/MONTHS



The following table shows the National Oceanic and Atmospheric Administration's National Climatic Data Center Palmer Drought Severity Index from January 1, 1900 through December 31, 2009 with the number of monthly occurrences shown with moisture content:

PALMER DROUGHT SEVERITY INDEX
NUMBER OF MONTHS PER DECADE

DECADES	EXTREME DROUGHT -4.00 and Above	SEVERE DROUGHT -3.00 TO -3.99	MODERATE DROUGHT -2.00 TO -2.99	MID-RANGE -1.99 TO +1.99	MODERATELY MOIST +2.00 TO +2.99	VERY MOIST +3.00 TO +3.99	EXTREMELY MOIST +4.00 and Above
1900 to 1909	0	0	10	62	33	10	6
1910 to 1919	1	16	21	62	5	7	8
1920 to 1929	0	2	6	96	14	8	0
1930 to 1939	41	23	17	38	0	0	0
1940 to 1949	7	3	5	61	20	16	7
1950 to 1959	28	15	17	17	14	14	15
1960 to 1969	0	11	19	47	25	18	1
1970 to 1979	0	0	0	86	16	4	14
1980 to 1989	3	18	10	41	28	18	2
1990 to 1999	0	4	11	41	19	18	26
2000 to 2009	0	2	8	71	17	17	5

REGULATORY

The Kansas Emergency Management Act (K.S.A. 48-924) states that the Governor shall be responsible for meeting the dangers to the state and people presented by disasters, and that the Governor may declare a state of drought for specific areas or communities, for specific water sources, or statewide. The Kansas Water Office is charged by statute (K.S.A. 74-2608), with advising the Governor when drought conditions exist within the state, and recommending assembly of the Governor's Drought Response Team.

The descriptions in the following table are from the U.S. Drought Monitor while the possible impacts are derived from both sources. Impacts are shown for illustrative purposes only and may vary throughout the state or from time-to-time.

KANSAS PHASED DROUGHT RESPONSE SUMMARY

(Ref: Kansas Water Office Operations Plan)

Stage	Description	Declared by	Possible Impacts	Response Summary [1]
Drought Watch	Moderate Drought	Governor	Some damage to crops and pastures. High rangeland fire danger. Serious public water system water shortages not imminent, but likelihood of shortages growing.	Governor notified by Kansas Water Office and Governor's Drought Response Team activated. County, municipal and public water system officials notified. Outdoor burning bans may be imposed. Public water systems may implement Stage 1 Water Watch phase of municipal water conservation plan.
Drought Warning	Severe Drought	Governor	Crop or pasture losses likely. Some stock water shortages. Very high rangeland fire danger. Public water system water shortages present. Some streamflow targets not met.	Public water systems may implement Stage 2 Water Warning phase of municipal water conservation plan. Hay and Pasture Exchange activated. Urgent surplus water contracts from state controlled storage authorized. Governor may request authorization for haying and grazing of Conservation Reserve Program acres.
Drought Emergency	Extreme/ Exceptional Drought	Governor	Widespread major crop and pasture losses. Extreme rangeland fire danger. Widespread stock water shortages. Widespread severe public water system water shortages. Many streamflow targets not met.	Governor may declare outdoor burning ban upon advice of Adjutant General. Public water systems may implement Stage 3 Water Emergency phase of municipal water conservation plans triggered. Emergency surplus water contracts from state controlled storage authorized. Emergency water withdrawals from USACE reservoirs and state fishing lakes per MOU's authorized. USACE emergency water assistance if needed. Governor may request Presidential disaster declaration and/or USDA disaster declaration for drought.

1. See Tables 1-3 for a comprehensive listing of response actions.
USACE – United States Army Corps of Engineers
USDA – United States Department of Agriculture
Adopted from U.S. Drought Monitor (2001) and Kansas 1990 Municipal Water Conservation Plan Guidelines.

Probability of Future Occurrences

Lack of precipitation for a given area is the primary contributor to drought conditions. Since precipitation levels cannot be predicted long-term, it is difficult to determine the probability of future occurrences of drought. However, using available historical data, we can determine that south central Kansas experienced severe and extreme drought 10-14.9% of the time during the 100 year period from 1895 to 1995. Therefore, the probability of a drought in any given year is "likely."

Magnitude/Severity

This hazard's CPRI magnitude/severity is "critical."

Calculated Priority Risk Index	Planning Significance
2.80	Moderate

20.7 EARTHQUAKE

Definition: An earthquake is the shaking of the Earth's surface caused when energy stored within the Earth's crust, usually in the form of strain in rocks, suddenly releases. This energy is transmitted to the surface of the Earth by seismic waves. The destruction an earthquake causes depends on its magnitude and duration, or the amount of shaking that occurs. Earthquakes vary from small, imperceptible shaking to large shocks felt over thousands of kilometers. Earthquakes can deform the ground; make buildings and other structures collapse, and cause soil liquefaction.

Kansas experiences small earthquakes on a routine basis, but few are of a magnitude that causes damage to buildings or the infrastructure. According to a 2001 FEMA report, Kansas ranks 45th among the states in the amount of damage caused by earthquakes in an average year.

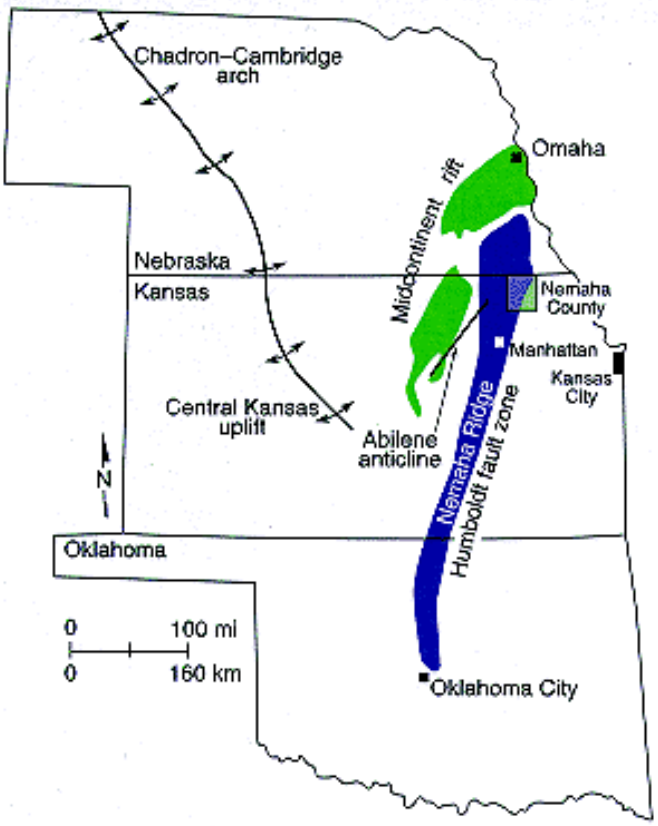
Warning Time: Less than 6 hours

Duration: Less than 6 hours

Geographic Location

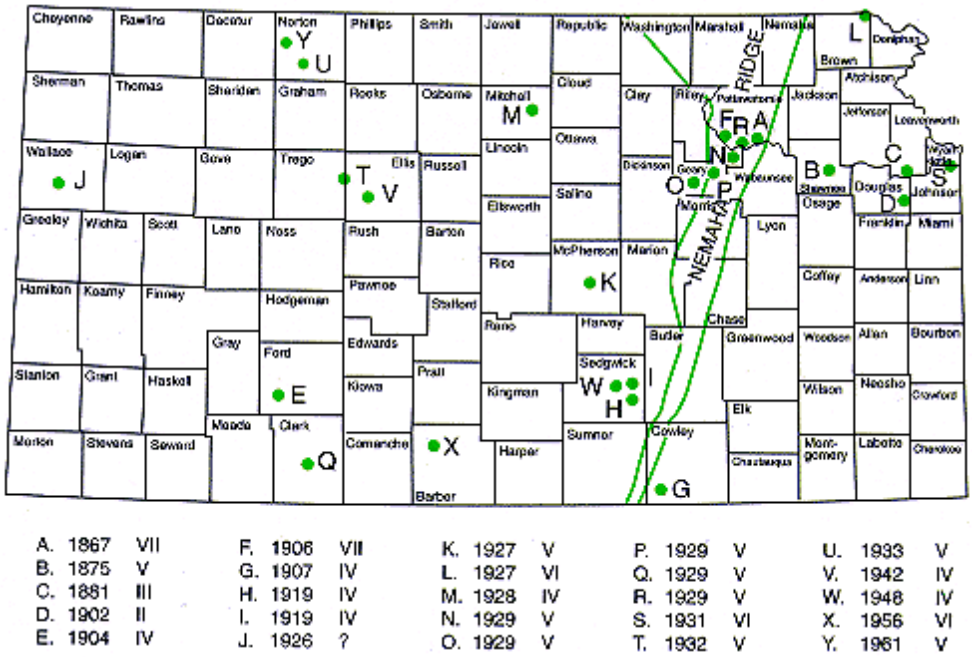
Overall, Kansas is in an area of relatively low seismic activity. Some Kansas earthquakes are associated with the Nemaha Ridge, a buried granite "mountain range" that extends from roughly Omaha, Nebraska, to Oklahoma. This subsurface range was formed about 300 million years ago with peak to valley elevations ranging from 2,300 to 3,300 feet near Manhattan. The Nemaha is broken by cross faults, apparent shears of northwest trend, and evidence of reverse faulting. Faults that bound it are still slightly active today, especially the Humboldt fault zone that forms the eastern boundary of the Nemaha Ridge, passing near Wamego, east of Manhattan, and near El Dorado, east of Wichita and proceeding southwesterly.

MAJOR REGIONAL SUBSURFACE FEATURES RELATED TO EARTHQUAKE ACTIVITY



Source: Kansas Geological Survey

HISTORICAL EARTHQUAKES IN KANSAS, PRIOR TO 1977



A. 1867	VII	F. 1906	VII	K. 1927	V	P. 1929	V	U. 1933	V
B. 1875	V	G. 1907	IV	L. 1927	VI	Q. 1929	V	V. 1942	IV
C. 1881	III	H. 1919	IV	M. 1928	IV	R. 1929	V	W. 1948	IV
D. 1902	II	I. 1919	IV	N. 1929	V	S. 1931	VI	X. 1956	VI
E. 1904	IV	J. 1926	?	O. 1929	V	T. 1932	V	Y. 1961	V

Source: Kansas Geological Survey

Between 1867 and 1976, more than 25 earthquakes resulting from the Humboldt fault have been felt. The largest earthquake recorded in Kansas was centered in Manhattan on April 24, 1867 at a Richter scale magnitude of 5.5 and a 1931 Modified Mercalli Intensity (MMI) scale of VII. The affected area reportedly covered 500,000 square kilometers east of the epicenter. Moderate earthquakes near Topeka, Kansas, in 1867 and 1906, caused MMI scales of VIII and VII, respectively, in the epicenter area and Intensities VI and IV, respectively, in both Kansas City and St. Joseph, Missouri. Three small earthquakes have been felt in northwestern Missouri in the last five years. On May 13, 1999, a magnitude 3.0 earthquake located in Kansas City, Kansas, caused damage to two medical buildings.

Additional Earthquake Activity

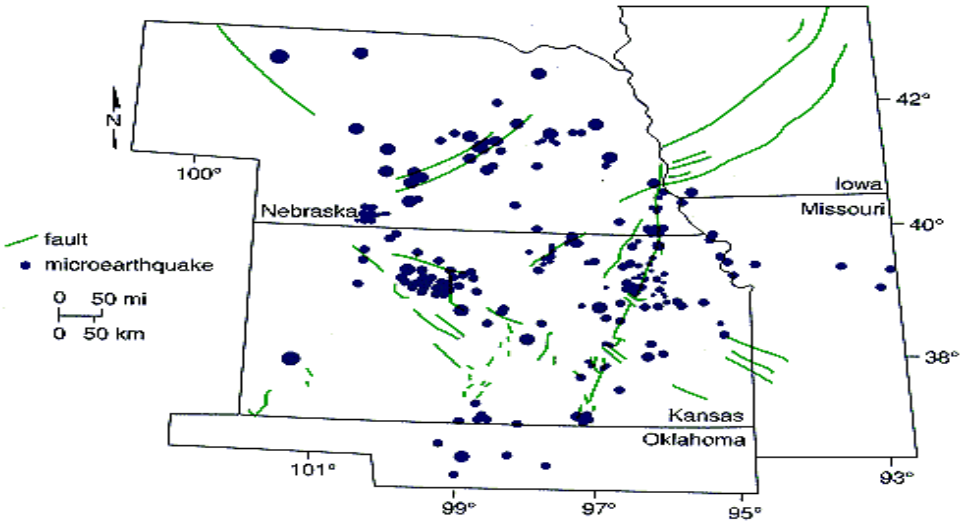
- January 24, 1991: At 5:00:26 AM, a magnitude 3.0 earthquake occurred 84 miles away.
- October 30, 1998: At 5:41:22 PM, a magnitude 3.5 (Intensity: II - III) earthquake occurred 76 miles away.
- July 24, 2001: At 2:02:35 PM, a magnitude 3.0 earthquake occurred north of Augusta and west of the Humboldt fault zone in the Nemaha Ridge.
- November 5, 2011: At 10:53:10 PM, a 5.6-magnitude earthquake (strongest on record for Oklahoma) occurred approximately 45 miles east of Oklahoma City, with an epicenter four miles east of Sparks, Oklahoma with multiple aftershocks. The tremor was felt and as far away as Kansas City and Dallas, Texas. Additional information from the US Geological Survey (USGS) provides a summary of probability and impact from Midwestern earthquakes:

  An earthquake of magnitude 5.6 like the one that occurred yesterday east of Oklahoma City, are believed to be capable of striking anywhere in eastern North America at irregular intervals. Earthquakes east of the Rocky Mountains, although less frequent than in the West, are typically felt over a much broader region. East of the Rockies, an earthquake can be felt over an area as much as ten times larger than a similar magnitude earthquake on the west coast. A magnitude 4.0 eastern U.S. earthquake typically can be felt at many places as far as 100 km (60 mi) from where it occurred, and it infrequently causes damage near its source. A magnitude 5.5 eastern U.S. earthquake usually can be felt as far as 500 km (300 mi) from where it occurred, and sometimes causes damage as far away as 40 km (25 mi).[22]

[22] *USGS Earthquake Summary, Magnitude 5.6 - Oklahoma*

Between August 1977 and August 1989 the KGS recorded more than 100 earthquakes in Kansas. Fortunately most of these were micro earthquakes that are earthquakes that are too small to feel. The largest recorded event had a magnitude of 4.0 and the smallest had a magnitude of 0.8 on the Richter scale.

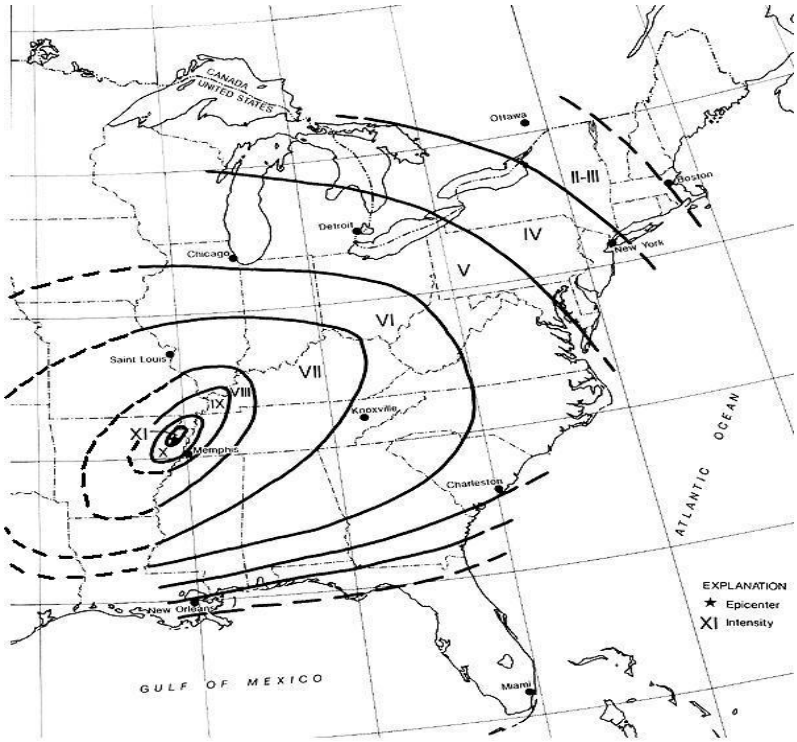
MICROEARTHQUAKES BETWEEN AUGUST 1977 AND AUGUST 1989



Source: Kansas Geological Survey

As shown below, the New Madrid Seismic Zone roughly follows the Mississippi River valley from southeastern Missouri to northwestern Mississippi. A large earthquake in this region could displace several thousand people and potentially lead to an influx into Kansas of victims.

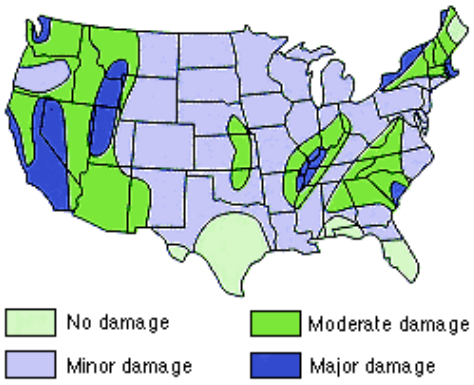
USGS ISOSEISMAL PROJECTIONS



Based on USGS disaggregated seismic hazard projections for 0.2 second and 1.0 second spectral accelerations at 0.0592g to 0.169g, there is the potential for up to a Richter 6 earthquake in south-central Kansas if comparable 1811-1812 New Madrid earthquake magnitudes occurred.

