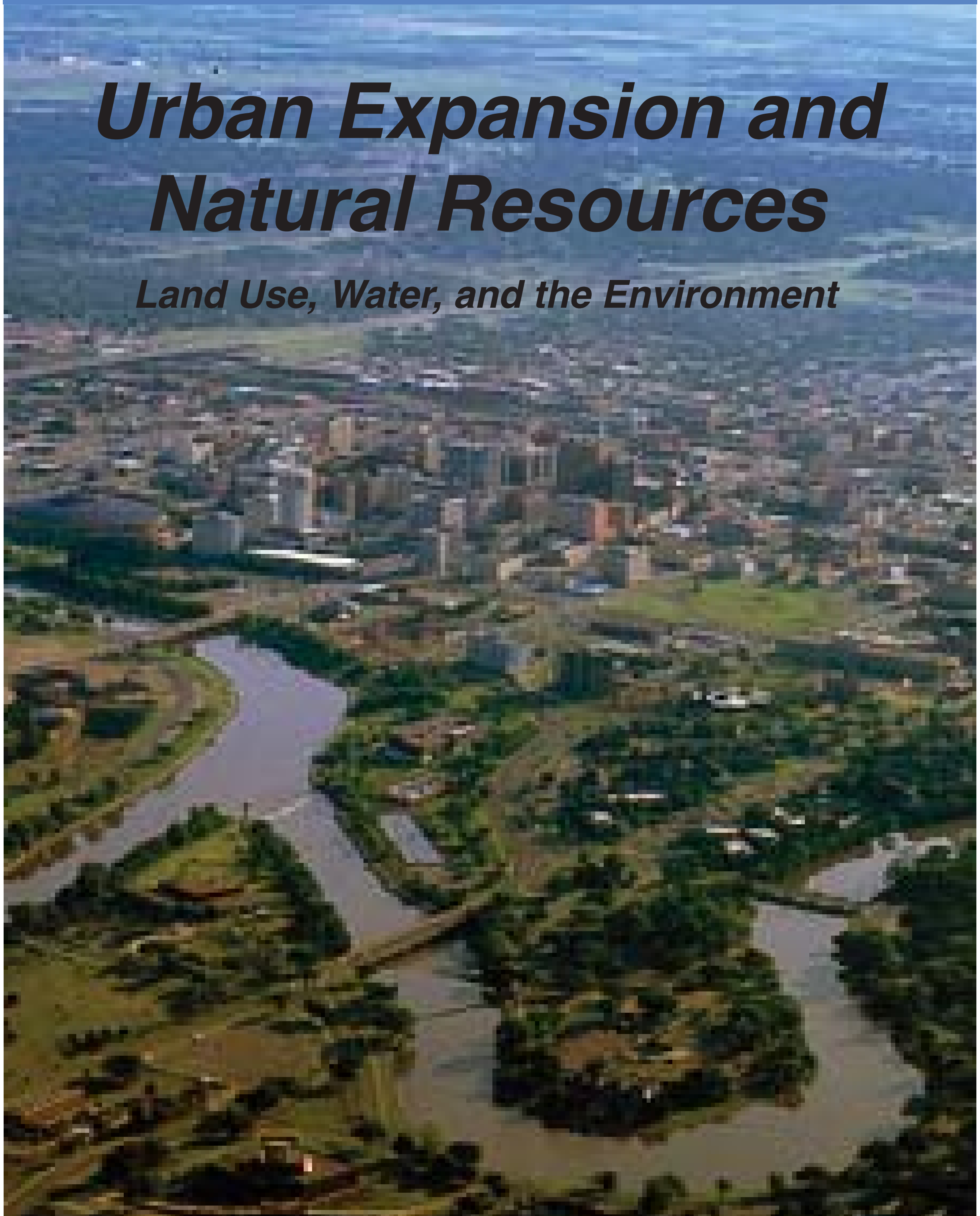
Kansas Earth Resources Field Project

Urban Expansion and Natural Resources

Land Use, Water, and the Environment



1997 FIELD CONFERENCE
June 4–6, 1997

**Sponsored by Kansas Geological Survey,
State Conservation Commission, and Kansas Department of Health and Environment**

KANSAS EARTH RESOURCES FIELD PROJECT

FIELD GUIDE

1997 FIELD CONFERENCE

Urban Expansion and Natural Resources

Land Use, Water, and the Environment

June 4-6, 1997

Edited by

Robert S. Sawin
and
Rex C. Buchanan

This project is operated by the Kansas Geological Survey and funded, in part, by the Kansas Department of Health and Environment using Kansas Water Plan funds, and the State Conservation Commission from the State Water Plan Special Revenue Fund and the Land Reclamation Fee Fund.