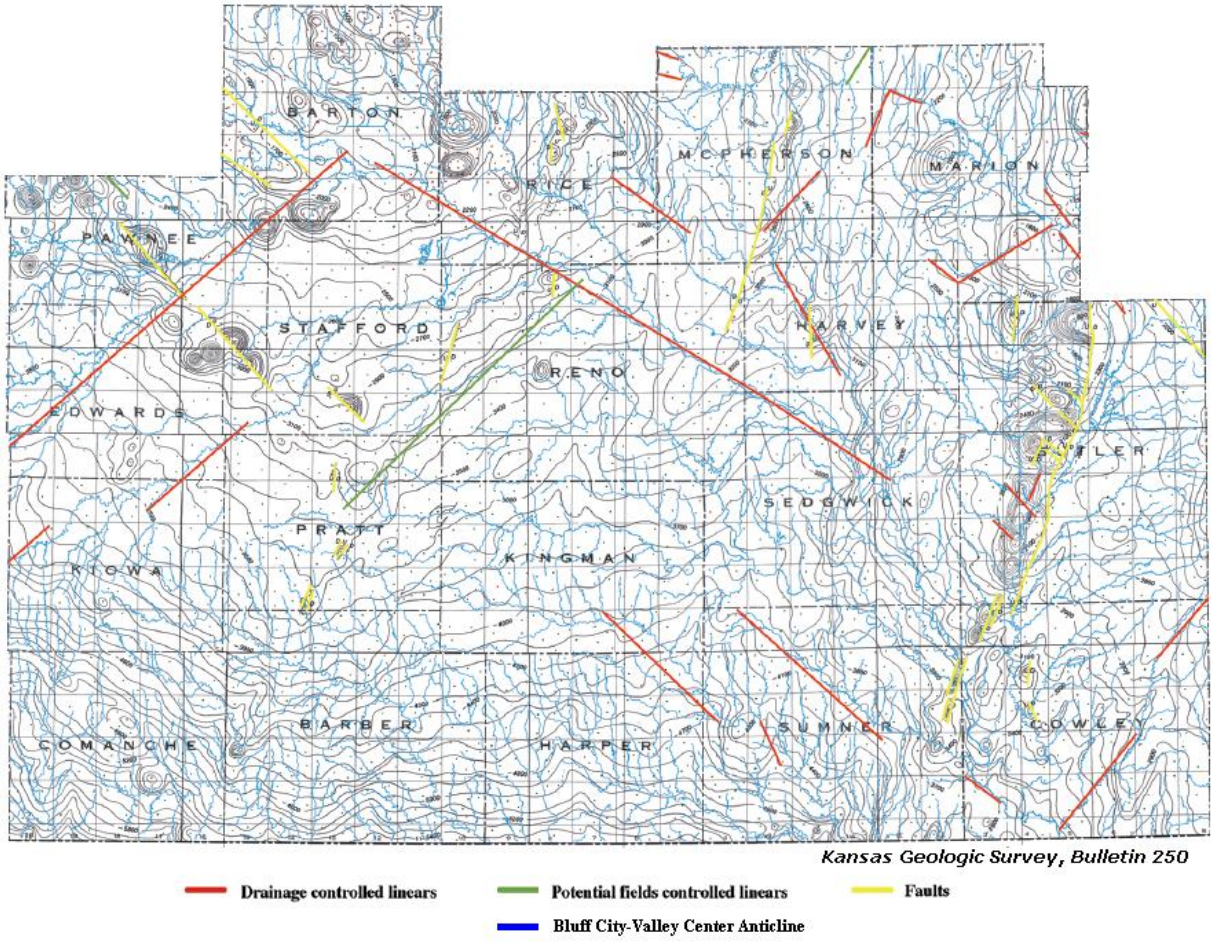
Based on the map shown below, counties in south central Kansas have the potential for minor to moderate damage to buildings, dams, and power plants resulting from an earthquake.

EARTHQUAKE RISK MAP



Intensities of earthquakes in south central Kansas counties measured in the Modified Mercalli Intensity (MMI) Scale of 1931, were between 3 and 4 on the MMI scale, or roughly equivalent to 2 on the Richter scale. A portion of the KGS Preliminary Lineament Map of Kansas by Lee Gerhardt (Bulletin 250, Part 1) shows the proximity of counties to the Nemaha Ridge and Humboldt Fault Zone.

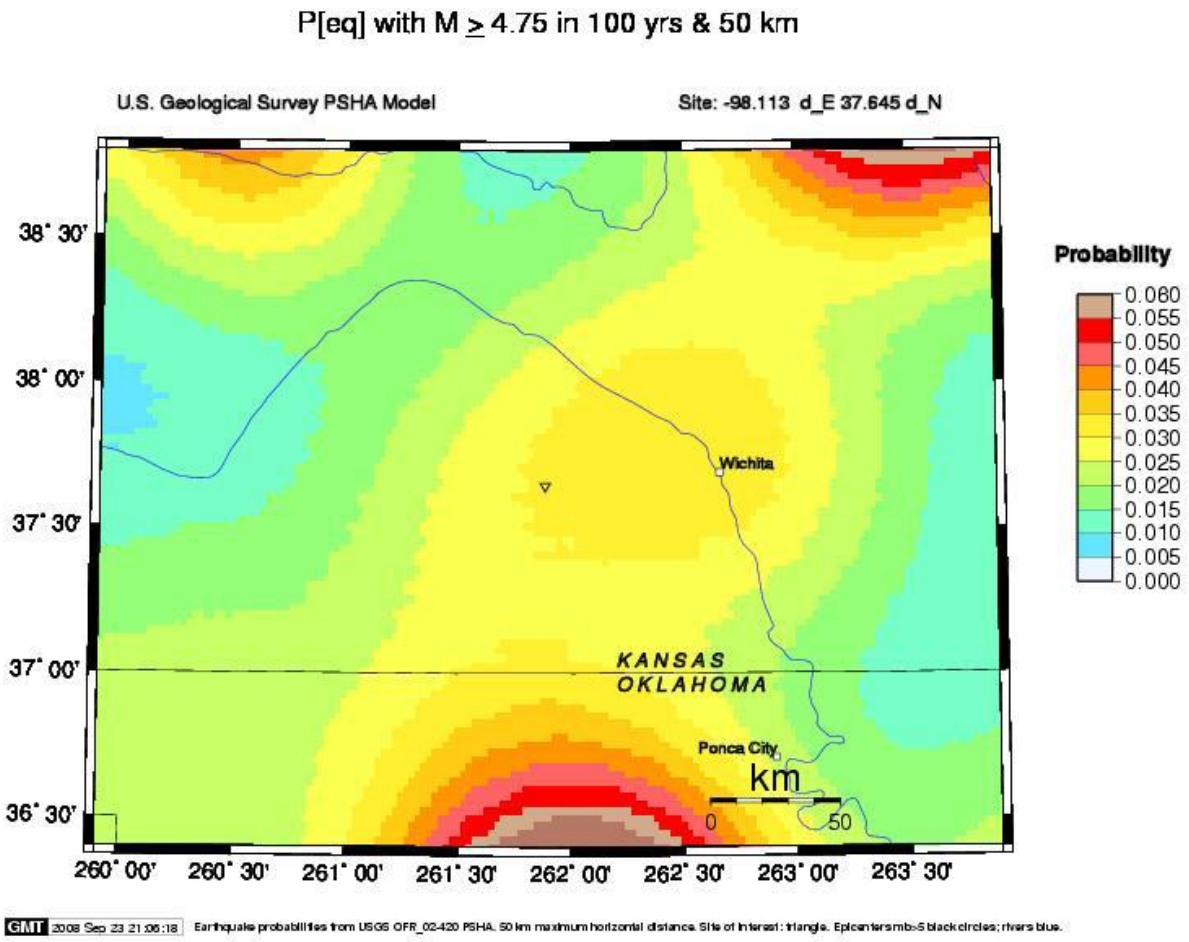
RELATIONSHIP OF GEOLOGIC FEATURES



PROBABILITY OF FUTURE OCCURRENCES

The following diagram demonstrates that the probability of an earthquake with a magnitude greater than 4.75 over a 100 year time period is .040-.05. Therefore, the probability of a significant earthquake in any given year is "unlikely."

EARTHQUAKE PROBABILITY MAP



http://eqint.cr.usgs.gov/eqprob/2002/index.php

REGULATORY

The National Earthquake Hazards Reduction Program (NEHRP) Recommended Provisions was selected by model code organizations as the basis for the seismic design provisions of the International Building Code, the International Residential Code, and the National Fire Protection Association 5000. The seismic hazard maps developed by USGS are directly referenced in the NEHRP Recommended Provisions, and the National Science Foundation (NSF) research results are also used.

MAGNITUDE/SEVERITY

Considering the location of counties within south central Kansas in relation to existing fault lines, this hazard's CPRI magnitude/severity is "limited."

Calculated Priority Risk Index	Planning Significance
1.75	Low

20.8 FOG

Description

Fog results when air is cooled to the point where it can no longer hold all of the water vapor it contains. For example, rain can cool and moisten the air near the surface until fog forms (precipitation fog). A cloud-free, humid air mass at night can lead to fog formation, where land and water surfaces that have warmed up during the summer are still evaporating a lot of water into the atmosphere (radiation fog). A warm moist air mass blowing over a cold surface can also cause fog to form (advection fog).

In Kansas, fog is principally a threat to public safety. Of particular concern is the potential for multi-vehicle accidents on major highways in Kansas. These accidents can cause injuries and deaths and can have serious implications for health, safety, and environment if a hazardous or nuclear waste shipment is involved. Other disruptions from fog include delayed emergency response vehicle travel.

Location

Fog occurs statewide, but according to data from the National Climatic Data Center compiled by *USA Today*, western Kansas has more annual incidents of heavy fog (visibility is less than 1/4 mile) than the rest of the state.

Previous Occurrences

Generally, fog is a relatively common occurrence in Kansas, but fog events with significant adverse impacts are relatively rare. According to the National Climatic Data Center's Storm Events database, there were 37 fog events in Kansas between 1993 and 2010. These events caused $105,000 in damage, 5 deaths, and 25 injuries. All of the damage was attributable to three events or which one occurred in south-central Kansas:

January 17, 2010 - An unusually long spell of periodic dense freezing fog persisted across much of the area from January 12th through the 19th. Fog was most dense during the nighttime and morning hours. The fog eventually led to two known injury (indirect) accidents across Barton and Reno Counties on the 17th and 18th.

Other Fog Event

December 24, 1994—Fog and icy road conditions contributed to a 38-car reaction collision on the Kansas Turnpike near El Dorado.

Probability

According to data from the National Climatic Data Center compiled by *USA Today*, Kansas experiences at least 10-20 days of heavy fog (visibility is less than 1/4 mile) each year. Western Kansas experiences 20-40 days of heavy fog each year. An event causing significant damage occurs less frequently, thus, this hazard's CPRI probability is "**possible**" within the next five years.

Vulnerability and Potential Losses by Jurisdiction

While western Kansas experiences more events, fog often settles in the floodplain valleys of eastern Kansas, where there is more population and more potential for a traffic accident. Interstate corridors across the state are at risk to mass transportation accidents triggered by fog.

20.9 RADIOLOGICAL

DEFINITION: Radiation is a process of emission of energy or particles. Various forms of radiation may be distinguished, depending on the type of the emitted energy/matter, the type of the emission source, properties and purposes of the emission, etc. Hazards that may face jurisdictions may be through explosive technological release or solar impact.

Description

An accident involving radioactive materials could occur in Kansas from a variety of sources: nuclear reactors, transportation accidents, industrial and medical uses, and lost or stolen sources where the public could be exposed, or contaminated, with a high level of radiation. Radiological accidents could cause injury or death, contaminate property and valuable environmental resources, as well as disrupt the functioning of communities and their economies. There have been no reported events of this type in the State of Kansas.

There are over 300 licensees for radioactive material that varies in size from small sources to large sources. Most uses of radioactive materials are spread across the state, though in some relation to population. Diagnostic and therapy medical sources are common at most hospitals. Universities often have some radioactive material for research and education. Commercially used radioactive materials are more common in the eastern third of Kansas. Radioactive materials used in water and hydrocarbon extraction are commonly used in western Kansas. It is common for materials, including pharmaceuticals, industrial sources, and nuclear fuel rods destined to nuclear reactors, to be transported across Kansas highways and railroads

20.9.1 Nuclear Weapon

Nuclear weapons can range in size and yield, with the smallest (Davy Crockett) weighing 51 pounds with a yield of 10 tons of trinitrotoluene (TNT) up to the 27-ton Tsar Bomba bomb with a yield of 50 megatons (50 million tons of TNT). By comparison, the Oklahoma City bombing non-radioactive yield was 2 tons of TNT.

Nuclear fission is used to produce energy for nuclear power and to drive the explosion of nuclear weapons. Nuclear fusion of light elements releases the energy that causes nuclear weapons to explode.

For a low altitude atmospheric detonation of a moderate sized weapon in the kiloton range, the energy is distributed roughly as follows: 50% as blast; 35% as thermal radiation; and, 15% as nuclear radiation of which 5% is initial ionizing radiation within the first minute after detonation, and 10% as residual nuclear radiation (fallout).

Surface Burst: An explosion in which a weapon is detonated on or slightly above the surface of the earth so that the fireball actually touches the land or water surface.

Subsurface Burst: An explosion in which the point of the detonation is beneath the surface of land or water.

High Altitude Burst: The weapon is exploded at such an altitude (above 30 km) that the fireball is much larger and expands much more rapidly. The ionizing radiation from the high altitude burst can travel for hundreds of miles before being absorbed. Significant ionization of the upper atmosphere (ionosphere) can occur. Severe disruption in communications can occur following high altitude bursts. They also lead to generation of an intense electromagnetic pulse (EMP) that can significantly degrade performance of or destroy sophisticated electronic equipment. There are no known biological effects of EMP; however, indirect effects may result from failure of critical medical equipment.

20.9.2 Radiological Dispersal Device (RDD)

An RDD or “dirty bomb” combines a conventional explosive, such as dynamite, with radioactive material. In most instances, the conventional explosive itself would have more immediate lethality than the radioactive material. At the levels created by most probable sources, not enough radiation would be present in a dirty bomb to kill people or cause severe illness. Contamination caused by the use of certain types of radioactive materials would be the main concern in the release of an RDD.

20.9.3 Electromagnetic Radiation/Pulse (EMR/EMP)

EMR from an explosion (especially nuclear explosions) or an intensely fluctuating magnetic field caused by Compton-recoil electrons (increase in wavelength decrease in energy) which occurs when X-ray (or gamma ray) photons with energies of around 0.5 MeV to 3.5 MeV interact with electrons in a material) and photoelectrons from photons scattered in the materials of the electronic or explosive device or in a surrounding medium. An EMP acts like a stroke of lightning but is stronger, faster, and shorter. It can seriously damage electronic devices connected to power sources or antennas. This includes communication systems, computers, electrical appliances, and automobile or aircraft ignition systems. The damage could range from a minor interruption to actual burnout of components. Battery-powered radios with short antennas generally would not be affected. A nuclear burst of approximately 20 megatons over the central part of the United States at an altitude of 500 kilometers would produce an EMP field that would incapacitate all communications systems in the continental United States.

20.9.4 Solar Radiation

The National Weather Service’s Space Environment Center monitors solar activity from the sun to determine the effects of geomagnetic storms, solar radiation storms, and radio blackouts that may occur on Earth.

Intensities of each of these solar effects are measured on a scale from 1 (minor) to 5 (extreme).

Descriptions of each of these storm types, occurrences, durations, and potential effects on Earth are shown below:

Geomagnetic Storm Effects (G)

A category G5 (Extreme) can occur an average of four times in an 11-year period and can last up to four days per event. This type of storm can affect power systems in the following manner: widespread voltage control problems and protective system problems can occur; some grid systems may experience complete collapse or blackouts. Transformers may experience damage. Pipeline currents can reach hundreds of amps, HF (high frequency) radio propagation may be impossible in many areas for one to two days, satellite navigation may be degraded for days, and low-frequency radio navigation can be out for hours. An example of a G5 storm is one that occurred in 1989 that made currents on the ground that caused a failure in the Hydro-Quebec electric power system. This prevented 6 million people in Canada and the US from having electricity for over 9 hours.

Solar Radiation Storm (S)

A Category S5 (Extreme) occurs less than once every 11 years and can cause the following effects on satellites: satellites may be rendered useless, memory impacts can cause loss of control, may cause serious noise in image data, star-trackers may be unable to locate sources; permanent damage to solar panels possible. Global Positioning System (GPS) would also be impacted by this type storm.

Radio Blackout Effects (R)

A Category R5 (Extreme) occurs less than once every 11 years and can cause the following effects: Complete HF (high frequency) and other frequency radio blackout on the entire sunlit side of the Earth lasting for a number of hours. This results in no HF radio contact with mariners and en route aviators in this sector.

Previous Occurrences

There are several occurrences of radiological accidents in Kansas during operation and transportation of devices and sources. Most notably, none have caused serious injury or death. Incidents include lost and stolen sources, well-logging sources lost down hole, overexposures, and fires involving gauges and materials.

Notable Radiological Events

- March 22, 1979–Transportation spill: At the I-235 underpass near the Meridian Street exit in Wichita, a truck carrying refined uranium, yellow cake, overturned and several container drums were breached. Soil and the refined uranium were removed, over packed, and shipped to a facility out of the state.

- May 17, 2002–Destroyed moisture/density gauge: A moisture/density gauge was destroyed when it was run over by an earthmover. The case and source rod were intact and undamaged, the guide rod for the source rod was bent.

- July 12, 2005–Destroyed moisture/density gauge: A moisture/density gauge was destroyed when the operator of a passenger car failed to follow a pilot car at a construction site, entered a closed lane, and ran over the gauge while in operation.

Probability

This hazard's CPRI probability is "**unlikely**" within the next ten years.

Vulnerability and Potential Losses by Jurisdiction

In general, radioactive material is distributed across the state proportionally to population density. Areas near interstates and major highways have an increased risk of transportation accidents. Remote areas also have to account for long response times from hazardous materials and health physics personnel. Stolen and lost sources can put the public at elevated risks if the material is unidentified and lost, abandoned, or intentionally placed in a public area. Field radiography cameras are used extensively in pipeline construction and repair.

Development in Hazard-Prone Areas

During all lawful operations of radioactive materials, the licensee is responsible for ensuring that the area around the source material is cordoned off or shielding is used to prevent unnecessary exposures. Inspections of practices and security measures are regularly conducted to ensure compliance and conformity to regulations in order to protect the public. The frequency of inspections can be adjusted in response to perceived risk. Public risk can be reduced by minimizing the duration of exposure, shielding the source material, and maximizing the distance from the source.

20.10 FIRE/WILDFIRE[23]

Description

Wildfires in Kansas typically originate in pasture or prairie areas following the ignition of dry grasses (by natural or human sources). About 75 percent of Kansas wildfires start during spring due to dry weather conditions. Since protecting people and structures takes priority, a wildfire's cost to natural resources, crops, and pastured livestock can be ecologically and economically devastating. In addition to the health and safety impacts to those directly affected by fires, the State is also concerned about the health effects of smoke emissions to surrounding areas.

Wildfires in Kansas are frequently associated with lightning and drought conditions, as dry conditions make vegetation more flammable. As new development encroaches into the wildland-urban interface (areas where development occurs within or immediately adjacent to wildlands, near fire-prone trees, brush, and/or other vegetation), more and more structures and people are at risk. On occasion, ranchers and farmers intentionally ignite vegetation to restore soil nutrients or alter the existing vegetation growth. These fires have the potential to erupt into wildfires.

Location

The risk of wildfire varies based on season, drought conditions, and location in the state. However, because of the primarily rural, agricultural characteristics of the state, most, if not all, of Kansas' counties are susceptible to wildfires. The wildfire risk is moderate in the eastern part of the state and somewhat less in the western part. This is largely because of the rapid growth and resulting increasing encroachment into the wildland-urban interface.

Development in the urban interface is best assessed on a local basis, because of the site specific nature of the hazard and the neighborhoods at risk. Therefore, the KHMT anticipates that, as the hazard identification and risk estimation analyses become available from local mitigation plans, the generalized assessment presented here will be modified and improved. The issue of smoke emissions is more of a concern in the eastern part of the state because of the higher populations.