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KANSAS GEOLOGICAL SURVEY
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KANSAS EARTH RESOURCES FIELD PROJECT

Urban Expansion And Natural Resources

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TABLE OF CONTENTS

FRIDAY, JUNE 6

POCKET

Urban Expansion And Natural Resources

Land Use, Water, and the Environment

1997 FIELD CONFERENCE

June 4-6, 1997

PARTICIPANTS LIST

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Mike Dealy	Manager	Equus Beds Groundwater Management District No. 2	313 Spruce Street Halstead, KS 67056-1925 316/835-2224
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Douglas Johnston	Representative, 92nd District	Kansas House of Representatives/ Environment Committee	P.O. Box 1736 Wichita, KS 67201-1736 316/262-7534
Jerry Karr	Senator, 17th District	Kansas Senate/ Energy and Natural Resources Committee	1155 N. Highway 99 Emporia, KS 66801 913/343-1607
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Wayne Lebsack	Board of Directors	The Nature Conservancy Kansas Chapter	603 S. Douglas Lyons, KS 67554 316/938-2396
Al LeDoux	Director	Kansas Water Office	109 SW 9th, Suite 300 Topeka, KS 66612-1249 913/296-3185
Janis Lee	Senator, 36th District	Kansas Senate	Rural Route 1, Box 145 Kensington, KS 66951 913/476-2294
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John Strickler	Executive Director	KACEE (Kansas Association for Conservation and Environmental Education)	2610 Claflin Rd. Manhattan, KS 66502 913/537-7050
Mary Torrence	Assist. Revisor of Statutes	Revisor of Statutes Office	300 SW 10th, Suite 322S Topeka, KS 66612 913/296-5239
Jim Triplett	Chairman/ Professor	Statewide Council of Basin Advisors Comm./ Pittsburg State University	1701 S. Broadway Pittsburg, KS 66762 316/235-4730

BIOGRAPHICAL INFORMATION

Dennis Baker
Title
Land Reclamation Specialist
Affiliation
State Conservation Commission
Address and Telephone
109 SW 9th, Suite 500
Topeka, KS 66612
913/296-3600
Current Responsibilities
Land Reclamation Program Coordinator
Experience
Teacher, 12 years; Assistant Professor Oklahoma State University, 8 years; Farmer/Rancher, 22 years; State 9 years.
Education
Emporia State University - BSE, 1965
Pittsburg State University - MS, 1966
Oklahoma State University - PhD, 1988

Don Biggs
Title
Senator, 3rd District
Affiliation
Kansas Senate/Energy and Natural Resources Committee
Address and Telephone
Rm 140-N, State Capitol
Topeka, KS 66612
913/296-7372
Current Responsibilities
Kansas State Senator
Experience
President, Mutual Savings Association 1964 - 1992; Retired, June 1995.
Education
Kansas State University - BS, 1952

Jamie Clover Adams
Title
Legislative Liaison
Affiliation
Governor's Office
Address and Telephone
Office of the Governor
State Capitol, 2nd Floor
Topeka, KS 66612
913/296-1773
Current Responsibilities
Governor's Legislative Liaison for agriculture, environment, energy, natural resources, and emergency management.
Experience
Vice President, Kansas Grain & Feed Assoc.; Vice President, Kansas Fertilizer & Chemical Assoc.; Director, American Feed Industry Assoc.; Research Analyst, U.S. Chamber of Commerce.
Education
University of Michigan - BGS, 1985
Georgetown University - MPP, 1992

Mike Dealy
Title
Manager
Affiliation
Equus Beds Groundwater Management District No. 2
Address and Telephone
313 Spruce Street
Halstead, KS 67056-1925
316/835-2224
Current Responsibilities
Manage Equus Beds Groundwater Management District No.2.
Experience
Hydrologist, Southwest Kansas GMD, 1979-1984; Manager, Equus Beds GMD, 1984-present.
Education
Wichita State University - BA, 1976
Fort Hays State University - BS, 1979