Wildfires in Kansas are frequently associated with lightning and drought conditions, as dry conditions make vegetation more flammable. As new development encroaches into the wildland urban interface (areas where development occurs within or immediately adjacent to wildlands, near fire-prone trees, brush, and/or other vegetation), more structures and people are at risk. On occasion, ranchers and farmers intentionally ignite vegetation to restore soil nutrients or alter the existing vegetation growth. These fires have the potential to erupt into wildfires.

Warning Time: Less than 6 hours
Duration: Less than 1 day

Geographic Location

Conservation Reserve Program land is burned, and in rural areas individuals may burn ditches to alter vegetation, trash or debris, which increases the chance of a controlled burn getting out of control. It is a smart practice to monitor the wind weather forecast before planning to burn any area. When these agricultural fires get out of control they easily spread to dry vegetation such as native grasses, shrubs, and invasive eastern red cedar trees. The US Forest Service provides Forecast Fire Danger Class maps and Burning Index maps on a daily basis to use as a general tool for fire behavior prediction.

Previous Occurrences

- March 30, 2006 (FEMA-2632: Obee Fire)—A wildfire burned 5,400 acres east of the Hutchinson Airport. It was likely started by a lightning strike from thunderstorms early that afternoon. Three hundred to four hundred people were evacuated from a 21 square-mile area. The fire destroyed five houses and 20 outbuildings. Numerous campers, automobiles, and farm implements were damaged

[23] *2010 Kansas Hazard Mitigation Plan*

or destroyed. Scattered power outages were reported. Damage was estimated at $1.1 million. This incident marked the state's first request for federal fire management assistance.

- March 8, 2006—This large fire started just east of Towanda and, fed by drought conditions and very strong southwesterly winds, spread quickly. The fire started as an accident involving sparks from a trailer on K-254. The fire caused thick smoke across the Kansas Turnpike, which resulted in a two-car accident and eventually shut the roadway down for 45 minutes. The fire charred 10,700 acres of grassland, damaged or destroyed 10 outbuildings, caused minor damage to two homes, set three oil wells ablaze, and caused the evacuation of Oil Hill Elementary School.

- February 9, 2006—A large grass fire along the Reno/Harvey County line erupted just north of Burrton and spread quickly, fed by drought conditions and sustained winds of 25 to 35 mph. The fire was believed to be extinguished that evening but around noon on February 10 the fire reignited as strong winds once again swept across the area. The fire was eventually extinguished late in the day on February 10. The fire burned 8,800 acres and caused approximately $30,000 in damage to ranch and farmland.

Local Plan Statistics for Wildfire Events

Wildfire						
County	Hazard Ranking	# of Events	Damages (Prop)	Damages (Crop)	Injuries	Fatalities
Butler	Moderate	N/A	N/A	N/A	N/A	N/A
Cowley	Moderate	N/A	N/A	N/A	N/A	N/A
Harper	Moderate	86	N/A	N/A	N/A	N/A
Harvey	High	355	$2,588,700.00	N/A	N/A	N/A
Kingman	High	261	$264,000.00	N/A	N/A	N/A
Kiowa	High	138	$5,000.00	N/A	N/A	N/A
Marion	High	N/A	N/A	N/A	N/A	N/A
Pratt	High	N/A	N/A	N/A	N/A	N/A
Reno	Moderate	566	$2,374,395.00	N/A	N/A	1
Sedgwick	Moderate	2777	$10,650,796.00	N/A	N/A	N/A

Source: 2010 Kansas Hazard Mitigation Plan

Regulatory

Regulatory guidance is contained in National Fire Protection Association (NFPA) codes and standards and the 2003 International Fire Code. Compliance with ISO fire suppression requirements for specific fire insurance ratings.

Probability of Future Occurrences

This hazard's CPRI probability is "highly likely" (event is probable within the calendar year).

Magnitude/Severity

This hazard's CPRI magnitude/severity is "limited."

20.11 WEAPON OF MASS DESTRUCTION

Definition: According to Title 18 United States Code (USC) Section 2332a, a weapon of mass destruction is defined as: "(A) any destructive device as defined in section 921 of this title; (B) any weapon that is designed or intended to cause death or serious bodily injury through the release, dissemination, or impact of toxic or poisonous chemicals, or their precursors; (C) any weapon involving a biological agent, toxin, or vector (as those terms are defined in section 178 of this title); or (D) any weapon that is designed to release radiation or radioactivity at a level dangerous to human life."

An explosive is a sudden rapid violent release of mechanical, chemical, or nuclear energy from a confined region; especially such a release that generates a radial transmitting shock wave accompanied by a loud, sharp report, flying debris, heat, light and fire. There are three types of explosives: low, high and tertiary.

20.11.1 LOW EXPLOSIVES

A low explosive is a combustible substance that decomposes rapidly (deflagration), but does not explode under normal conditions. Under certain conditions, though, it is possible for them to detonate, usually through the combined use with high explosives. Low explosives are normally employed as propellants. Most low explosives are mixtures; most high explosives are compounds, but to both there are notable exceptions. They undergo deflagration at rates that vary from a few centimeters per second to approximately 400 meters per second. Included in this group are smokeless powders and pyrotechnics such as flares and illumination devices.

20.11.2 HIGH EXPLOSIVES

High explosives are normally employed in mining, demolition, and military warheads. They undergo detonation at rates of 1,000 to 9,000 meters per second. High explosives are conventionally subdivided into two classes differentiated by sensitivity:

- Primary explosives are extremely sensitive to shock, friction, and heat. They will burn rapidly or detonate if ignited.

- Secondary explosives, also called base explosives, are relatively insensitive to shock, friction, and heat. They may burn when ignited in small, unconfined quantities, but detonation can occur. These are sometimes added in small amounts to blasting caps to boost their power.

20.11.3 TERTIARY EXPLOSIVES

Also called blasting agents, are so insensitive to shock that they cannot be reliably detonated by practical quantities of primary explosive, and instead require an intermediate explosive booster of secondary explosive.

RESOURCES

The Wichita Police Department's EOD team in Sedgwick County is assigned to the Special Operations Bureau and is one of only several bomb units within the state of Kansas, and the only civilian team within the southern half of the state. The EOD Team supports the regional office of Bureau of Alcohol, Tobacco and Firearms (BATF) within their 69 county regional jurisdictions. They are called upon to respond to any incident that requires handling or securing of explosives, suspected devices, or weapons of mass destruction. McConnell AFB also has an EOD team; however, they are used to handle only un-improvised military style ordinance outside the military installation.

20.12 HAZARDOUS MATERIAL[24]

According to the Kansas Division of Emergency Management, there are 40 “critical” sites in Kansas. They are deemed so because of the severity of the chemicals, the quantity of chemicals, and the amount of population affected in a worst-case scenario. These facilities are listed below in order of criticality. Information about these facilities in this plan is limited because of security and liability issues. The following counties and facilities in south central Kansas are included::

- Barton County—Fertilizer Sales
- Butler County—Refinery
- Cowley County—Beef Packing
- McPherson County—Refinery
- McPherson County—Chemical Production and Distribution
- Reno County—Food Processing
- Sedgwick County—Produces Dairy Products
- Sedgwick County—Chemical Plant
- Sedgwick County—Water Treatment
- Sedgwick County—Ethanol Plant
- Sedgwick County—Chemical Distribution
- Sedgwick County—Meat Processing

In terms of estimating potential losses the most significant loss potential with hazardous materials is the potential for deaths and injuries. As with all hazard events, special populations are particularly vulnerable to the impacts of a hazardous materials incident especially because of the inherent difficulties involved in evacuation. The state has inventoried special population’s facilities (adult, child care, and health facilities; state prisons; and schools) 1/2, 1, and 2 miles from chemical facilities. The following table shows the percentage of each type of these facilities each county has within 1/2 mile of a chemical facility.

2010 Special Population Facilities near Chemical Facilities

	Percentage within 1/2 mile of Chemical Facility					
County	Health Facilities	Colleges	Educational Facilities	Aging Facilities	Child Care	Correctional Institutions
Barber	100.0%	0.0%	80.0%	100.0%	87.5%	100.0%
Barton	93.8%	0.0%	76.2%	55.6%	67.8%	100.0%
Butler	66.7%	0.0%	56.0%	27.3%	43.3%	33.3%
Comanche	100.0%	0.0%	66.7%	50.0%	50.0%	0.0%
Cowley	0.0%	50.0%	35.5%	33.3%	29.7%	66.7%
Edwards	100.0%	0.0%	66.7%	0.0%	37.5%	100.0%
Harper	100.0%	0.0%	100.0%	100.0%	84.0%	100.0%
Harvey	37.5%	50.0%	47.6%	50.0%	39.7%	100.0%
Kingman	66.7%	0.0%	77.8%	50.0%	57.6%	100.0%
Kiowa	100.0%	100.0%	100.0%	66.7%	62.5%	100.0%
McPherson	80.0%	66.7%	66.7%	76.5%	79.8%	100.0%
Marion	40.0%	100.0%	73.3%	42.9%	67.2%	100.0%
Pawnee	66.7%	0.0%	54.5%	66.7%	45.5%	25.0%
Pratt	14.3%	0.0%	36.4%	33.3%	46.2%	100.0%
Reno	42.9%	0.0%	37.5%	28.6%	23.1%	50.0%
Rice	60.0%	0.0%	92.9%	50.0%	74.3%	0.0%
Sedgwick	46.5%	52.4%	34.6%	28.4%	26.6%	70.0%
Stafford	50.0%	0.0%	33.3%	33.3%	18.8%	0.0%
Sumner	90.9%	0.0%	60.0%	75.0%	53.1%	100.0%

Source: 2010 Kansas Hazard Mitigation Plan

[24] *2010 Kansas Hazard Mitigation Plan*

20.13 SOLID WASTE DISPOSAL

According to the 2010 Kansas Solid Waste Management Plan, the amount of solid waste disposed at permitted Kansas landfills and transferred to out-of-state landfills is divided into five major categories of waste. In 2009, municipal solid waste (MSW) comprised 54 percent of the 5.58 million tons which were handled by landfill and transfer station operators. A total of 761,500 tons were imported (mostly from Missouri) and only 82,800 tons were exported through transfer stations. Industrial waste and construction & demolition (C&D) waste comprised 20.1 and 16.1 percent of the waste total, respectively. Smaller amounts of special waste (498,000 tons / 8.9 percent) and waste tires (50,000 tons / 0.9 percent) were landfilled. Special waste consists of a variety of waste types including medical waste, contaminated soil, and miscellaneous industrial process wastes. Waste types are further explained as follows:

- C&D – The amount of C&D waste can also be related to natural disasters and even the prevalence of hail storms.
- Industrial Waste – Most industrial waste is generated by coal fired electric power generation facilities (fly ash, bottom ash, and other air pollution control residues). This type of waste may increase as additional air pollution controls are required and implemented. However, the pressures to move away from coal may result in some decreased generation. Other major industrial waste generators include foundries, cement plants, and other metal casting facilities. These wastes are nearly all disposed of in onsite landfills. Industrial waste volumes are similar to C&D waste quantities, perhaps somewhat less.
- Special Waste – Some special waste is routinely generated (medical waste, wastewater treatment sludge, asbestos, etc.) but most is related to environmental clean-up projects, including spill response activities (primarily contaminated soil).

DISASTER RELATED SOLID WASTE

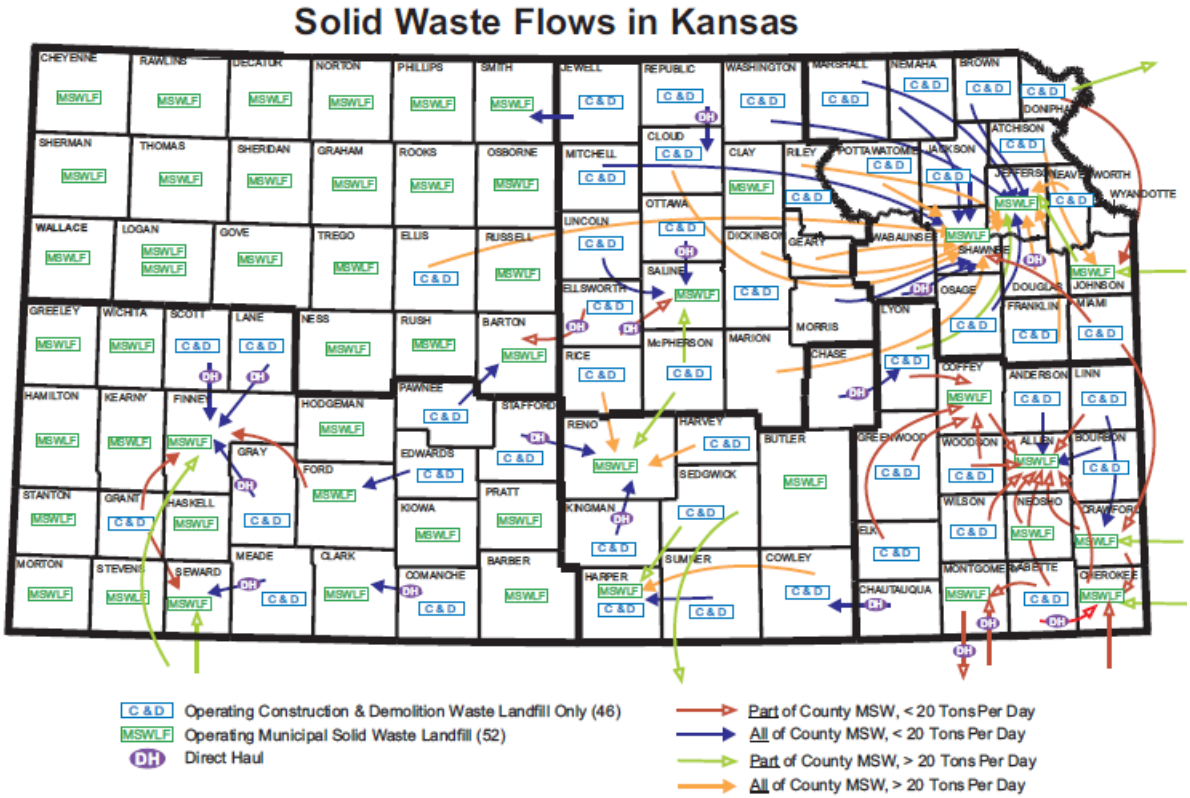
Disasters are unpredictable and debris amounts can range from small to astronomical. Every year, some disaster related debris is generated from tornados, floods, hail storms, wind events, and ice storms. A large tornado can result in the generation of hundreds of thousands of tons of mixed debris. Nearly a half million tons of debris were generated by the 2007 EF-5 tornado that hit Greensburg.

Most tornado debris can be managed as C&D waste. Smaller amounts of MSW and recyclables are also generated by tornados and floods. Waste segregation is always appropriate when a disaster strikes a community. Items such as household hazardous wastes, appliances, scrap metal, electronic waste, trees and brush, automobiles, and even bricks and concrete should be separated to maximize recycling and environmentally sound disposal. Many other industrial and commercial wastes may also require segregation including things such as electrical transformers, tanks, 55 gallon drums, propane cylinders, waste tires, and other items.

Another type of disaster could be the death of a large number of animals including cattle, pigs, or birds (chickens or turkeys). The reasons for such deaths could be weather (heat, cold, blizzards, or ice) or a foreign animal disease. The magnitude of animal death can range from a small number of animals to hundreds of thousands. Kansas has millions of animals on farms and ranches and a widespread event could result in major processing or disposal needs.

MSW LANDFILLS AND TRANSFER STATIONS

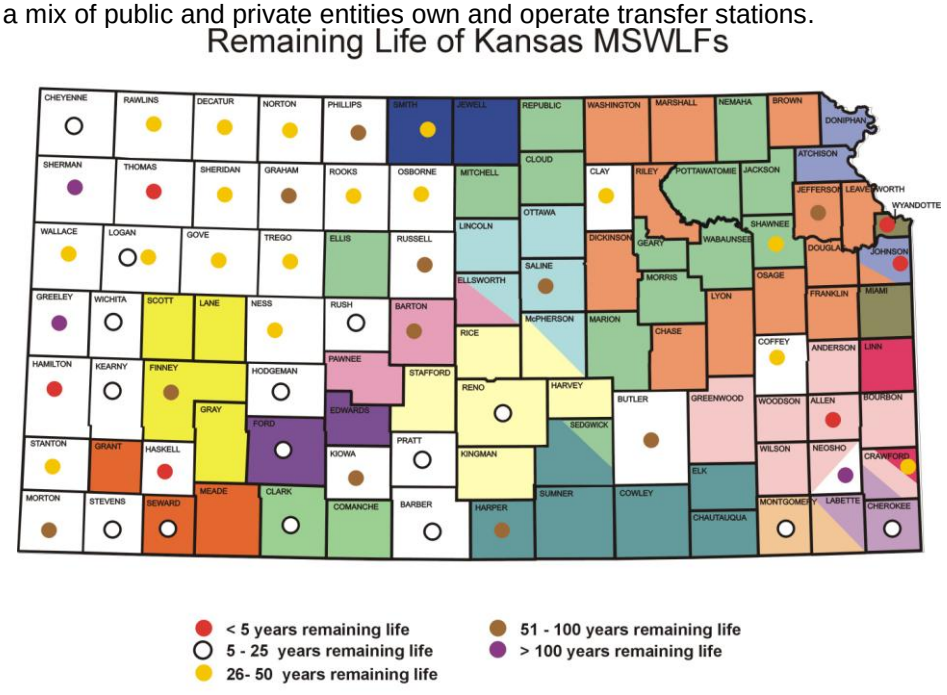
Many of these landfills have the capability to expand their permitted capacity within their permitted boundaries while others have adjacent property which could be used for expansion. The following map shows the remaining permitted capacity of each MSW landfill in years based upon the volume of waste currently being landfilled. It also shows which counties use each MSW landfill by means of flow lines from the counties sending the waste to the landfills. If the designation “DH” is used on the flow lines, that means the waste is directly transported in collection vehicles rather than through a transfer station.



Source: 2010 Kansas Solid Waste Management Plan

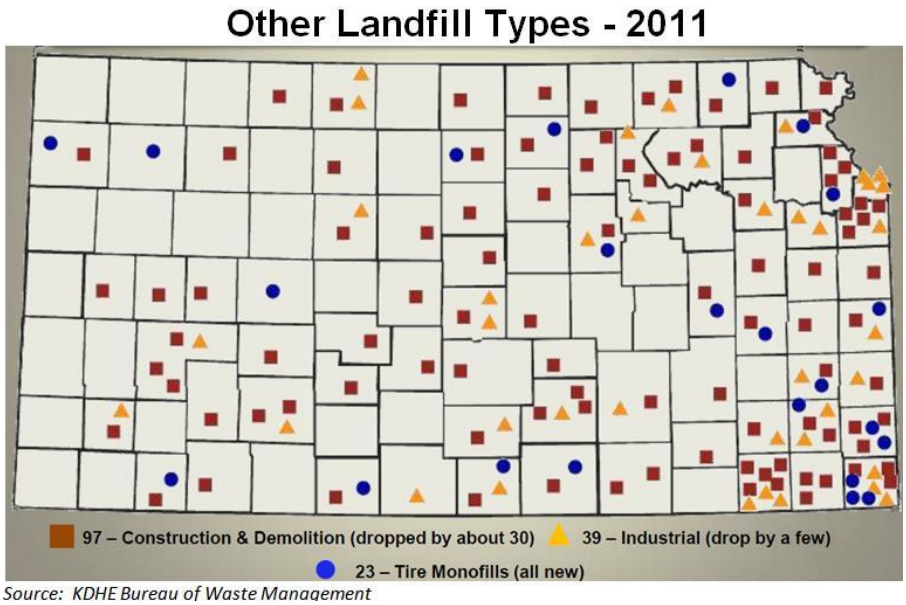
More than half of Kansas counties (59) transfer their MSW to landfills in other counties or out-of-state. Overall, waste transfers have remained steady since the early to mid-1990s when Subtitle D regulations went into effect. The decision to transfer waste in Kansas is made by local planners, public works officials, and elected county commissioners.

The ownership and operation of transfer facilities and waste hauling companies varies from county to county. In some cases, operations are totally owned and operated by local government. In other cases, private companies or a mix of public and private entities own and operate transfer stations.



Source: 2010 Kansas Solid Waste Management Plan

The following map shows the other types of permitted landfills that make up the waste disposal system in Kansas including landfills for C&D waste, industrial waste, and waste tire monofills. Nearly every county has at least one C&D landfill and a few counties have several landfills.

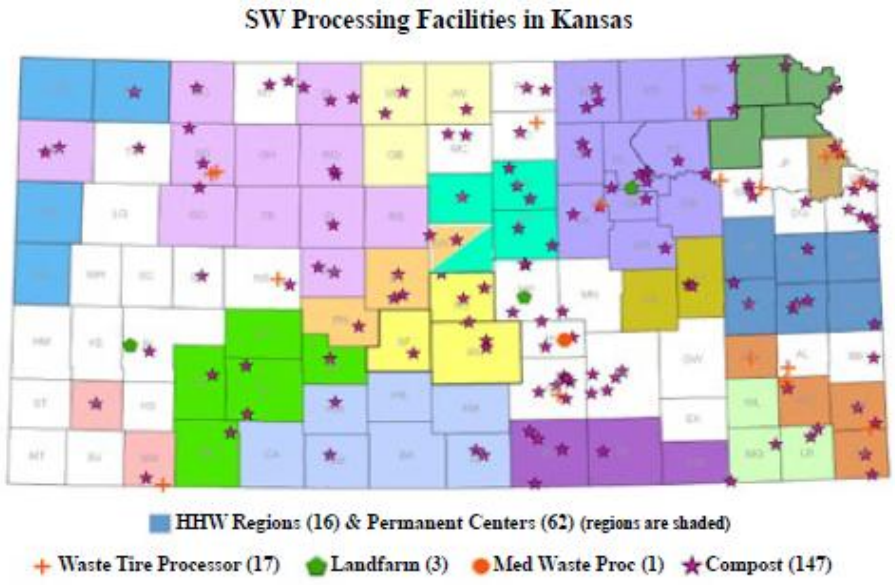


Source: KDHE Bureau of Waste Management

Most industrial landfills are located "on-site" at manufacturing facilities (mostly foundries) or at coal-fired power plants. The U.S. EPA has proposed more stringent regulations for coal combustion residue landfills which could impact the future of such facilities. Kansas has a few large waste tire monofills that receive tires from other states as well as Kansas and about 20 more small monofills that are primarily used for waste tires that are brought to small landfills by the public.

PERMITTED WASTE PROCESSING FACILITIES

The following map shows the distribution of composting facilities, household hazardous waste facilities including their satellite collection points for regional programs, waste tire processors, landfarms for contaminated soils, and medical waste processors. Composting and HHW facilities are widely distributed to conveniently meet the needs of the general public. Waste tire processors, landfarms, and medical waste processors are widespread, specialized facilities that receive waste through commercial collection services.



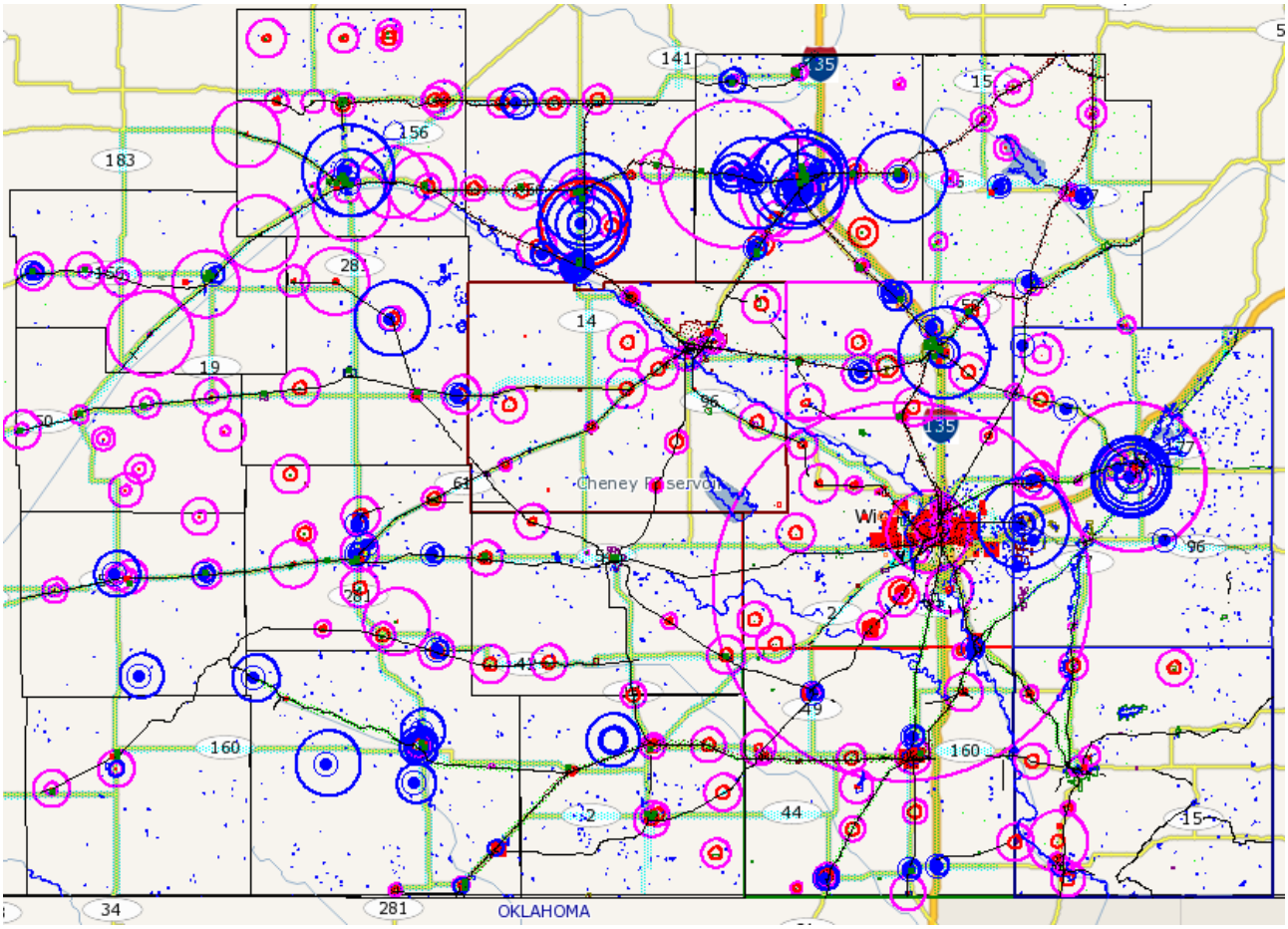
Source: 2010 Kansas Solid Waste Management Plan

20.14 EXTREMELY HAZARDOUS SUBSTANCES AND RELEASES

Hazardous materials are transported, stored and used primarily in and near urbanized areas. The principle causes of an accidental release of hazardous materials are from human error and equipment failure. There is also the potential for intentional releases caused by illegal tampering and criminal intent.

Emergency Planning and Community Right-to-Know Act (EPCRA), also known as Title III of the Superfund Amendments and Reauthorization Act of 1986 (SARA), Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) and chemicals listed under section 112(r) of the Clean Air Act (CAA).

The presence of Extremely Hazardous Substances (EHSs) in quantities at or above the Threshold Planning Quantity (TPQ) requires certain emergency planning activities to be conducted. The extremely hazardous substances and their TPQs are listed in 40 CFR part 355, Appendices A and B. For section 302 EHSs, Local Emergency Planning Committees (LEPCs) must develop emergency response plans and facility owner or operator must notify the Commission on Emergency Planning and Response (CEPR) and LEPC if a chemical is present at the facility or above the EHS's TPQ. The following map shows the potential release zones:

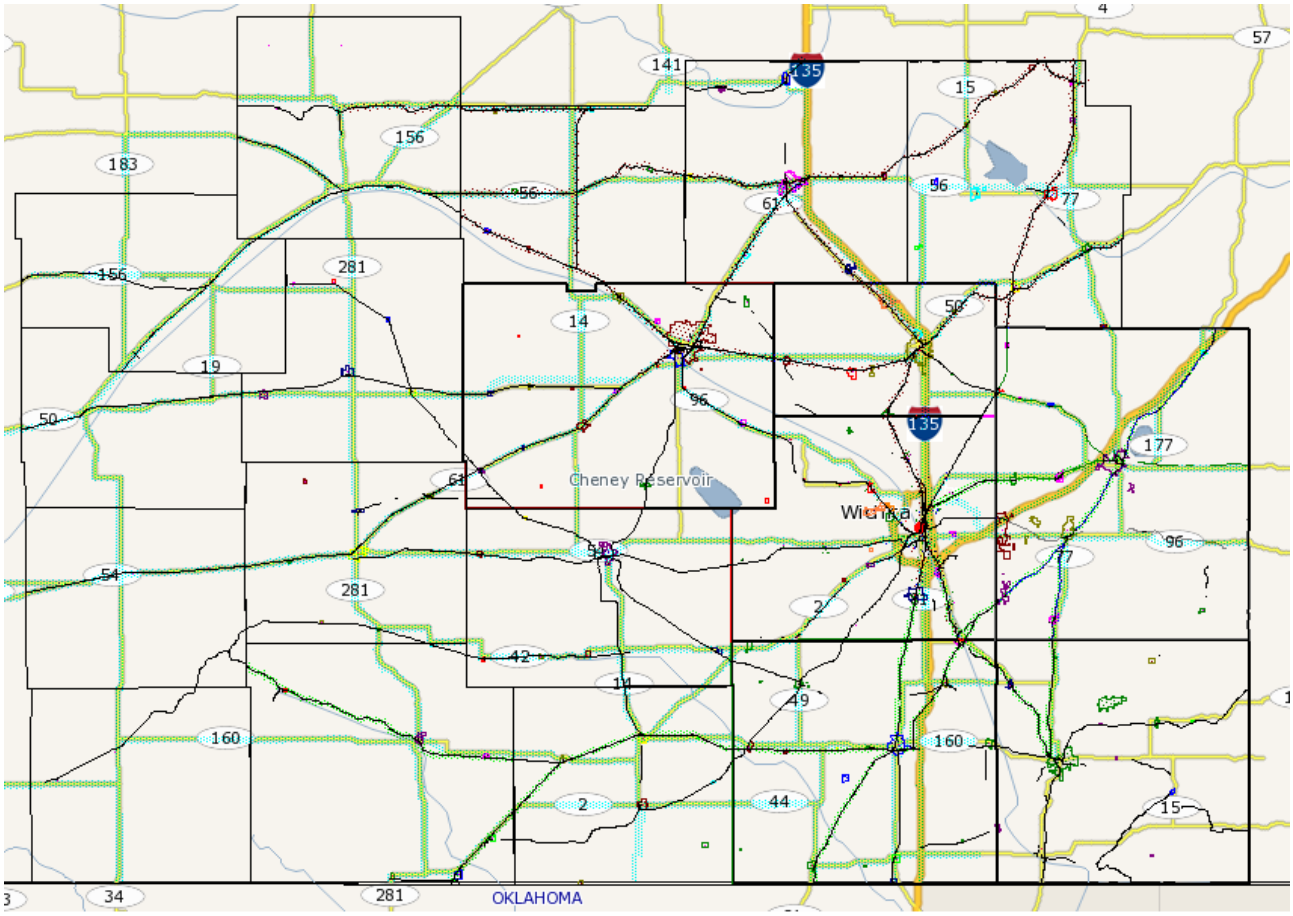


Source: County Tier II Reports

Each of the county hazard analysis plans show the locations of facilities that have hazardous chemicals, estimated probable and worst case release zones, and expected impact of the release to the public.

Coincidentally, facilities with EHS chemicals have also completed risk management plans (RMPs). Under the authority of section 112(r) of the Clean Air Act, the Chemical Accident Prevention Provisions require facilities that produce, handle, process, distribute, or store certain chemicals to develop a Risk Management Program, prepare a RMP, and submit the RMP to EPA. Also shown are potential release transportation corridors.

Railroads and Over-The-Road (OTR) vehicles that transport hazardous materials are considered to have a "hazard zone of concern" of ½-mile either side of the track or roadway (shown on the map as green for railroad and blue for roadway). Anyone located within this hazard zone of concern may be required to evacuate or shelter in-place depending on the local authority's determination of the chemical and expected release. Facilities located within this hazard zone of concern should have an emergency plan that includes evacuation from the zone and shelter in-place procedures. As shown on the map below, federal and state highways are predominate routes with a ½-mile proximity zone including railroads.



20.15 DAMS AND LEVEES

The failure of dams or levees could result in injuries, loss of life, or damage to property, the environment, and the economy. While levees are built solely for flood protection, dams often serve multiple purposes, one of which may be flood control. Severe flooding and other storms can increase the potential that dams and levees will be damaged and fail as a result of the physical force of the flood waters or overtopping.

Dams and levees are usually engineered to withstand a flood with a computed risk of occurrence. If a larger flood occurs, then that structure will likely be overtopped. If during the overtopping, the dam or levee fails or is washed out, the water behind is released as a flash flood. Failed dams and levees can create floods that are catastrophic to life and property, in part because of the tremendous energy of the released water.

20.15.1 DAMS

A dam is defined as a barrier constructed across a watercourse for the purpose of storage, control, or diversion of water. Dams are typically constructed of earth, rock, concrete, or mine tailings. A dam failure is the collapse, breach, or other failure resulting in downstream flooding. A dam impounds water in the upstream area, referred to as the reservoir. The amount of water impounded is measured in acre-feet. An acre-foot is the volume of water that covers an acre of land to a depth of one foot. As a function of upstream topography, even a very small dam may impound or detain many acre-feet of water. Two factors influence the potential severity of a full or partial dam failure: the amount of water impounded, and the density, type, and value of development and infrastructure located downstream.

The National Inventory of Dams maintained by the U.S. Army Corps of Engineers lists 5,650 dams in the State of Kansas of which 712 are in south central Kansas. The following tables show the conditions of dams located within each of the counties in south central Kansas:

Barber County

Hazard Categories	Number of Dams
High	2
Significant	1
Low	93
Undetermined	0
Total	**96**

Barton County

Hazard Categories	Number of Dams
High	1
Significant	0
Low	7
Undetermined	0
Total	**8**

Butler County

Hazard Categories	Number of Dams
High	13
Significant	10
Low	190
Undetermined	0
Total	**213**

Comanche County

Hazard Categories	Number of Dams
High	1
Significant	1
Low	20
Undetermined	4
Total	**26**

Cowley County

Hazard Categories	Number of Dams
High	3
Significant	16
Low	105
Undetermined	0
Total	**124**

Edwards County

Hazard Categories	Number of Dams
High	0
Significant	0
Low	2
Undetermined	0
Total	**2**

Harper County

Hazard Categories	Number of Dams
High	0
Significant	2
Low	17
Undetermined	0
Total	**19**

Harvey County

Hazard Categories	Number of Dams
High	2
Significant	6
Low	22
Undetermined	0
Total	**30**

Kingman County

Hazard Categories	Number of Dams
High	2
Significant	1
Low	25
Undetermined	0
Total	**28**

Kiowa County

Hazard Categories	Number of Dams
High	0
Significant	0
Low	7
Undetermined	0
Total	**7**

Marion County

Hazard Categories	Number of Dams
High	2
Significant	8
Low	13
Undetermined	0
Total	**23**

McPherson County

Hazard Categories	Number of Dams
High	0
Significant	1
Low	12
Undetermined	9
Total	**22**

Pawnee County

Hazard Categories	Number of Dams
High	0
Significant	2
Low	13
Undetermined	0
Total	**15**

Pratt County

Hazard Categories	Number of Dams
High	0
Significant	0
Low	10
Undetermined	0
Total	**10**

Reno County

Hazard Categories	Number of Dams
High	1
Significant	0
Low	18
Undetermined	0
Total	**19**

Rice County

Hazard Categories	Number of Dams
High	0
Significant	1
Low	9
Undetermined	1
Total	**11**

Sedgwick County

Hazard Categories	Number of Dams
High	5
Significant	7
Low	38
Undetermined	4
Total	**54**

Stafford County

Hazard Categories	Number of Dams
High	1
Significant	0
Low	2
Undetermined	0
Total	**3**

Sumner County

Hazard Categories	Number of Dams
High	1
Significant	1
Low	7
Undetermined	0
Total	**9**

The Kansas Division of Water Resources defines a state-regulated “dam” as any artificial barrier, including appurtenant works, with the ability to impound water, wastewater, or other liquids that has a height of 25 feet or more; or has a height of six feet or greater and also has the capacity to impound 50 or more acre feet. The height of the dam is measured from the downstream toe to the top if a watercourse is affected or from the lowest elevation of the outside limit of the dam to the top of the dam for barriers that do not extend across a stream or watercourse. The hazard potential for dam failure is classified according to the following definitions accepted by the Interagency Committee on Dam Safety:

- **High Hazard Dam (Class C)** — A dam located in an area where failure could result in any of the following: extensive loss of life, damage to more than one home, damage to industrial or commercial facilities, interruption of a public utility serving a large number of customers, damage to traffic on high-volume roads that meet the requirements for hazard class C dams or a high-volume railroad line, inundation of a frequently used recreation facility serving a relatively large number of persons, or two or more individual hazards described for significant hazard dams.

- **Significant Hazard Dam (Class B)** — 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 certain requirements, 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

- **Low Hazard Dam (Class A)** — 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 low hazard dams Dam failures can result from any one or a combination of the following causes:

    - Prolonged periods of rainfall and flooding, which causes most failures;
    - Inadequate spillway capacity, resulting in excess overtopping flows;
    - Internal erosion caused by embankment or foundation leakage or piping;
    - Improper maintenance, including failure to remove trees, repair internal seepage problems, replace lost material from the cross section of the dam and abutments;
    - Improper design, including the use of improper construction materials and construction practices;
    - Negligent operation, including failure to remove or open gates or valves during high flow periods;
    - Failure of upstream dams on the same waterway;
    - Landslides into reservoirs, which cause surges that result in overtopping;

- High winds, which can cause significant wave action and result in substantial erosion; and
- Earthquakes, which typically cause longitudinal cracks at the tops of embankments and weaken entire structures.