Christine Downey
Title
Senator, 31st District
Affiliation
Kansas Senate
Address and Telephone
10320 N. Wheat State Rd.
Inman, KS 67546
316/543-2628
Current Responsibilities
Agriculture Committee; Ranking Minority Member, Education Committee; Ways & Means Committee; Board of Directors, Newton Medical Center; Adjunct Professor, Bethel College.
Experience
Public School Teacher, 20 years;
Bethel College Adjunct Professor, 5 years.
Education
Wichita State University - BS 1980
Wichita State University - MEd 1986

Vaughn L. Flora

Title

Representative, 57th District

Affiliation

Kansas House of Representatives

Address and Telephone

431 Woodland Ave.
Topeka, KS 66607
913/232-5147

Current Responsibilities

HouseEnvironment Committee

Experience

President, Non-profit Affordable Housing Corp., 2 years; Real Estate Broker; Home remodeling and construction; Kansas Rural Center.

Education

Kansas State University - BS, 1968

Joann Flower

Title

Representative, 47th District

Affiliation

Kansas House of Representatives

Address and Telephone

Rm 426-S, State Capitol
Topeka, KS 66612
913/296-7684

Current Responsibilities

Chair, House Agriculture Committee

Education

Johns Hopkins University - BS, 1958

Raney Gilliland

Title

Principal Analyst

Affiliation

Kansas Legislative Research Department

Address and Telephone

Rm 545-N, State Capitol
Topeka, KS 66612
913/296-3181

Current Responsibilities

Staff - House Environment; Senate Energy and Natural Resources; House Agriculture; Senate Agriculture; Administrative Rules & Regulations.

Experience

Legislative Research, 18 years.

Education

Kansas State University - BS, 1975
Kansas State University - MS, 1979

Ron Hammerschmidt

Title

Director, Division of Environment

Affiliation

Kansas Department of Health and Environment

Address and Telephone

Forbes Field, Bldg. 740
Topeka, KS 66620
913/296-1535

Current Responsibilities

Responsible for administration/management of regulatory division; planning, budgeting, and legislative responsibilities.

Experience

Research Scientist, VA Hospital, Omaha, NE; Director of Agriculture Lab, Harris Labs, Lincoln, NE; Senior Public Health Lab Scientist, KDHE Labs; Director, Bureau of Environment Remediation, KDHE; Dept. Director, Office of Science & Support, KDHE.

Education

St. Mary of the Plains College, DC - BA, 1973
University of Nebraska - PhD, 1978

Carl Holmes

Title

Representative, 125th District

Affiliation

Kansas House of Representatives

Address and Telephone

Rm 115-S, State Capitol
Topeka, KS 66612
913/296-7670

Current Responsibilities

Chairman, Agriculture and Natural Resources Subcommittee Appropriations; Chairman, Fiscal Oversight Committee; Chairman, Retail Wheeling Task Force; National Conservation State Legislatures Environment Committee.

Experience

Chairman, House Energy & Natural Resources Committee.

Education

Colorado State University - BS, 1962

Becky Hutchins

Title

Representative, 50th District

Affiliation

Kansas House of Representatives/House Environment Committee

Address and Telephone

700 Wyoming
Holton, KS 66436
913/364-2612

Current Responsibilities

House Agriculture Committee; Health & Human Services Committee; Environment Committee.

Experience

Second term in Kansas House of Representatives, 50th District.