The 2005 Kansas Water Plan states that some dams are exhibiting structural deficiencies due to age. Some signs of structural deficiency include:

- Inadequate hydrologic capacity,
- Deteriorating metal pipes and structural components
- Increased runoff due to upstream development, and
- Increased failure hazard due to downstream development.

20.15.2 LEVEES

A levee, dike, embankment, flood bank or stop bank is a natural or artificial slope or wall to regulate water levels. Levees are usually earthen and often parallel to the course of a river or the coast. The main purpose of an artificial levee is to prevent flooding of the adjoining countryside; however, they also confine the flow of the river, resulting in higher and faster water flow. Levees can be mainly found along the sea, where dunes are not strong enough, along rivers for protection against high-floods, along lakes or along polders. Furthermore, levees have been built for the purpose of emboldening, or as a boundary for an inundation area. The latter can be a controlled inundation by the military or a measure to prevent inundation of a larger area surrounded by levees. Levees have also been built as field boundaries and as military defenses.

Man-made levees can fail in a number of ways. The most frequent (and dangerous) form of levee failure is a *breach*. A *levee breach* is when part of the levee actually breaks away, leaving a large opening for water to flood the land protected by the levee. A breach can be a sudden or gradual failure that is caused either by surface erosion or by a subsurface failure of the levee. Levee breaches are often accompanied by levee boils, or sand boils. A sand boil occurs when the upward pressure of water flowing through soil pores under the levee (under seepage) exceeds the downward pressure from the weight of the soil above it. The under seepage resurfaces on the landside, in the form of a volcano-like cone of sand. Boils signal a condition of incipient instability which may lead to erosion of the levee toe or foundation or result in sinking of the levee into the liquefied foundation below. Complete breach of the levee may quickly follow. Sometimes levees are said to fail when water *overtops* the crest of the levee. *Levee overtopping* can be caused when flood waters simply exceed the lowest crest of the levee system or if high winds begin to generate significant swells in the ocean or river water to bring waves crashing over the levee. Overtopping can lead to significant landside erosion of the levee or even be the mechanism for complete breach. Properly built levees are armored or reinforced with rocks or concrete to prevent erosion and failure.

Warning Time: More than 24 hours
Duration**:** More than one week

REGULATORY

Title 33, Chapter 15 of the U.S. Code of Federal Regulations addresses flood control to include floodplain management, projects, and levees. Cheney reservoir dam is maintained under the Reclamation Safety of Dams Act, Public Law 95-578 and amended in 1984 under Public Law 98-404.

PROBABILITY OF FUTURE OCCURRENCES

The probability of Dam and Levee failure is very difficult to project when there is little or no history of such an event. However, weatherization is understood to be erosive and regular dam and levee inspections should be conducted with the intent to maintain the structure for the maximum amount of public protection. State identified dams and levees are required by the State to document inspections and enforce compliance with any corrective action(s) necessary for periodic repair and upkeep, which assures the community of the safety level to the downstream residents. This hazard's CPRI probability is "unlikely" due to the fact that only two high hazard dams exist with a minimal number of downstream residents. The agricultural levees that exist and the levee around the fairground are not considered in the probability rating since the level of protection provided by these structures is considered minimal and they are not recognized by FEMA as providing protection.

MAGNITUDE/SEVERITY

There are dams and levees in the region that have the potential of causing widespread damage to include evacuations, infrastructure failure, and exceeding resource availability.

This hazard's CPRI magnitude/severity is "limited."

Calculated Priority Risk Index	Planning Significance
1.60	Low

20.16 EMERGING PUBLIC HEALTH THREATS

Definition: Threats of illness and disease (viral and bacteriological), community infections, early diagnosis and treatment of illnesses and diseases, or any other health related mechanism that can cause harm to individuals, whether intentional or accidental. This includes the potential for widespread (epidemic) outbreak of a disease, or a large number of cases of a disease in a single community or relatively small area. An epidemic may be restricted to one locale or may even be global (pandemic).

Historical Outbreaks:

- October 26, 1916 – Scarlet fever was prevalent in every county in Kansas.

- October 19, 1917 – Scarlet fever epidemics were reported in Cowley, Butler, Dickinson, and Leavenworth counties.

- Kansas was part of the *Salmonella* Saintpaul multistate outbreak investigation. This multistate outbreak was reported in May 2008 with cluster of cases in both New Mexico and Texas. At the end of the investigation there were 1463 cases reported from 43 states with onset of illness ranging from 4/16/08 to 8/23/08. In Kansas, we investigated 22 cases from 13 counties with onset of illness ranging from 5/12/08 until 7/13/08. Tomatoes were implicated as the food vehicle early in the outbreak. However, *Salmonella* Saintpaul was never isolated from any tomatoes. Additional investigation revealed that jalapenos and Serrano peppers were both associated with illness and *Salmonella* Saintpaul was isolated from jalapeno peppers. Multiple food vehicles are thought to have caused this outbreak. KDHE issued a press release on June 4, 2008 after the warning was issued from FDA about consumption of tomatoes. A second press release was issued by KDHE on July 9 after the warning from FDA changed to include jalapeno and Serrano peppers. KDHE did not publish a report, but CDC published an MMWR on August 29, 2008.

- Kansas was part of a multistate outbreak investigation of *Salmonella* Tennessee. Nationwide there were 603 cases from 47 states with onset dates of illness that ranged from 8/1/06 to 4/20/07. In Kansas, there were 19 cases identified with onset dates of illness from 8/1/06 to 3/22/07. Product testing did detect the outbreak strain in peanut butter. Nineteen products were positive, 1 Great Value Peanut Butter and 18 Peter Pan Peanut Butter. In Kansas 1 product tested positive for the outbreak strain. An MMWR was published by CDC on 6/1/07.

- KDHE was notified by a local health department about gastrointestinal illness among participants of "Bike Across Kansas" on 6/15/06. KDHE sent out staff to conduct this investigation. There were 126 participants that reported illness and onset of illness ranged from 6/9/06 to 6/22/06. Ill participants were from 10 states and many counties in Kansas. Limited hand washing facilities contributed to this outbreak that was spread via person-to-person and through food by snacks served at SAG stops. A press release was issued by KDHE on 6/21/06 and the final report was published by KDHE on 5/21/08.

- An increase in the number of mumps cases in Kansas was detected by routine surveillance. From January 2006 to December 2006 there were 986 cases of mumps affecting 73 counties. The peak of cases occurred in April and May of 2006 and many college campuses were affected throughout the state of Kansas. KDHE issued 35 press releases from April through July of 2006 and held a news conference on 4/11/06. In addition, KDHE held frequent conference calls with local health departments to assist in these investigations. To assist with control of this outbreak KDHE provided 10,000 doses of MMR to local health departments at no charge. During this same time period other states in the United States were reporting similar increases in mumps cases. During 2006, 6,584 cases of mumps were reported.

Examples of outbreaks from reportable diseases from poor health practices:

- Marion County Viral Gastroenteritis Outbreak Attributed to Norovirus (July 2005) - 52 of 96 people contracted norovirus (foodborne illness)
- Greenwood County Assisted Living Facility Outbreak of Diarrheal Illness (April 2005) - 22 of 40 people contracted diarrheal illness (improper health prevention)
- Osage County Grade School Viral Gastroenteritis Outbreak Attributed to Norovirus (March 2005) - 55 of 70 students contracted viral gastroenteritis and norovirus (foodborne illness)
- Sedgwick County Day Care Viral Gastroenteritis Outbreak Attributed to Norovirus (February 2005) - 6 of 6 people contracted norovirus (foodborne illness)
- *Salmonella typhimurium* Outbreak at a Department Store - Kansas November-December 2004 - 27 of 99 people contracted salmonella (foodborne illness)

Examples of large outbreaks from reportable diseases from accidental contamination:

- New York County Fair (Albany, NY): In September 1999, there was a reported 1,013 suspected and confirmed cases of *E. coli* O157:H7 infection resulted from drinking water from a contaminated well and spread from person to person because of poor sanitary practices.

- Municipal Water Supply (Walkerton, Ontario): In May 2000, 1,304 people became infected with *E. coli* O157:H7 after one of the city's water wells became contaminated due to flooding from agricultural field run-off from a cattle manure farm and overwhelming the water treatment system because of increased turbidity.

Examples of recent epidemic and pandemic diseases:

- West Nile Virus: According to the 2003 Public Health Service's Centers for Disease Control and Prevention report *Epidemic/Epizootic West Nile Virus in the United States: Guidelines for Surveillance, Prevention, and Control*, the first domestically acquired human cases of West Nile (WN) encephalitis were documented in the U.S. in late summer 1999. Surveillance tracked the spread of WNV throughout much of the U.S. between 2000 and 2002. By the end of 2002, WNV activity had been identified in 44 states and the District of Columbia. The 2002 WNV epidemic and epizootic resulted in reports of 4,156 reported human cases of WN disease (including 2,942 meningoencephalitis cases and 284 deaths), 16,741 dead birds, 6,604 infected mosquito pools, and 14,571 equine cases. The 2002 WNV epidemic was the largest recognized arboviral meningoencephalitis epidemic in the Western Hemisphere and the largest WN meningoencephalitis epidemic ever recorded. Significant human disease activity was recorded in Canada for the first time, and WNV activity was also documented in the Caribbean basin and Mexico. Cowley County had two confirmed cases of Avian Flu in 2003 and 2004, including two Equine cases in 2003 and one Equine case in 2004.

Reported Cases in Kansas	**2004**	**2003**	**2002**
Human cases confirmed by KDHE Laboratory or CDC Surveillance	46	90	22
Human Deaths	2	7	0
Additional deaths attributed to WNV, but unconfirmed by KDHE	0	3	0
Counties with positive birds, mosquitoes and horses	50	91	103
Positive birds	58	145	170
Positive horses	9	82	793

- Novel H1N1: (referred to as "swine flu" early on) is a new influenza virus causing illness in people. This new virus was first detected in people in the United States in April 2009. Other countries,

including Mexico and Canada, have reported people sick with this new virus. This virus is spread from person-to-person, probably in much the same way that regular seasonal influenza viruses spread. The World Health Organization (WHO) raised the worldwide pandemic alert level to Phase 6 in response to the ongoing global spread of the novel influenza A (H1N1) virus. A Phase 6 designation indicates that a global pandemic is underway. Cases of human infection with novel H1N1 influenza virus were first confirmed in the U.S. in Southern California and near Guadalupe County, Texas. The outbreak intensified rapidly from that time and more and more states have been reporting cases of illness from this virus. As of July 6, 2009, more than 70 countries reported over 94,500 cases of human infection and 429 deaths with novel H1N1 flu of which the United States had 33,902 confirmed and probable cases with 170 deaths. Kansas reported 136 cases during that same period. In comparison, the 1918-1919 H1N1 influenza which occurred in three waves with an estimated global mortality from the 1918-1919 pandemic at anywhere between 30 and 50 million. An estimated 675,000 Americans were among the dead. Kansas is often considered to be ground zero for the 1918 pandemic (*pandemicflu.gov*).

Additionally, Influenza A pandemics since that time, and indeed almost all cases of influenza A worldwide (excepting human infections from avian viruses such as H5N1 and H7N7), have been caused by descendants of the 1918 virus. Other notable pandemic influenza events include the 1957 Asian flu (H2N2) resulting in roughly two million deaths worldwide of which 70,000 deaths were in the United States, and the 1968-1969 Hong Kong flu (H3N2) resulted in 750,000 to one million deaths worldwide of which nearly 34,000 were in the United States.

- Avian Influenza: In the United States, an outbreak of highly pathogenic avian influenza (HPAI) A (H5N2) was detected in February 2004 through routine surveillance and reported in a flock of 7,000 chickens in Gonzales County in south-central Texas. This was the first outbreak of HPAI in the United States in 20 years. During the same time, an outbreak of low pathogenic avian influenza (LPAI) A (H7N2) was reported on two chicken farms in Delaware; LPAI H7N2 was reported from a flock of chickens in Pocomoke City, Maryland: and, LPAI H2N2 was reported in a layer flock located in Pennsylvania. In November 2003, there was been one reported case of human infection through the LPAI H7N2 in New York, and two Canadian poultry related laboratory confirmed cases of H7N3 in the Fraser Valley region of British Columbia. Influenza A (H5N1) virus was first identified in birds in South Africa and has spread throughout 14 countries in Asia and resulted in the death or destruction of more than 100 million birds including poultry. In 1997 the first case of spread from a bird to a human was seen during an outbreak of bird flu in poultry in Hong Kong causing severe respiratory illness in 12 people and six deaths. Since that time, there have been human cases of H5N1 infection occurring in Thailand, Vietnam and Cambodia during large H5N1 outbreaks in poultry. H5N1 has a human mortality rate of 60 percent.

Naturally Occurring Outbreaks

- Hantavirus Pulmonary Syndrome: Although present in the U.S. since 1959, it was not until 1993 when an outbreak occurred in the southwest U.S. after heavy rains created an overpopulation of rodents. Between May 1993 and July 6, 2005, a total of 396 cases (14 in Kansas) of hantavirus pulmonary syndrome have been reported in the United States. Thirty-six percent of all reported cases have resulted in death.

- Monkeypox: A rare viral disease that occurs mostly in central and western Africa first found in 1958 in laboratory monkeys and later found in African squirrels, rats, mice, and rabbits. Monkeypox was reported in humans for the first time in 1970, and a multi-state outbreak occurred in the United States (including one in Kansas) in July 2003 infecting 71 people after importation of small mammals to Texas from Ghana. The mortality rate is estimated between one and ten percent of those infected.

Diseases potentially used as biological weapons:

This type of usage includes any infectious agents or toxic chemical that could in theory be engineered for deliberate use as a weapon. Experts in this field believe that anthrax, botulism, plague, smallpox, tularemia, and viral hemorrhagic fever are the pathogens most likely to be used.

- Anthrax: Grazing livestock can become infected by anthrax spores in the soil, and humans can contract the disease by handling products (cutaneous transmission) from infected animals, by breathing (inhalation transmission) anthrax spores from infected animal products (i.e. wool from sheep), or eating (digestive transmission) undercooked meat from infected animals. In the United States, 22 cases of anthrax infection were reported from a higher grade form of anthrax and delivered through the mail system to intentionally contaminate individuals for terrorist purposes.

- Botulism: There are three main kinds of botulism: foodborne botulism is caused by eating foods that contain the botulism toxin; wound botulism is caused by toxin produced from a wound infected with *Clostridium botulinum*; and, infant botulism is caused by consuming the spores of the botulinum bacteria, which then grow in the intestines and release toxin. In the United States an average of 110 cases of botulism are reported each year of which 25% are foodborne and 72% are infant botulism.

- Plague: Plague is an infectious disease of animals and humans caused by a bacterium named *Yersinia pestis*. Fleas feeding on infected animals transmit the disease to humans and mammals. The disease can also be transmitted through handling infected animals or exposure to persons or animals with plague pneumonia and cough. Human plague in the United States has occurred as mostly scattered cases in rural areas (an average of 5 to 15 persons each year). About 14% (1 in 7) of all plague cases in the United States are fatal.

- Smallpox: Smallpox is a serious, contagious, and sometimes fatal infectious disease. The last case of smallpox in the United States was in 1949. The last naturally occurring case in the world was in Somalia in 1977. Smallpox also can be spread through direct contact with infected bodily fluids, direct and fairly prolonged face-to-face contact, or contaminated objects such as bedding or clothing.

- Tularemia: Tularemia is one of the most infectious pathogenic bacteria known that occurs naturally in the United States and is caused by the bacterium *Francisella tularensis* which is especially found in rodents, rabbits, and hares. Humans can become infected through diverse environmental exposures to include bites by infected arthropods; handling infectious animal tissues or fluids; direct contact with or ingestion of contaminated food, water, or soil; and inhalation of infective aerosols. It is. Between 1985 and 1992, 1409 cases and 20 deaths were reported in the U.S., a case fatality rate of 1.4%.

- Viral Hemorrhagic Fever: Generally, this group of illnesses cause severe multisystem syndrome (multiple organ systems in the body are affected), the overall vascular system is damaged, and the body's ability to regulate itself is impaired. For the most part, rodents and arthropods are the main reservoirs for the viruses. This includes Argentine hemorrhagic fever, Bolivian hemorraghic fever, Sabia-associated hemorrhagic fever, Venezuelan hemorrhagic fever, Lassa fever, Lymphocytic choriomeningitis (LCM), Crimean-Congo hemorrhagic fever (CCHF), Hantavirus Pulmonary Syndrome (HPS), hemorrhagic fever with renal syndrome (HFRS), Rift Valley fever, Ebola hemorrhagic fever, Marburg hemorrhagic fever, Kyasanur Forest disease, Omsk hemorrhagic fever, tick-borne encephalitis, Hendra virus disease, and Nipah virus encephalitis.

REGULATORY

There are numerous health plans in effect; medical quarantine procedures by local area hospitals and inoculations are required of school-aged children.

20.17 UTILITIES

Definition: Utilities can be defined as a public service that provides power, heat and water. Forms of energy and planning for use are nuclear, electric, gas, solar, wind and petroleum base fuels.

REGULATORY

The Kansas Corporation Commission protects the public interest through impartial and efficient resolution of all jurisdictional issues. The agency regulates rates, service and safety of public utilities, common carriers, motor carriers, and regulates oil and gas production by protecting correlative rights and environmental resources.

Westar Energy is part of the Southwest Power Pool (SPP), which is a group of 46 members serving more than 4 million customers, and covers a geographic area of 255,000 square miles containing a population of over 18 million people. The SPP is one of six North American Electric Reliability Council (NERC) regions that make up the Eastern Interconnect.

HAZARD SEVERITY RATINGS

The following rating table indicates the probability of an emerging public health threat event occurring at least once every 25 years, impacting less than 25% of the land, resulting in minor injuries and/or illnesses.

EMERGING PUBLIC HEALTH THREAT HAZARD RATING TABLE

Consequence	Probable Rating	Catastrophic Rating
Area Impacted	1	4
Probability	4	0
Health & Safety	1	3
Property	0	0
Environment	0	0
Economic	0	2
Total Ratings	***6***	***9***

CATASTROPHIC EVENT

A catastrophic worst-case event would be loss of electrical power at peak summer or winter months where restoration may take days.

20.18 TRANSPORTATION ACCIDENTS

Definition: Transportation accidents can be all modes of travel in and around the community.

Condition of Transportation

HIGHWAYS

Information obtained from the KDOT 2011 Pavement Management Information System (PMIS) shows District 5 has a total of 2,029 miles of surveyed Kansas highways. Performance level assessments of the highways were broken down to those roads not requiring corrective action, those requiring at least routine maintenance, and those requiring rehabilitation action beyond routine maintenance. There were no roads identified in the latter classification.