Education

Washburn University - BA, 1985

Douglas Johnston
Title
Representative, 92nd District
Affiliation
Kansas House of Representatives/House Environment Committee
Address and Telephone
SCDP
P.O. Box 1736
Wichita, KS 67201-1736
316/262-7534

Gerald Karr
Title
Senator, 17th District
Affiliation
Kansas Senate
Address and Telephone
1155 N. Highway 99
Emporia, KS 66801
913/296-3245
Current Responsibilities
Senate Energy and Natural Resources Committee; Farmer/Stockman
Education
Kansas State University - BS, 1959
Southern Illinois University - MS, 1962
Southern Illinois University - PhD, 1966

Dan Kuhlman
Title
Earth Science Teacher
Affiliation
Kansas Earth Science Teachers Association
Address and Telephone
Eudora Unified School District 491
P.O. Box 500
Eudora, KS 66025
913/542-4960
Current Responsibilities
Earth Science, Eudora Middle School.
Education
University of Wisconsin - BS, 1976
University of Kansas - MA, 1985

Wayne Lebsack
Title
Board of Directors
Affiliation
The Nature Conservancy, Kansas Chapter
Address and Telephone
603 S. Douglas
Lyons, KS 67554
316/938-2396
Current Responsibilities
Kansas Board of Trustees.
Experience
Oil and gas exploration; Ground-water exploration and pollution research.
Education
Colorado School of Mines - Geol. Eng., 1949
Colorado School of Mines - Geol. Eng., 1951
Colorado School of Mines - 2 years grad. studies

Al LeDoux
Title
Director
Affiliation
Kansas Water Office
Address and Telephone
109 SW 9th, Suite 300
Topeka, KS 66612-1249
913/296-3185
Current Responsibilities
Plan, market, develop, implement, and evaluate policies/programs for current and future water needs.
Experience
Sr. Govt. Affairs Liaison, Gov. Graves; Adm. Assist. to Maj. Leader, Ks. Sen., Lt. Gov. Frahm; Legis. Liaison and Ag. Advisor, Gov. Hayden; Admin. Assist. to the Maj. Leader, Ks. House; Farmer and Stockman.
Education
Baker University - BA, 1969
University of Kansas - Graduate School

Janis Lee
Title
Senator, 36th District
Affiliation
Kansas Senate
Address and Telephone
Rural Route 1, Box 145
Kensington, KS 66951
913/476-2294
Current Responsibilities
State Senator; Part owner/operator of a ranch/farm.
Experience
Ranching and farming.
Education
Kansas State University - BSE/Ed, 1970

Laura McClure
Title
Representative, 119th District
Affiliation
Kansas House of Representatives
Address and Telephone
Rm 248W, State Capitol
Topeka, KS 66612
913/296-7680

Current Responsibilities
State Representative, 119th District.
Experience
Owner/operator flower and antiques shop; Nutrition site manager, Beloit Senior Center; Grassroots Lobbyist.
Education
Mankato High School - 1968

Gary Mitchell
Title
Secretary
Affiliation
Kansas Department of Health and Environment
Address and Telephone
900 SW Jackson, Suite 620
Topeka, KS 66612-1290
913/296-0461
Current Responsibilities
Governor appointee to Cabinet Agency with responsibility for protection of public health and the environment.
Experience
Chief of Staff, Committee on Agriculture, U.S. House of Representatives; State Director for Congressman Pat Roberts; Assistant to Congressman Pat Roberts in Washington, D.C.
Education
Kansas State University - BS, 1978

Karl Mueldener
Title
Director, Bureau of Water
Affiliation
Kansas Department of Health and Environment
Address and Telephone
Forbes Field, Bldg. 283
Topeka, KS 66620
913/296-5502
Current Responsibilities
Water and wastewater regulatory work including municipal, industrial, and agricultural wastes; underground injection; nonpoint source; and drinking-water quality.
Experience
Water and wastewater with KDHE 1975-present.
Education
Kansas State University - BS, 1973
Kansas State University - MS, 1974

Matt Scherer
Title
Program Manager
Affiliation
Division of Water Resources, Kansas Department of Agriculture
Address and Telephone
901 S. Kansas Ave.
Topeka, KS 66612
913/296-3705
Current Responsibilities
Manager, Water Management Services Program, Division of Water Resources, dealing with long-term water-management issues, interstate-water issues, and support.
Experience
10 years with DWR, past 3 as Basin Team leader; 2 years as Water Resource planner in KWO; several years with SCS (now NRCS).
Education
Kansas State University - BS, 1979
Kansas State University - MS, 1983

Tom Sloan
Title
Representative, 45th District
Affiliation
Kansas House of Representatives/House Environment Committee
Address and Telephone
772 Hwy 40
Lawrence, KS 66049
913/841-1526
Current Responsibilities
Strategic planning facilitator, Sloan & Associates.
Experience
Chief of Staff, Kansas Senate President; Assistant Professor Political Science, Kansas State University; Western Resources; Getty Oil Company.
Education
Syracuse University - AB, 1968
Michigan State University - MA, 1969
University of North Carolina - PhD, 1975