Railroads

The railroads report that track supervisors and maintenance employees inspect all track structures very frequently. All mainline tracks are driven over and inspected daily. Automated trackside detectors monitors for mechanical defects as well as all personnel are required to watch passing trains for problems. Bridge and trestle specific information was not available due to the current status of national security, and the additional information concerning the infrastructure of the railroad is beyond what can be made available at this time.

Pipelines

All of the pipeline companies routinely do fly over inspections of the entire pipeline systems for visual indications of leakages or damage to the pipelines. Electronic monitoring equipment continually monitors pressure changes within the pipelines to aid in leak or breach detections.

Airports

Kansas Airport Improvement Program – A review of the KDOT Airport Improvement Program that gives grant funded information on airport improvement and maintenance projects.

KANSAS AIRPORT IMPROVEMENT PROGRAM
FY 2012 PROJECTS

LOCATION	DESCRIPTION OF WORK	GRANT
Benton	Emergency Taxiway Repair	$40,500
El Dorado	AWOS-III	$50,000
Great Bend	Airfield Drainage Improvements	$6,250
Greensburg	Replace Airport	$380,000
Hillsboro	Airport Development Plan	$38,000
Hutchinson	Repair & Seal Runway 4-22 and Taxiways	$15,000
Kinsley	Overlay Runway 18-36	$267,300
Oxford	Replace Hangar Apron	$11,205
Wellington	Reconstruct South Taxiway	$59,541
Wellington	Repair Jet-A Ramp	$37,500
Wellington	Emergency AWOS Repair	$1,635

REGULATORY

The respective carriers and haulers maintain transportation safety regulations.

HAZARD SEVERITY RATINGS

The following rating table indicates the probability of an emerging public health threat event occurring annually and impacting less than 25% of the area.

TRANSPORTATION HAZARD RATING TABLE

Consequence	Probable Rating	Catastrophic Rating
Area Impacted	1	1
Probability	4	0
Health & Safety	0	4
Property	0	3
Environment	0	2
Economic	0	2
Total Ratings	***5***	***12***

CATASTROPHIC EVENT

A worst-case scenario would be one involving a release of chemicals passing across the most populated areas.

20.19 CIVIL DISTURBANCES

Definition: Civil disturbances can be riots, protests, demonstrations, bomb threats, and any form resulting in terrorism.

Examples of major civil disturbances within south central Kansas includes the following notable civil disturbances since 1958:

- A three-week sit-in protest in Wichita in August 1958 involving blacks protesting local racial segregation laws by banding together to demand service, often at whites-only lunch counters, and refusing to leave until served.

- In 1979, a riot erupted at Herman Hill Park between police and concert goers that initially started as police ordering people to remove their cars from the grass.

- Racial tensions building between the minority community and the police department erupted in violence in April 1980 along the 21st Street corridor between Grove and Hillside.

- Operation Rescue conducted its “Summer of Mercy” anti-abortion protest resulting in sit downs, blockading and storming the Women's Health Care Services Clinic (formerly Wichita Family Planning) in 1991 resulting in 13 arrests.

20.19.1 HATE GROUPS

According to information provided by the Southern Poverty Law Center, some of the nationally recognized hate groups that are present in Sedgwick County are Midland Hammerskins[1] (racist skinheads), the National Socialist Movement[2] (neo-Nazi), and the Imperial Klans of America Knights of the Ku Klux Klan[3]. The most recent incident in Sedgwick County occurred at Derby in August 2003 where a cross was burned on the front yard of a Hispanic family's residence and a brick with a racial message written on it was thrown through one of the windows. Westboro Baptist Church (WBC) has conducted nationwide protests.

Racist Skinheads form a particularly violent element of the white supremacist movement, and have often been referred to as the "shock troops" of the hoped-for revolution. The classic Skinhead look is a shaved head, black Doc Martens boots, jeans with suspenders and an array of typically racist tattoos.

Neo-Nazi groups share a hatred for Jews and a love for Adolf Hitler and Nazi Germany. While they also hate other minorities, homosexuals and even sometimes Christians, they perceive "the Jew" as their cardinal enemy, and trace social problems to a Jewish conspiracy that supposedly controls governments, financial institutions and the media. While some neo-Nazi groups emphasize simple hatred, others are more focused on the revolutionary creation of a fascist political state.

The Ku Klux Klan, with its mystique and its long history of violence, is the most infamous -- and oldest -- of American hate groups. Although blacks have typically been the Klan's primary target, it also has attacked Jews, immigrants, homosexuals and, until recently, Catholics.

Incorporated in 1967 as a not-for-profit organization, WBC considers itself an “Old School (or Primitive)” Baptist Church. WBC’s leader is Fred Phelps and several of his children and dozens of his grandchildren appear to constitute the majority of the group’s members. Protests include anti-Semitic, anti-gay, schools and churches perceived to be pro-gay, veteran funerals, etc.

20.19.2 ACTIVIST GROUPS

ANONYMOUS[25]

An international hacking group, spread through the Internet, initiating active civil disobedience, while attempting to maintain anonymity. Originating in 2003, the term refers to the concept of many online community users simultaneously existing as an anarchic, chaotic, global brain. It is also generally considered to be a blanket term for members of certain Internet subcultures, a way to refer to the actions of people in an environment where their actual identities are not known. Beginning with 2008, the Anonymous collective has become increasingly associated with collaborative, international hacktivism, undertaking protests and other actions, often with the goal of promoting internet freedom and freedom of speech. The following are recent examples of criminal DDOS attacks against companies:

- In December 2010, the Dutch police arrested a 16-year old for cyber attacks against Visa, MasterCard and PayPal.
- In January 2011, the FBI issued more than 40 search warrants in a probe against the Anonymous attacks on companies that did not explicitly support Wikileaks.
- In January 2011, the British police arrested five boys and men between the ages of 15 and 26.
- On June 10, 2011 the Spanish police captured three purported members of Anonymous in the cities of Gijon, Barcelona and Valencia. This particular group had made attacks on the web servers of the Playstation store, BBVA, Bankia, and the websites of the governments of Egypt, Algeria, Libya, Iran, Chile, Colombia and New Zealand.
- During Operation Avenge Assange in July 2010, more than 20 arrests were made of suspected Anonymous hackers in the U.S., U.K., and the Netherlands.

OCCUPY MOVEMENT[26]

The Occupy movement is an international protest movement which is primarily directed against economic and social inequality. The first Occupy protests to be widely covered were “Occupy Wall Street” in New York City and “Occupy San Francisco”, both taking place on September 17, 2011. By October 9, Occupy protests had taken place or were ongoing in over 95 cities across 82 countries, and over 600 communities in the United States. The movement was initiated by the Canadian activist group Adbusters, and partly inspired by the Arab Spring, especially Cairo's Tahrir Square protests, and the Spanish Indignants. The protests have focused on social and economic inequality, high unemployment, greed and corruption, and the undue influence of corporations—particularly that of the financial services sector—on government, and the movement commonly uses the slogan “*We are the 99%*.”

SOVEREIGN CITIZENS[27]

The "sovereign citizen" movement is a loosely organized collection of groups and individuals who have adopted a right-wing anarchist ideology originating in the theories of a group called the Posse Comitatus in the 1970s. Its adherents believe that virtually all existing government in the United States is illegitimate and they seek to "restore" an idealized, minimalist government that never actually existed. To this end, sovereign citizens wage war against the government and other forms of authority using "paper terrorism" harassment and intimidation tactics, and occasionally resorting to violence. Notable actions taken by the movement include the 1996 Montana Freeman standoff; 1997 Republic of Texas standoff Tactics "Paper terrorism," including frivolous lawsuits, frivolous liens, fictitious financial instruments, fictitious automobile-related documents, and misuse of genuine documents such as IRS forms; various frauds and scams. In April 2010, a sovereign citizen group calling itself Guardians of the Free Republics issued ultimatums to all 50 governors to vacate their offices within 72 hours. On May 20, 2010, two West Memphis, Arkansas, police officers were killed and two Crittenden County sheriff’s officers wounded in two linked shootouts involving an anti-government sovereign citizen with ties to Ohio and Florida.

[25] *Wikipedia*
[26] *Wikipedia*
[27] *Anti Defamation League*

PEOPLE FOR THE ETHICAL TREATMENT OF ANIMALS (PETA)[28]

Founded in 1980, PETA is the largest animal rights organization in the world, with more than 3 million members and supporters based in Norfolk, Virginia. PETA focuses its attention on the four areas in which the largest numbers of animals suffer the most intensely for the longest periods of time: on factory farms, in the clothing trade, in laboratories, and in the entertainment industry. We also work on a variety of other issues, including the cruel killing of beavers, birds, and other "pests" as well as cruelty to domesticated animals. PETA works through public education, cruelty investigations, research, animal rescue, legislation, special events, celebrity involvement, and protest campaigns.

ANIMAL LIBERATION FRONT (ALF)[29]

Founded in 1976, ALF is an international, underground leaderless resistance that engages in illegal direct action in pursuit of animal liberation. Activists see themselves as a modern-day "Underground Railroad", removing animals from laboratories and farms, destroying facilities, arranging safe houses and veterinary care, and operating sanctuaries where the animals live out the rest of their lives. ALF has used violence (i.e. bombings and arson) to further their cause. Between 1996 and 2002, the Animal Liberation Front (ALF) and the Earth Liberation Front (ELF) had committed more than 600 criminal acts since 1996 that resulted in a minimum of $43 million in damage.[30]

EARTH LIBERATION FRONT (ELF)[31]

Founded in 1977 as the Environmental Life Force, ELF's first "commando style" attack was an attempt to place fire bombs on seven crop dusters. ELF would have no central leadership or chain of command with each cell intended to be autonomous. Today's ELF, Earth Liberation Front, came into being around 1992 and rejoined the battle to protect Earth by using the same tactics employed by the original ELF fifteen years earlier. Members who "*have served or are serving their prison sentences honorably (without snitching)*, *can make official comments and speak as a legitimate ELF spokesperson. Prison validates an ELF spokesperson's credentials*."

20.19.3 TERRORISM

There is no single, universally accepted, definition of terrorism. Terrorism is defined in the Code of Federal Regulations as "the unlawful use of force and violence against persons or property to intimidate or coerce a government, the civilian population, or any segment thereof, in furtherance of political or social objectives" (28 C.F.R. Section 0.85).

The FBI describes terrorism as either domestic or international, depending on the origin, base, and objectives of the terrorist organization. For purposes of clarification, the FBI uses following definitions:

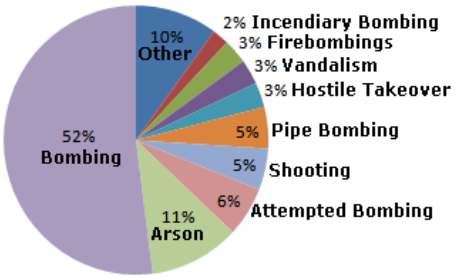
- Domestic terrorism is the unlawful use, or threatened use, of force or violence by a group or individual based and operating entirely within the United States or Puerto Rico without foreign direction committed against persons or property to intimidate or coerce a government, the civilian population, or any segment thereof in furtherance of political or social objectives.
- International terrorism involves violent acts or acts dangerous to human life that are a violation of the criminal laws of the United States or any state, or that would be a criminal violation if committed within the jurisdiction of the United States or any state. These acts appear to be intended to intimidate or coerce a civilian population, influence the policy of a government by intimidation or coercion, or affect the conduct of a government by assassination or kidnapping. International terrorist acts occur outside the United States or transcend national boundaries in terms of the means by which they are accomplished, the persons they appear intended to coerce or intimidate, or the locale in which their perpetrators operate or seek asylum.

[28] *PETA Website*
[29] *Wikipedia*
[30] *Southern Poverty Law Center/FBI*
[31] *ELF Website*

The FBI Divides Terrorist-Related Activities into Two Categories:

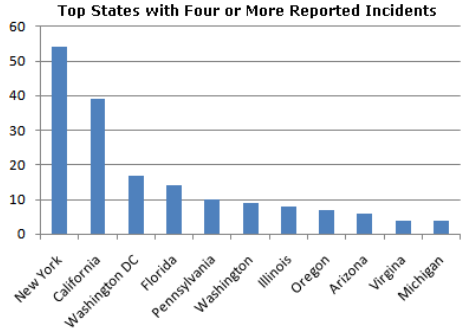
- A terrorist *incident* is a violent act or an act dangerous to human life, in violation of the criminal laws of the United States, or of any state, to intimidate or coerce a government, the civilian population, or any segment thereof, in furtherance of political or social objectives.
- A terrorism *prevention* is a documented instance in which a violent act by a known or suspected terrorist group or individual with the means and a proven propensity for violence is successfully interdicted through investigative activity.

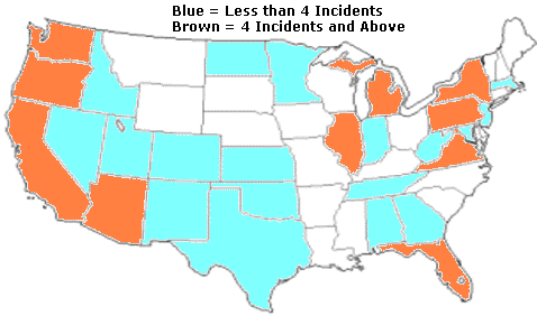
A chronological summary of 204 terrorist incidents (excludes 111 in Puerto Rico) between 1980 and 2005, recorded in the FBI's *Terrorism/Terrorism in the United States* series, has been extrapolated and shown below:



Other includes the following types:

Aircraft Attack	Malicious Destruction
Armed Assault	Smoke Bombing
Attempted Assassination	Tear Gas Bombing
Attempted Firebombing	Tree Spiking
Attempted Incendiary Bombing	Attempted Pipe
Bacillus anthracis	Bank Robbery
Burglary and Vandalism	Incendiary Attack
Car Fire and Attempted	Kidnapping
Destruction of Property	Rocket Attack
Hijacking	Assault
Letter Bombing	Attempted Arson
Mailings	Robbery





The following local event is classified as an attempted attack related to international terrorism by an extremist group:

- Kansas Letter Bomb, Leavenworth KS

  On January 3, 1997 – Three letter bombs disguised as holiday cards and postmarked from Alexandria, Egypt were discovered by a postal worker outside the Leavenworth penitentiary and were addressed to a parole officer at the prison. At the time Leavenworth's inmate population included Mohammed Salameh who was one of four people convicted in the 1993 World Trade Center bombing. The letter bombs were believed to have been tied to the five letter bombs discovered a day earlier in Washington DC.

The following national events are some of the successful and attempted attacks that have occurred in the U.S. which are classified as terrorism.

- World Trade Center, New York City NY (1993)

  Islamic extremist groups (including the Islamic Jihad, Hamas and Sudanese National Islamic Front) gathered materials for approximately two months prior to the February 26 bombing. They resided in New Jersey and apparently rented storage space that was used as a staging area for the bomb and subsequent loading of it into a Ryder rental van. The terrorists drove the 1,500-pound urea-nitrate bomb into the basement parking area of the World Trade Center's North Tower and then set the timer and left. It was intended to knock the North Tower (Tower One) into the South Tower (Tower Two), bringing both towers down and killing thousands of people. However, at 12:17PM Ramzi Yousef detonated the explosive and blast opened a 100 foot (30 m) hole through five sublevels with

the greatest damage occurring on levels B1 and B2 and significant structural damage on level B3 of the North Tower killing six people and injuring 1,042 others.

- Alfred P. Murrah Federal Building, Oklahoma City OK (1995)

  Timothy McVeigh, U.S. Army veteran and militia movement sympathizer, chose to bomb the Murrah building in retaliation for the government actions of the Waco Siege (which happened exactly two years prior in 1993) and the siege at Ruby Ridge. The building was approximately 75 feet wide, 318 feet long and nine stories tall and occupied the block bordered by NW 4th and 5th Streets between Robinson and Harvey Avenues. The building contained regional offices for the Social Security Administration, the Drug Enforcement Administration (DEA), and the Bureau of Alcohol, Tobacco, and Firearms (ATF). The building also contained recruiting offices for both the U.S. Army and the U.S. Marine Corps. The building housed approximately 550 employees and a daycare center. At 9:02 a.m. on April 19, a Ryder rental truck, containing approximately 5,000 pounds (2,300 kg) of ammonium nitrate fertilizer, nitromethane, and diesel fuel was parked along NW 5th Street between the building and the street in a loading zone located in front of the building's north entrance and detonated. The blast destroyed a third of the building and caused severe damage to several other buildings located nearby. As a result of the explosion, 168 people were killed, including 19 children, and over 800 others were injured. Two individuals killed were in the Oklahoma Water Resources Building, one person was in the Athenian Building, one person was outside the building near the blast and a nurse who lost her life in the rescue efforts. Rescue and recovery efforts were concluded at 11:50 p.m. on May 4, with the bodies of all but three victims recovered.

- Centennial, Olympic Park, Atlanta GA (1996)

  The park was designed as the "town square" of the Olympics, and thousands of spectators had gathered for a late concert by the band Jack Mack and the Heart Attack. Eric Robert Rudolf planted a green U.S. military ALICE pack (field pack) containing a steel plate as a directional device, three pipe bombs weighing in excess of 40 pounds, and nitroglycerin surrounded by nails underneath a bench near the base of a concert sound tower. He then left the pack but at some point was tipped over and helped minimize the blast area. A security guard, discovering the bag and reporting it to the Georgia Bureau of Investigation, began clearing the immediate area before the bomb exploded at 1:20 a.m. on July 27th. The bomb killed one and wounded 111 others. Turkish cameraman Melih Uzunyol died from a heart attack he suffered while running to cover the blast

- Columbine High School, Columbine CO (1999)

  Starting in 1996, both Eric Harris and Dylan Klebold were involved in video gaming and journal entries with an ever growing anger on society and later placed in diversion for theft of equipment and tools in 1998. Harris continued under a psychologist's care until a few months before the attack, all while he and Klebold plotted; the pair felt as if they were at war against society and needed to take action toward those they hated. Journal entries revealed that the pair had an elaborate plan for a major bombing rivaling that of Oklahoma City. Prior to the attack, they acquired two 9mm firearms and two 12-gauge shotguns, as well as building 99 improvised explosive devices of various designs and sizes. At 11:10 a.m. April 20, they arrived at Columbine High School in separate cars. After entering the cafeteria, two 20 pound (9 kg) propane bombs in bags were placed and left back to their cars. When the bombs failed to explode, they began shooting at students outside at 11:19 a.m. and proceeded to enter the school library hallway. Carbon dioxide bombs were thrown into the cafeteria area and started shooting in the library at 11:37 a.m. before leaving at 11:42 a.m... At 12:08p.m., they re-entered the library and committed suicide. In the aftermath, they killed 12 students and one teacher. They also injured 21 other students directly, and three people were injured while attempting to escape. Although Harris complained of depression, anger, and suicidal thoughts at a meeting with his psychiatrist and prescribed antidepressants, it was determined he was a clinical psychopath with a messianic-level superiority complex, while Klebold was depressive.

- World Trade Center, New York City NY (2001)

  World Trade Center (WTC) was a complex of seven buildings in Lower Manhattan in New York City built between 1975 and 1981 and contained 13.4 million square feet of office space. Financial/trade and communications offices were in WTC #1 (North Tower) and WTC #2 (South Tower); Marriott Hotel in WTC #3); various exchanges, Deutsche Bank and NY Board of Trade in WTC #4; financials and various offices in WTC #5; U.S. government office in WTC #6; and, financials as well as U.S. government offices and the New York City Office of Emergency Management in WTC #7. On September 11, 19 Al-Qaeda-affiliated hijackers flew two 767 jets into the complex, American Airlines Flight 11 in the North Tower at 08:46, impacting between the 93rd and 99th floors, and 17 minutes later United Airlines Flight 175 into the South Tower, impacting between the 77th and 85th floors. At 9:59 a.m., the South Tower collapsed due to fire, and the North Tower collapsed at 10:28 a.m. The attacks on the World Trade Center resulted in 2,752 deaths including 343 firefighters and 60 police officers from New York City and the Port Authority. World Trade Center 7 collapsed later in the day and the other buildings, although they did not collapse, had to be demolished because they were damaged beyond repair. The process of cleanup and recovery at the World Trade Center site took eight months.

- Pentagon (2001)

  Within 30 minutes of two planes hitting the World Trade Center twin towers, American Airlines Flight 77 departed Dulles International Airport bound for Los Angeles. The Boeing 757 was hijacked and crashed, loaded with 10,000 gallons of fuel, at 345 mph into the west side of the Pentagon. The plane hit the helicopter landing pad and hit the outermost ring of the Pentagon, (E Ring) midway between corridors 4 and 5. It cut a wedge through the D and C rings and stopping at the B ring. All 58 passengers, four flight attendants, and both pilots on board, as well as 125 occupants of the Pentagon died in the attack.

- Shanksville, Pennsylvania (2001)

  United Airlines Flight 93, a Boeing 757-200, was hijacked around 9:28 a.m. by four al-Qaeda terrorists 46 minutes into the flight from Newark International Airport to San Francisco International Airport. Originally projected to leave at 8:01 a.m., the plane was delayed until 8:42 a.m. before takeoff. It is believed the pilot was overpowered and diverted toward Washington D.C. until passengers overpowered the terrorists. The plane crashed in a field in Stonycreek Township, near Shanksville, in Somerset County, Pennsylvania, about 80 miles southeast of Pittsburgh and 150 miles northwest of Washington, D.C., killing all 37 passengers and seven crew members, including the four hijackers.

- American Airlines Flight 63 (2001) - Attempted

  On December 22, Islamic fundamentalist Richard Colvin Reid unsuccessfully tried to light a fuse leading into a shoe containing 100 milligrams of TATP and PETN while flying from Charles De Gaulle International Airport in Paris, France, to Miami International Airport in Miami, Florida. After being subdued in-flight, the plane was redirected to Logan International Airport in Boston, Massachusetts.

- West Nickel Mines School, Nickel Mines PA (2006)

  On October 2, Charles Carl Roberts IV (a milk truck driver who served several Amish farms in the area) backed a pickup truck up to the front of the Amish one-room schoolhouse and entered the school at approximately 10:25 a.m. EDT with a 9mm handgun, shortly after the children had returned from recess. He had the boys carry lumber, a shotgun, a stun-gun, wires, chains, nails, tools and a small bag. Also brought into the classroom was a length of wooden board with multiple sets of metal eye-hooks. The contents of the bag included a change of clothes, toilet paper, candles, and flexible plastic ties. Using wooden boards, Roberts barricaded the front door. He ordered the girls to line up against the chalkboard and allowed a pregnant woman, three parents with infants, and all remaining boys to exit the building. At approximately 11:07 a.m., Roberts began shooting the ten remaining girls (aged 6-13 years). As the first Pennsylvania State trooper reached a window, the shooting

abruptly stopped after Roberts had committed suicide. Five of the girls were all shot in the head at close range, with 17 or 18 shots fired in all.

- Fort Dix, New Jersey (2007) - Attempted

  On May 8, six radical extremists (Dritan Duka (age 28), Shain Duka (26) and Eljvir Duka (23) ethnic Albanians from the Republic of Macedonia; Mohamad Ibrahim Shnewer (22), Dritan Duka's brother-in-law, a Palestinian cab driver from Jordan; Serdar Tatar, born in Turkey; and, Agron Abdullahu, Albanian from Kosovo) were arrested by the FBI after attempting to murder U.S. service members. In 2006, they practiced firing semi-automatic weapons at a Pennsylvania firing range complete with video footage before authorities were alerted by a Circuit City store employee where the video was taken for duplication processing. The group was intending on purchasing a large number of weapons and grenade launchers from undercover FBI agents in early 2007 before the arrest.

- Virginia Polytechnic Institute, Blacksburg VA (2007)

  Virginia Polytechnic Institute also known as Virginia Tech is a public university that was the location of an attack by a student on faulty and students alike on April 16. Seung-Hui Cho was senior English major and diagnosed with severe anxiety disorder. Cho shot his two students around 7:15 a.m. in West Ambler Johnston Hall using a .22 caliber Walther P22 and 9mm Glock 19 before walking into Norris Hall two hours later with a backpack containing several chains, locks, a hammer, a knife, the two handguns, nineteen 10- and 15-round magazines, and almost 400 rounds of ammunition. During the second assault, Cho fired at least 174 rounds killing 29 more (five faculty and 24 students) before committing suicide.

- Fort Hood, Killeen TX (2009)

  On November 5, 39-year old U.S. Army Major Nidal Malik Hasan (psychiatrist) entered his workplace, the Soldier Readiness Center, at 1:34PM where personnel receive routine medical treatment immediately prior to and on return from deployment. He started shooting armed with an FN Five-Seven handgun and .357 Magnum revolver. Over the next 10 minutes of shooting, 30 people were wounded and 13 killed (12 soldiers and one civilian) of which 11 died at the scene and two died later in a hospital. Investigations showed there were 146 spent shell casings recovered inside the building, and another 68 collected outside, for a total of 214. When the shooting ended, the wounded Hasan was still carrying 177 rounds of unfired ammunition in his pockets, contained in both 20- and 30-round magazines. Note: Possible ties to Anwar al-Awlaki.

- Northwest Airlines Flight 253, Detroit MI (2009) - Attempted

  On December 25, 23-year old Umar Farouk Abdulmutallab is a Nigerian citizen who attempted to detonate plastic explosives hidden in his underwear while on board Northwest Airlines Flight 253, en route from Amsterdam to Detroit, Michigan. Reports indicate that he spent about 20 minutes in the bathroom as the flight approached Detroit, and then covered himself with a blanket after returning to his seat. Other passengers then heard popping noises, smelled a foul odor, and some saw Abdulmutallab's trouser leg and the wall of the plane on fire. His underwear contained a six-inch (15-cm) packet of PETN explosive which was sewn in along with TAPN. He indicated that he had been directed by al Qaeda, and that he had obtained the device in Yemen. He was subsequently charged on six criminal counts, including attempted use of a weapon of mass destruction and attempted murder of 289 people. Note: Possible ties to Anwar al-Awlaki.

- Times Square, New York NY (2010) - Attempted

  On May 1, 30-year old Pakistani-born U.S. citizen Faisal Shahzad attempted to set of a vehicle borne device in Times Square. At 6:28 p.m., a video surveillance camera recorded what was believed to be the dark green Nissan S.U.V. driving west on 45th Street. Moments later, a T-shirt vendor on the sidewalk saw smoke coming out of vents near the back seat of the S.U.V. containing three canisters of propane, five-gallon cans of gasoline and consumer grade fireworks. The vendor called to a mounted police officer, who smelled gunpowder when he approached the S.U.V. and called for assistance. The police began evacuating Times Square, from 43rd Street to 48th Street, and from Sixth to Eighth Avenues which was closed for much of the evening.

- Christmas Lighting, Portland OR (2010) - Attempted

  On November 26, 19-year old Mohamed Osman Mohamud, a Somali-born U.S. citizen and part-time student at Oregon State University, was arrested at 5:42 p.m., 18 minutes before the tree lighting was to occur, on an attempt to use a cell phone to explode a vehicle borne device loaded with six 55-gallon drums with detonation cords and plastic caps at the Christmas tree-lighting ceremony in Portland's Pioneer Courthouse Square. Unknown to Mohamud, he and undercover FBI agents traveled to a remote spot in Lincoln County on November 4 where they detonated a bomb concealed in a backpack as a trial run for the upcoming attack. The arrest was the culmination of a long-term undercover operation, during which Mohamud had been monitored for months as his alleged bomb plot developed for participating in violent jihad.

- Military Recruitment Center, Catonsville MD (2010) – Attempted

  On December 8, 19-year old Mohamed Osman Mohamud was arrested in connection with a scheme to attack an Armed Forces recruiting station in Catonsville, Maryland, with a vehicle bomb. There was no actual danger to the public as the explosives were inert and the suspect had been carefully monitored by law enforcement for months. Believing he was receiving help from a larger ring of jihadists, he communicated details of the plot, including where to park the van filled with explosives to hurt the most people, was actually provided to undercover agents.

State Resources

Kansas Homeland Security

Kansas Homeland Security, within the Adjutant General's Department, coordinates statewide activities pertaining to the prevention of and protection from terrorist-related events. This involves all aspects of prevention/mitigation, protection/preparedness, response and recovery. Kansas Homeland Security serves as a liaison between federal, state and local agencies and the private sector on matters relating to the security of Kansas and its citizens.

Kansas Bureau of Investigation (KBI)

The KBI is dedicated to providing professional investigative and laboratory services to criminal justice agencies, and the collection and dissemination of criminal justice information to public and private agencies, for the purpose of promoting public safety and the prevention of crime in Kansas. The Kansas Threat Integration Center (KSTIC) is a component of the KBI. The Information Technology department consists of application developers, technical support staff and information security personnel that collectively provide technology services to the KBI as well as technical and administrative support for the Kansas Criminal Justice Information System (KCJIS). KCJIS provides access to vital, time-sensitive information from national and state criminal justice databases on a secure and reliable network. Through KCJIS criminal justice and law enforcement agencies have access to information sources such as the National Crime Information center (NCIC) wanted persons, known gang and terrorists and stolen property files.

Kansas Highway Patrol – Homeland Security

Homeland Security/Special Operations is assigned to the Patrol's General Headquarters, is responsible for the agency's homeland security related functions, and administers the Homeland Security Grant Program and other related grant programs. It also includes the agency's personnel assigned to Criminal Interdiction/Asset Forfeiture, the U.S. Drug Enforcement Agency (DEA) Task Force, and the FBI's Joint Terrorism Task Force (JTTF).

Federal Resources

FBI Counterterrorism Division

The FBI's Counterterrorism Division collects, analyzes, and shares critical information and intelligence with the proper authorities to combat terrorism on three fronts: 1) international terrorism operations both within the United States and in support of extraterritorial investigations; 2) domestic terrorism operations; and 3) counterterrorism relating to both international and domestic terrorism.

National Counterterrorism Center (NCTC)

At the NCTC, analysts from the FBI, CIA, DHS, DOD, DOE, Health and Human Services, the Nuclear Regulatory Commission, and the Capitol Police work side-by-side to analyze and confront the threats facing the U.S. and our interests. NCTC analysts produce the National Threat Bulletin for the president, the Threat Matrix, and other analytic products. Its secure website, NCTC Online, is the primary dissemination system for terrorism information produced by the NCTC and other counterterrorism mission partners, including international partners. The NCTC also conducts strategic operational planning.

Joint Terrorism Task Force (JTTF).

These task forces combine the resources of the Bureau, the intelligence community, the military, and state and local police officers. The National Joint Terrorism Task Force, located just outside Washington, D.C., includes representatives from more than 40 agencies, including components of the Department of Homeland Security (DHS), Central Intelligence Agency (CIA), Department of Defense (DOD), and the Department of Energy (DOE).

FBI Terrorist Screening Center (TSC)

The TSC was established in December 2003 to create a single comprehensive database of known or suspected terrorists (both domestic and international). The TSC leverages the FBI's law enforcement databases to provide real-time actionable intelligence to state and local law enforcement.

FBI Terrorism Financing Operations Section (TFOS)

The TFOS coordinates efforts to track and shut down terrorist financing and to exploit financial information in an effort to identify previously unknown terrorist cells and recognize potential activity/planning. TFOS builds on the FBI's expertise in conducting complex criminal financial investigations and long-established relationships with the financial services sector. Through this effort, the FBI has made tremendous progress in tracking and freezing terrorists' assets.

FBI Counterintelligence Division

The FBI has the principal authority to conduct and coordinate counterintelligence investigations and operations within this country. It is the only federal agency with a mandate to investigate foreign counterintelligence cases within U.S. borders. Specially trained FBI counterintelligence experts monitor and neutralize foreign intelligence operations against the United States and investigate violations of federal laws against espionage, misuse of classified data, and other criminal matters relating to national security. The counterintelligence program is also involved in international terrorism threats, weapons of mass destruction threats, and attacks on the nation's critical infrastructures (i.e., communications, banking systems, and transportation systems).

FBI Safe Streets Task Forces (SSTFs)

SSFTs are dedicated to identifying, prioritizing, and targeting violent gangs. These SSTFs are comprised of more than 2,000 local, federal, and state investigators representing 653 law enforcement agencies throughout the United States.

National Gang Intelligence Center (NGIC)

The NGIC is a multi-agency effort that integrates gang-related intelligence assets from federal, state, and local law enforcement entities. It serves as a centralized intelligence resource for gang information and analytical support. The NGIC is co-located with GangTECC—the Gang Targeting, Enforcement, and Coordination Center—which is the national, multi-agency anti-gang task force created by the attorney general.

20.20 EXPANSIVE SOILS AND SUBSIDENCE

DESCRIPTION

A relatively widespread geologic hazard for Kansas is the presence of soils that expand and shrink in relation to their water content, absorption, or impervious surface. For Kansas, the vulnerability to this hazard most frequently is associated with soils shrinking during periods of drought. Retracting soils can cause physical damage to building foundations, roadways, communications towers, and other infrastructure components. When clay soils shrink, as a secondary impact to drought, typical signs in structures affected are unleveled settling, tilted or "off" appearance, and separation cracks in the soil next to the structure. The reverse can occur when there is excessive moisture, causing the clay soils to swell and thereby expand the grounds underneath the structure. Upward and lateral expansion can easily crack foundations and cause serious structural compromise. Typical signs are large rises in the soil called *heave*, which causes driveways to bubble up and crack, porches to be separated from the foundation of a structure, and homes or businesses that sustain severe structural damage that may result in condemnation. For Kansas, the vulnerability to this hazard most frequently is associated with soils shrinking during periods of drought.

Warning Time: 1—more than 24 hours
Duration: 4—more than one week
Geographic Location

The following map shows the swelling potential of soils in Kansas.

SWELLING SOILS MAP OF KANSAS

MAP LEGEND

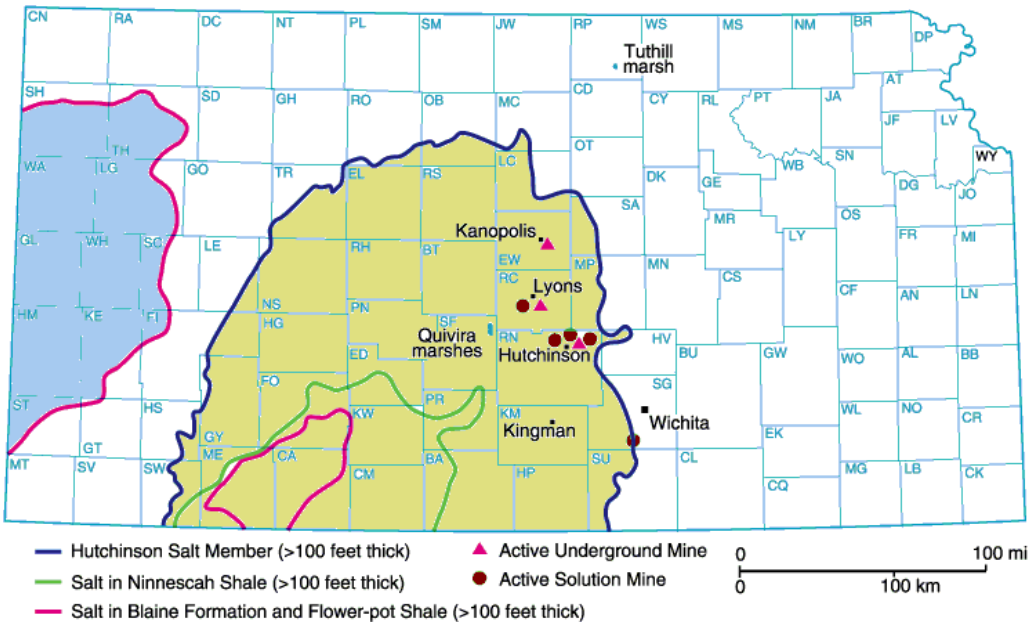
- Unit contains abundant clay having high swelling potential
- Part of unit (generally less than 50%) consists of clay having high swelling potential
- Unit contains abundant clay having slight to moderate swelling potential
- Part of unit (generally less than 50%) consists of clay having slight to moderate swelling potential
- Unit contains little or no swelling clay
- Data insufficient to indicate clay content of unit and/or swelling potential of clay

Source: U.S. Geological Survey publication, http://www.surevoid.com/soil_maps/ks.php

SINKHOLE DEVELOPMENT

Sinkhole development is associated with several of the following structural and topographic conditions: Structural crests of anticlines, upland drainage divides, nearly level to gently sloping land surface, entrenched river valleys nearby, and lack of thick surficial cover. These factors in combination are thought to enhance the possibility for vertical drainage of water into highly fractured, soluble bedrock with resulting

sinkhole solution. Another example of potential sinkhole development is solution mining where water is injected into a salt formation and brine is extracted.



Trapped gases created in sinkholes as well as natural gases released from abandoned wells are an explosive hazard consideration. Surface subsidence in western Kansas is possible and geologic subsurface evaluations are of great importance prior to development on the Hutchinson Salt member.

PREVIOUS OCCURRENCES

Streets and parking lots throughout jurisdictions are damaged every year by the effects of expansive soils as well as underground water lines that are damaged as the soil expands and contracts at varying levels along a water line. The frequency of damage from expansive soils can be associated with the cycles of drought and heavy rainfall, which reflect changes in moisture content. There is no available data for the planning area specific to damages resulting from expansive soils. These damages are largely isolated incidents and affected property owners make any necessary repairs.

Probability of Future Occurrences

Although there will continue to be some damage to paved areas and foundations due to swelling soils, it is unlikely that these damages will become greater in the future unless new development occurs in areas where the hazard is more severe. Certain buildings and construction practices could be put in place to lessen these impacts. It is determined that significant damage to assets from swelling soils occurs in the planning area and such damage is likely in the next three years.

Likely: Event is probable within the next three years

Magnitude/Severity: The impacts to the planning area from expansive soils are, for the most part, minor in damage and handled by individual property owners, but have the potential to be critical in nature.