Tracy Streeter
Title
Executive Director
Affiliation
State Conservation Commission
Address and Telephone
109 SW 9th, Suite 500
Topeka, KS 66612
913/296-3600
Current Responsibilities
Agency Head.
Experience
Employed by SCC from 1985 to present; family farm in Brown County until 1990.
Education
Highland Community College - AS, 1983
Missouri Western State College - BS, 1985
University of Kansas - MPA, 1993

John Strickler

Title

Executive Director

Affiliation

KACEE (Kansas Association for Conservation and Environmental Education)

Address and Telephone

2610 Claflin Rd.
Manhattan, KS 66502
913/537-7050

Current Responsibilities

Executive Director, KACEE.

Experience

Special Assistant for Environment and Natural Resources to Governor Mike Hayden, 2 years; Acting Secretary, Kansas Department of Wildlife and Parks, 1987 and 1995; Kansas State and Extension Forestry, Kansas State University, 33 years; U.S. Forest Service, 4 years.

Education

University of Missouri - BSF, 1957
Kansas State University - MS, 1968

Mary Torrence

Title

Assistant Revisor of Statutes

Affiliation

Revisor of Statutes Office

Address and Telephone

300 SW 10th, Suite 322S
Topeka, KS 66612
913/296-5239

Current Responsibilities

Legislative staff; drafting legislation; and legal advisor.

Experience

Revisor of Statutes Office, 22 years.

Education

University of Kansas - BA, 1971
University of Kansas - JD, 1974

Jim Triplett

Title

Chair of Department of Biology

Affiliation

Pittsburg State University

Address and Telephone

1701 S. Broadway
Pittsburg, KS 66762
316/235-4730

Current Responsibilities

Chairman, Statewide Council of Basin Advisors Committee; Chairman, Neosho Basin Advisory Committee; Chairman, Crawford County Solid Waste Committee; Member, Solid Waste Grants Advisory Committee; Professor and Chairman, Biology Department, Pittsburg State University.

Experience

Chairman, Biology Department, Pittsburg State University, 12 years; Assistant Professor, Division of Fisheries and Wildlife Management, Ohio State University, 5 years.

Education

Kansas State College of Pittsburg - BA, 1966
Kansas State College of Pittsburg - MS, 1968
University of Kansas - PhD, 1976

KANSAS GEOLOGICAL SURVEY STAFF

Lee Gerhard

Title

Director and State Geologist

Affiliation

Kansas Geological Survey

Address and Telephone

1930 Constant Ave.
Campus West
Lawrence, KS 66049
913/864-3965

Current Responsibilities

Director of administration and geologic research at the Kansas Geological Survey.

Experience

Kansas Geological Survey, 9 years; Colorado School of Mines, 5 years; North Dakota Geological Survey, 6 years; W. Indies Lab., Fairleigh Dickinson Univ., 3 years; Univ. of Southern Colorado, 6 years; Sinclair, 2 years; Consultant and Independent Petroleum Geologist.

Education

Syracuse University - BS, 1958
University of Kansas - MS, 1961
University of Kansas - PhD, 1964

Larry Brady

Title

Deputy Director

Affiliation

Kansas Geological Survey

Address and Telephone

1930 Constant Ave.
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Lawrence, KS 66049
913/864-3965

Current Responsibilities

Geologic research and administration.

Experience

Kansas Geological Survey, 24 years; Oklahoma State University, 1 year; U.S. Corps of Engineers, 5 years.

Education

Kansas State University - BS, 1958
University of Kansas - MS, 1967
University of Kansas - PhD, 1971

Rex Buchanan

Title

Associate Director

Affiliation

Publications and Public Affairs Section, Kansas Geological Survey

Address and Telephone

1930 Constant Ave.
Campus West
Lawrence, KS 66049
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Current Responsibilities

Supervise publication and public outreach activities, media relations, and non-technical communications.

Experience

Kansas Geological Survey, 17 years; University-Industry Research, University of Wisconsin, 3 years; Salina Journal, 4 years.

Education

Kansas Wesleyan University - BA, 1975
University of Wisconsin-Madison - MA, 1978
University of Wisconsin-Madison - MS, 1982

Melanie Hathaway

Title

Student Assistant

Affiliation

Kansas Geological Survey

Address and Telephone

1930 Constant Ave.
Campus West
Lawrence, KS 66049
913/864-3965

Current Responsibilities

Student library assistant; Student assistant for Geology Extension.

Experience

Kansas Geological Survey, 2 years.

Education

University of Kansas - BS, 1997

Jim McCauley

Title

Assistant Scientist

Affiliation

Geologic Investigations Section, Kansas Geological Survey

Address and Telephone

1930 Constant Ave.
Campus West
Lawrence, KS 66049
913/864-3965

Current Responsibilities

Geologic mapping, remote sensing, and public inquiries.

Experience

Kansas Geological Survey, 19 years; KU Remote Sensing Laboratory, 6 years.

Education

University of Kansas - BS, 1970
University of Kansas - MS, 1973
University of Kansas - PhD, 1977

Bob Sawin

Title

Research Assistant

Affiliation

Geology Extension, Publications and Public Affairs Section, Kansas Geological Survey

Address and Telephone

1930 Constant Ave.
Campus West
Lawrence, KS 66049
913/864-3965

Current Responsibilities

Public outreach activities, Kansas Earth Resources Field Project, and public inquiries.

Experience

Kansas Geological Survey, 4 years; Petroleum Geology, 15 years; Engineering Geology, 6 years.

Education

Kansas State University - BS, 1972
Kansas State University - MS, 1977

Don Whittemore

Title

Senior Scientist

Affiliation

Chief, Geohydrology Section, Kansas Geological Survey

Address and Telephone

1930 Constant Ave.
Campus West
Lawrence, KS 66049
913/864-3965

Current Responsibilities

Chief, Geohydrology Section; environmental geochemistry; geochemistry of ground- and surface-water resources.

Experience

Kansas Geological Survey, 8 years; Assistant Professor, Kansas State University, 6 years.

Education

University of New Hampshire - BS, 1966
Pennsylvania State University - PhD, 1973

Urban Expansion And Natural Resources
Land Use, Water, and the Environment
1997 FIELD CONFERENCE

June 4-6, 1997

Welcome to the 1997 Field Conference, sponsored by the Kansas Geological Survey. This year's Field Conference is co-sponsored by the Kansas Department of Health and Environment and the State Conservation Commission. **Financial support for the field conference is provided in part by the Kansas Department of Health and Environment using Kansas Water Plan funds, and the State Conservation Commission from the State Water Plan Special Revenue Fund and the Land Reclamation Fee Fund.**

The theme for the 1997 Field Conference is *Urban Expansion and Natural Resources - Land, Water, and the Environment*. As suburbs and cities edge into the countryside, they often come into conflict with existing uses of the land; at the same time, growing cities require a variety of resources, including water, construction materials, and space to dispose of waste. This field conference, then, focuses on the natural resource issues created by urban expansion and concentrates primarily on the rapidly growing areas in Shawnee, Douglas, Johnson, and Sedgwick counties.

During the two and one-half day conference, participants will visit selected sites designed to demonstrate the natural-resource issues that arise during the expansion of urban areas. Stops include limestone quarries, sand and gravel dredging operations, landfills, land-reclamation sites, and projects designed to enhance water quality and quantity. When applicable, participants will analyze the technology implemented at these sites to prevent or to remediate environmental degradation.

The 1997 Field Conference is the third of the Survey's annual field conferences. These conferences are more than guided tours. Rather, the sites are selected to demonstrate particular perspectives on an issue, and the program is designed to provide first-hand experience. Local and regional experts in resource development will describe each site and the resource issues related to it. In addition, a comprehensive Field Guide provides background on the sites and issues. When possible, participants will interact with county, state, and regional officials, environmental groups, and citizens' organizations. This information base provides participants with new and broader perspectives useful in formulating energy policies.