Critical: 25-50 percent of property severely damaged

Calculated Priority Risk Index	Planning Significance
2.80	Moderate

20.21 ASTEROIDS AND METEORITES

Definition: The following definitions are given for meteors, meteoroids, meteorites, and asteroids:

Meteor: is a bright streak of light that appears briefly in the sky and appears when a particle or chunk of metallic or stony matter called a meteoroid enters the earth's atmosphere from outer space. Meteoroids that reach the Earth are called meteorites.

Meteorite: Meteorites may be stony, iron, or stony-iron composition may disintegrate if they are too small or cause a mid-air explosion before reaching the Earth's surface. The largest meteorite ever found weighs about 66 short tons (60 metric tons).

Asteroid: Asteroids are metallic, rocky bodies without atmospheres that orbit the Sun but are too small to be classified as planets. Asteroids with orbits that bring them within 1.3 AU (121 million miles) of the Sun are known as Earth-approaching or near-Earth asteroids (NEAs). Approximately 250 NEAs have been found to date, probably only a few percent of their total population. The largest NEA presently known is 1036 Ganymed, with an approximate diameter of 25.5 miles.

Near-Earth Objects (NEOs): Comets and asteroids that have been nudged by the gravitational attraction of nearby planets into orbits that allow them to enter the Earth's neighborhood. Composed mostly of water ice with embedded dust particles, comets originally formed in the cold outer planetary system while most of the rocky asteroids formed in the warmer inner solar system between the orbits of Mars and Jupiter.

The following asteroids were recorded as recent near misses:

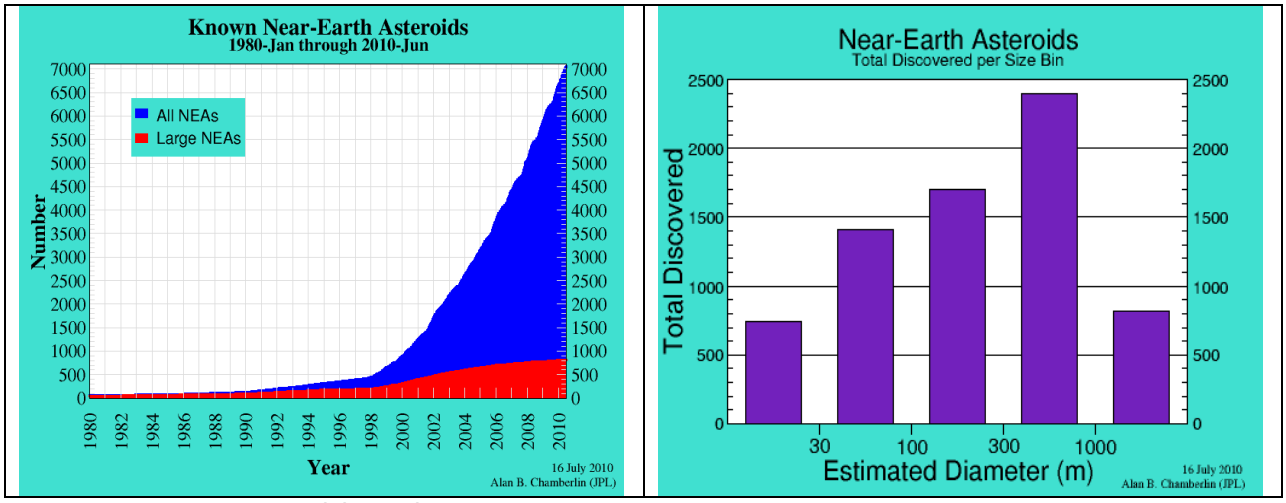
- March 23, 1989 – an asteroid 0.25-mile wide came within 400,000 miles of Earth.
- 2002 – a small asteroid (2002 MN) 150–360 ft in diameter, passed within 75,000 miles of Earth

The following interplanetary objects entered earth's atmosphere:

- Peekskill – October 9, 1992, a 1.7 meter diameter meteor fireball was observed from Kentucky to West Virginia and covered a ground path between 700 to 800 kilometers. One H6 monomict breccia meteorite in Peekskill, New York from this event had a mass of 27 pounds.
- Pennsylvania – On July 23rd, 2001, a small asteroid or piece of comet was observed as a fireball brighter than a full moon over several states to include Maryland, New York and New Jersey the fireball was moving on an east-west trajectory that carried it directly over the state of Pennsylvania. "It was traveling perhaps 15 km/s (34,000 mph) or faster when it exploded in the atmosphere with the force of about 3 kilotons of TNT," says Bill Cooke, a member of the Space Environments team at the Marshall Space Flight Center. If this was a rocky asteroid, then it probably measured between 1 and 2 meters across and weighed 30 or so metric tons. "The pressure wave from the airburst shattered some windows in towns west of Williamsport," Cooke continued. "Breaking glass requires an overpressure of about 5 millibars (0.5 kPa), which means that those homes were within 100 km of the explosion."
- Indonesia – On October 8th, 2009, a 10 meter wide asteroid exploded with an estimated yield of about 50 kilotons at 3:00 Greenwich time. According to NASA, a fireball event of this magnitude occurs about once every 2 to 12 years on average. As a rule, the most common types of stony asteroids would not be expected to cause ground damage unless their diameters were about 25 meters in diameter or larger.
- Salt Lake City, Utah – On November 18th, 2009, a bolide meteor not part of the Leonid debris stream exploded over Utah after midnight (MST) and was observed as far away as Los Angeles and Las Vegas with an estimated yield of up to one kiloton.
- Eastern Slovakia – On March 2, 2010, a meteor estimated to be 0.5 to one meter in diameter was observed around 11:30 at night at an altitude of 30 kilometers and exploded causing a loud explosion followed by a shock wave.
- Chicago, Illinois – On April 14th, 2010, during a Gamma Virginids event a meteor was observed after 10PM (CST) causing numerous sightings over several states and causing sonic booms in Iowa's Quad City area before reaching the horizon and breaking apart.

On a daily basis, about one hundred tons of interplanetary material drifts down to the Earth's surface. Most of the smallest interplanetary particles that reach the Earth's surface are the tiny dust particles that are released by comets as their ices vaporize in the solar neighborhood. The vast majority of the larger interplanetary material that reaches the Earth's surface originates as the collision fragments of asteroids that have run into one another some eons ago.

With an average interval of about 100 years, rocky or iron asteroids larger than about 50 meters would be expected to reach the Earth's surface and cause local disasters or produce the tidal waves that can inundate low lying coastal areas. On an average of every few hundred thousand years or so, asteroids larger than a kilometer could cause global disasters. In this case, the impact debris would spread throughout the Earth's atmosphere so that plant life would suffer from acid rain, partial blocking of sunlight, and from the firestorms resulting from heated impact debris raining back down upon the Earth's surface. Since their orbital paths often cross that of the Earth, collisions with near-Earth objects have occurred in the past and we should remain alert to the possibility of future close Earth approaches. It seems prudent to mount efforts to discover and study these objects, to characterize their sizes, compositions and structures and to keep an eye upon their future trajectories.



Source: NASA Jet Propulsion Laboratory

POTENTIAL IMPACT

Astronomers estimate that there are approximately 1,100 NEAs larger than 0.6 mi in diameter, and more than a million larger than 30m in diameter (the approximate threshold for penetration through the Earth's atmosphere).

The most recent NEA hitting the earth was at Tunguska, Siberia in 1908 which was 60 meters in diameter and produced a very destructive explosion of about 10-15 megatons energy and causing a 20 mile area of felled and scorched trees when it disintegrated at an altitude of 6-8 km. In contrast, the energy of a 30 m stony asteroid at the same speed is about 1 megaton of kinetic energy, and it does not penetrate within 10 km of the surface.

POTENTIAL OUTCOME

According to NASA's Science Definition Team (SDT), the following studies were found regarding asteroid impact potentials:

- Damage from a stony asteroid falls off very rapidly for sizes smaller than Tunguska, going to zero for energies below about 2 megatons.

- A one-megaton explosion exploding 15 km in the air may cause a large sonic boom with breakage of some windows near ground zero, but buildings would not generally suffer structural damage and trees would not be knocked down. Flying debris from short-lived gale-force winds might cause some injuries.

- There is a significant atmospheric attenuation of the hazard for impactors below about 70 m diameter, and that there would be no deaths from an impact smaller than about 45 m diameter.

REGULATORY

There are no regulatory procedures for this type of event.

HAZARD SEVERITY RATINGS

The following rating table indicates the probability of an asteroid and meteorite hazard event may rarely occur, impacting less than 25% of the land and few damages to property.

ASTEROID AND METEORITE HAZARD RATING

Consequence	Probable Rating	Catastrophic Rating
Area Impacted	1	2
Probability	0	0
Health & Safety	0	4
Property	1	3
Environment	0	3
Economic	0	2
Total Ratings	***2***	***14***

CATASTROPHIC EVENT

A catastrophic worst-case event equal or exceeding the Tunguska, Siberia event of 1908 that would level many buildings and cause widespread damage from debris.

SUMMARY

Table A on the following page depicts graphically the 16 types of specific hazards both natural and man-made that are of concern and rates each of the hazards as high, medium, or low in potential.

Table B shows the possible secondary events that could be triggered as a consequence of one of the 16 primary disasters occurring. It should be noted that it is generally more useful to consider all secondary events as a part of, and in the context of, the overall, situation created by the primary event.

Table A - Types of Hazards
Specific Hazard or Potential Emergency

Technological Hazards

	High	Medium	Low
1. Hazardous Materials			
a. Transportation			
Motor Carrier			
Railroad			
Aircraft			
Pipeline			
b. Fixed Facility			
Explosion			
Fire			
Accidential Release			
Theft / Loss			
c. Radiological			
Accidental Release			
Small Yield Detonation			
Dirty Bomb Release			
2. Fire			
a. High Rise Buildings			
b. Multiple Buildings			
c. Rangeland			
d. Pipelines			
e. Refinery			
f. Chemical Plant			
g. Industrial - Other			
3. Explosion			
a. Pipelines			
b. Industrial			
c. Chemical			
4. Pollution			
a. Air			
b. Water			
Mineral Inflow			
Rural Runoff			
Urban Runoff			
5. Water Related			
a. Dam or Reservoir Failures			
b. Dike or Levee Failure			
c. Water Shortage			
6. Medical Epidemic			
a. Human			
b. Animal			
7. Civil Disturbance			
a. Riot			
b. Bomb Threat			
c. Terrorism / Sabotage			

Natural Hazards

	High	Medium	Low
1. Floods			
a. River			
b. Creeks			
c. Flash			
2. Tornadoes			
3. Storms			
a. Lightning			
b. Hail			
c. Wind			
d. Heavy Snow			
e. Ice or Glaze			
4. Drought			
5. Earthquake			
6. Sinkholes			
7. Fog			

Critical Infrastructure

	High	Medium	Low
1. Utility			
a. Electrical			
Substation			
Power Lines			
Power Poles			
b. Natural Gas			
Main Lines			
Service Connections			
c. Water			
Water Treatment Plant			
Water Main Breakage			
Main Distribution System			
d. Storm Drainage			
e. Sanitary System			
Sewage Plants			
Sewage Mains			
Lift Stations			
Settling Ponds			
2. Transportation Accidents			
a. Motor Carrier			
b. Railroad			
c. Air			

TABLE B

Possible Secondary Events (Events that could possibly be of major consequence in a selected area are presented in this listing.)

Primary Disaster	Aircraft Accident	Animals-Loss/Injured/Dead	Crop Damage	Dam / Dike Failure	Epidemic	Explosion	Fallout	Fire	Flash Flood	Food Shortage	Fuel Shortage	Hazardous Materials Incident	Housing Shortage	Human Injured / Dead	Industrial Accident	Power / Gas Failure	Radiological Incident	Structural Collapse	Train Derailment	Vehicular Wreck	Water Shortage
NATURAL																					
1. Flood																					
a. River		X	X	X	X	X		X				X	X	X		X		X	X	X	X
b. Creeks		X	X	X	X	X		X				X	X	X		X		X	X	X	X
c. Flash		X	X	X	X	X		X				X	X	X		X		X	X	X	X
2. Tornadoes	X	X	X		X	X		X		X		X	X	X	X	X		X	X	X	X
3. Storms																					
a. Lightning	X	X	X			X		X				X	X	X							X
b. Hail	X	X	X							X				X	X					X	
c. Wind	X	X	X			X						X	X	X	X	X		X		X	
d. Blizzard																					
1. Heavy snow	X	X	X		X			X	X	X	X	X	X	X	X	X		X	X	X	X
2. Ice or Glaze	X	X	X			X		X	X	X		X	X	X						X	X
4. Drought		X	X		X					X				X							X
5. Earthquake				X	X	X		X			X	X	X	X	X	X		X	X	X	X
6. Fog	X											X		X	X				X	X	
MAN-MADE																					
1. Hazardous Materials																					
a. Transportation																					
1. Vehicular Wreck		X				X		X				X		X			X		X	X	
2 Train Derailment		X				X		X				X		X		X	X		X	X	
3 Downed Aircraft		X				X		X				X		X			X				
b. Industrial																					
1. Explosion						X	X	X				X		X	X	X	X	X			
2. Fire						X		X				X		X	X	X	X	X			
3. Accidental Release		X			X							X		X	X		X				
4. Theft / Loss												X					X				
2. Nuclear Emergencies		X	X	X	X	X	X	X		X	X	X	X	X	X	X	X	X	X	X	X
3. Fire																					
a. High Rise													X	X				X			
b. Multiple Buildings						X		X					X	X				X			
c. Industrial						X		X				X		X	X	X	X	X			
d. Rangeland		X	X					X		X				X							
e. Gas Lines						X		X			X	X		X	X						
f. Refinery						X		X			X	X		X	X						
g. Chemical Plant			X		X	X		X				X		X	X						
h. Health Care Facilities					X			X				X		X		X					

TABLE B

Possible Secondary Events (Events that could possibly be of major consequence in a selected area are presented in this listing.)

Primary Disaster	Aircraft Accident	Animals-Loss/Injured/Dead	Crop Damage	Dam / Dike Failure	Epidemic	Explosion	Fallout	Fire	Flash Flood	Food Shortage	Fuel Shortage	Hazardous Materials Incident	Housing Shortage	Human Injured / Dead	Industrial Accident	Power / Gas Failure	Radiological Incident	Structural Collapse	Train Derailment	Vehicular Wreck	Water Shortage
4. Explosion																					
a. Pipe Lines						X		X			X	X		X	X	X		X	X		
b. Industrial						X		X				X		X	X	X	X	X	X		
c. Chemical					X	X						X		X		X			X		
5. Pollution																					
a. Air		X	X		X																
b. Water																					
1. Mineral Inflow		X	X						X					X							X
2. Rural Runoff		X	X						X												
3. Urban Runoff				X					X												
6.Water Related																					
a. Dam or Reservoir Failures		X	X	X				X	X				X	X		X		X	X	X	X
b. Dike or Levee Failures		X	X	X				X	X				X	X	X	X		X	X	X	
c. Water Shortage		X	X		X																X
7. Medical Epidemic																					
a. Human					X									X							
b. Animal		X			X																
8. Utility																					
a. Power / Light																					
1. Sub Stations						X		X								X					
2. Downed Lines						X		X			X					X					
3. Downed Poles								X			X					X					
b. Natural Gas						X		X			X	X	X			X					
c. Water																					
1. Water Plant											X					X					X
2. Water Mains																					X
d. Storm Drainage									X												
e. Sanitary Drainage																					
1. Disposal Plant					X						X					X					
2. Mains						X												X			
3. Lift Stations					X											X					
4. Settling Ponds																					
9. Transportation Accidents																					
a. Truck		X				X		X			X	X		X			X	X	X	X	
b. Rail		X				X		X			X	X		X			X	X	X		
c. Air	X	X				X		X				X		X			X				
10. Civil Disturbance																					
a. Riot						X		X		X	X		X	X						X	
b. Bomb Threat	X			X		X		X				X		X					X	X	X
c. Terrorism / Sabotage	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X

DEFINITIONS

CASUALTY – is a term used in this analysis to refer to human injury or death as a result of a disaster event. Other losses categorized as a result of a disaster, such as property, the environment or social and economic activity is to be evaluated under the category of property for vulnerability and maximum threat ratings.

DISASTER/EMERGENCY – An event that causes or threatens to cause loss of life, human suffering, public and private property damage, and economic and social disruption. Disasters and emergencies require guidance and resources that are beyond the scope of local agencies in routine responses to day-to-day emergencies and accidents, and may be of such magnitude or unusual circumstances as to require response by several or all levels of government – local, state, and federal.

FEDERAL EMERGENCY MANAGEMENT AGENCY (FEMA) – Responsible for overall disaster-related federal programs involved with mitigation, preparedness, response and recovery to natural and man-made disasters or nuclear attack.

HAZARD – A potential event or situation that presents a threat to life and property.

HAZARD IDENTIFICATION – The determination of possible hazards, their probability and intensity, and the impact area.

HAZARD ANALYSIS – A review of the vulnerability of life, property, the environment, and social and economic activity to the actual or potential impact of hazards.

HISTORY – The record of occurrences of previous disasters or events.

LOCAL EMERGENCY PREPAREDNESS COORDINATOR is the person who is responsible for preparing, coordinating, training, organizing, and planning of emergency preparedness functions for the county and cities.

MAXIMUM TREAT – The greatest destruction that can be expected from an event.

MITIGATION – Those actions (including threat and vulnerability assessments) taken to reduce the exposure to and detrimental effects of a WMD incident.

PLUME – Airborne material spreading from a particular source; the dispersal of particles, gases, vapors, and aerosols into the atmosphere.

PROBABILITY – The likelihood that an even will occur.

RADIATION – High-energy particles or gamma rays that are emitted by an atom as the substance undergoes radioactive decay. Particles can be either charged alpha or beta particles or neutral neutron or gamma rays.

RECOVERY – Includes all types of emergency actions dedicated to continued protection of the public or promoting the resumption of normal activities in the affected area.

RESPONSE – Executing the plan and resources identified to perform those duties and services to preserve and protect life and property as well as provide services to the surviving population.

TERRORISM – The unlawful use of force or violence against persons or property to intimidate or coerce a government, the civilian population, or any segment thereof, in furtherance of political or social objectives. Domestic terrorism involves groups or individuals who are based and operate entirely within the United States and U.S. territories without foreign direction and whose acts are directed at elements of the U.S. government or population.

TOXICITY – A measure of the harmful effects produced by a given amount of a toxin on a living organism.

VULNERABILITY (or Risk) – The degree to which people, property, the environment, or social and economic activity – in short, all elements at risk – are susceptible to injury, damage, disruption, or loss.

WEAPONS-GRADE MATERIAL – Nuclear material considered most suitable for a nuclear weapon. It usually connotes uranium enriched to above 90% uranium-235 or plutonium with greater than about 90% plutonium-239.

WEAPON OF MASS DESTRUCTION (WMD) – Any explosive, incendiary, or poison gas, bomb, grenade, rocket having a propellant charge of more than 4 ounces, or a missile having an explosive incendiary charge of more than 0.25 ounce, or mine or device similar to the above; poison gas; weapon involving a disease organism; or weapon that is designed to release radiation or radioactivity at a level dangerous to human life. (Source: 18 USC 2332a as referenced in 18 USC 921)