The Field Conference is one aspect of the Survey's Kansas Earth Resources Field Project. The Field Project does not seek to resolve policy or regulatory conflicts, but rather provides unique opportunities to acquaint decision-makers and policy-makers with the various perspectives on resource problems and issues. As such, the Field Project goes beyond merely identifying the issues by bringing together experts who examine the unique technical, geographical, geological, environmental, social, and economic realities of the situation.

The Field Project provides an opportunity for participants to visit a variety of sites and discuss problems and issues with industry and government experts, residents, and community leaders. Participants will gain a better understanding and appreciation of the technology and concerns surrounding such development.

About the Kansas Earth Resources Field Project

The Kansas Earth Resources Field Project is an educational outreach program of the Kansas Geological Survey, administered through its Geology Extension program. The mission of the Field Project is to provide educational opportunities to individuals who make and influence policy about earth resources and related social, economic, and environmental issues in Kansas. Earth resources are defined as the mineral, energy, water, and soil resources of the earth. The industries that deal with earth resources include energy, mining, quarrying, and agriculture.

The Field Project consists of a series of onsite conferences at which the participants are introduced to the technical, economic, environmental, social, and policy-related aspects of earth-resource development. Using a field experience, the goal of the program is to provide participants with an educational opportunity that will assist them in making better informed, efficient, and effective decisions when dealing with earth-resource issues.

The Kansas Earth Resources Field Project strives to facilitate the exchange of information and ideas between working professionals who deal with earth-resource related issues. The programs are designed to open channels of communication among federal, state, and local governments as well as the private sector. The contacts established during the conference will provide a network for future information and idea exchange among the participants, and between participants and regional water, soil, energy, and mineral specialists.

The Kansas Earth Resources Field Project is modeled after a similar program of national scope, the Energy and Minerals Field Institute, operated by the Colorado School of Mines. The Kansas Geological Survey appreciates the support of Dr. Erling Brostuen, Director of the Energy and Minerals Field Institute, in helping develop the Kansas project.

Kansas Geological Survey

The Kansas Geological Survey is a research and service division administered by the University of Kansas. The Survey is responsible for studying and providing information about the state's geologic resources and hazards, particularly ground water, oil, natural gas, and other minerals. The Survey's role is strictly one of service, research, and reporting of results. The Survey has no regulatory authority.

The Kansas Geological Survey is organized into four research sections and several support groups. Research sections are Geologic Investigations, Geohydrology, Petroleum Research, and Mathematical Geology. Support sections include Exploration Services, Publications and Public Affairs, Technical Information Services, and Administration. The Survey also has a branch office in Wichita, the primary function of which is to collect, store, and loan cutting samples from oil and gas wells drilled in the state, along with providing publications sales and conducting geologic studies. The Kansas Geological Survey consists of more than 50 scientists, assisted by about 80 full-time staff members and student employees, specializing in a variety of geologic disciplines.

The Geologic Investigations Section studies and maps the state's surficial geology, paleontology, and industrial and metallic minerals deposits. This section is the focus for the Survey's geologic-mapping activities, and has been involved in the Survey's study of the geologic component of the recreational potential of the Kansas River valley.

The Geohydrology Section studies the state's water resources, including ground-water quantity and quality, and the relationship between ground water and surface water. The section conducts research and service projects directed toward accurately assessing the state's ground-water problems and finding effective ways of maintaining ground-water supplies to ensure availability for future generations. Research is designed to further the scientific understanding of the hydrology and water resources of Kansas and to disseminate research results and other hydrologic-related information to the people of the state.

The Petroleum Research Section works to increase the scientific understanding of the geologic and economic factors controlling the occurrence and production of hydrocarbon resources in Kansas. The section also works on the efficient transfer of research results and information to the people of Kansas in order to advance the understanding and effective management of its hydrocarbon resources. The section participates with other University of Kansas units in projects funded by the U.S. Department of Energy on the transfer of technology to Kansas operators through workshops held throughout the state, demonstration projects done in cooperation with independent producers, and the publication of results.

The Mathematical Geology Section applies statistical and mathematical techniques to various aspects of geology, such as mapping, analysis of the records of wells drilled in search of oil and gas, the movement of fluids through underground rocks, and other areas. These techniques can be applied to questions about natural-resource availability or the analysis of water contamination.

The Survey's Geology Extension program is designed to develop materials, projects, and services that communicate information about the geology of Kansas, the state's earth resources, and the products of the Kansas Geological Survey to the people of the state. The Kansas Earth Resources Field Project is managed and administered through this program.

Kansas Geological Survey Staff participating in the 1997 Field Conference:

Lee C. Gerhard, Director and State Geologist
Lawrence L. Brady, Deputy Director
Rex C. Buchanan, Associate Director, Publications and Public Affairs
James R. McCauley, Assistant Scientist, Geologic Investigations Section

Robert S. Sawin, Research Assistant, Geology Extension
Donald O. Whittemore, Chief, Geohydrology Section
Melanie M. Hathaway, Student Assistant, Geology Extension

State Conservation Commission

The State Conservation Commission, established in 1937, works to protect and enhance Kansas' natural resources through the development, implementation, and maintenance of policies and programs designed to assist local entities and individuals to conserve renewable resources.

This agency is charged with providing state aid to a variety of programs, including conservation districts, non-point-source pollution control, watershed-dam construction, small-lakes construction, water-rights purchases, and watershed-planning assistance. The Conservation Commission also works toward wetland protection and stream rehabilitation.

The State Conservation Commission administers the Kansas Conservation Districts Law, Watershed Districts Law, the Land Reclamation Act, and other statutes designed to assist local entities and individuals in conserving our natural resources. The agency is governed by five elected commissioners; two ex-officio members representing the Agricultural Experiment Station and Cooperative Extension Service, Kansas State University; and two appointed members representing the Kansas Department of Agriculture, and the USDA, Natural Resources Conservation Service. The agency is administered by an executive director appointed by the Commission. The current executive director is Tracy Streeter.

The Commission assists the 105 conservation districts, the 86 organized watershed districts, and other entities by:

- Developing and assisting in the implementation and administration of programs to conserve the natural resources of Kansas;

- Administering cost-share programs to assist landowners and users to install erosion-control and water-quality practices;

- Serving as liaison to local, state, and federal agencies;

- Providing administrative guidance to the 105 conservation districts;

- Providing a state match to county funds for conservation district operations.

Appropriations for Commission programs are from the State Water Plan Special Revenue Fund, the Land Reclamation Fee Fund, and the State General Fund. A majority of Commission programs are funded from the State Water Plan Fund, created in 1989 by Kansas Statute to provide a permanent, dedicated source of funding for the *Kansas Water Plan.*

Water Resources Cost-Share Program: Provides state cost-share assistance to landowners for the establishment of enduring water-conservation practices to protect and improve the quality and quantity of Kansas water resources. These practices, which are not generally a part of normal farming operations, are in the public interest and contribute to the protection and enhancement of water resources. The program is administered at the local level by the 105 county conservation districts.

Nonpoint Source Pollution Control Fund: Provides state financial assistance for nonpoint pollution control projects for the protection or restoration of surface- and ground-water quality. The program is administered locally by the county conservation districts.

Riparian and Wetland Protection Program: A program developed out of the State Water Plan and implemented by the conservation districts to address the conservation and management of riparian areas and wetlands. Financial assistance is provided to implement practices such as streambank stabilization, wetland enhancement, and other innovative bioengineering practices.

State Aid to Conservation Districts: Provides state funds to match county funds appropriated by county commissioners for the operation of county conservation districts in Kansas. Maximum state match is up to $10,000 in state funds per district.

Kansas Department of Health and Environment

This State agency is composed of two divisions, one responsible for health-related issues, the other for the environment. The Division of Health works with local health departments and other organizations in providing economic public health solutions. The Division conducts surveillance, policy and program development, and statewide assessment functions in order to determine and monitor the health status of Kansans, devise effective interventions, and set accountable measures of progress. The Division is composed of Environmental Health Services, Local and Rural Health Services, and an Office of Epidemiologic Services. The Division is directed by Dr. Steven R. Potsic.

The Division of Environment's mission is the protection of the public health and environment. The Division conducts regulatory programs involving public water supplies, industrial discharges, wastewater-treatment systems, solid-waste landfills, hazardous waste, air emissions, radioactive materials, asbestos removal, refined petroleum storage tanks, and other sources that impact the environment. In addition, the Division administers other programs to remediate contamination, lessen nonpoint pollution, and evaluate environmental conditions across the state.

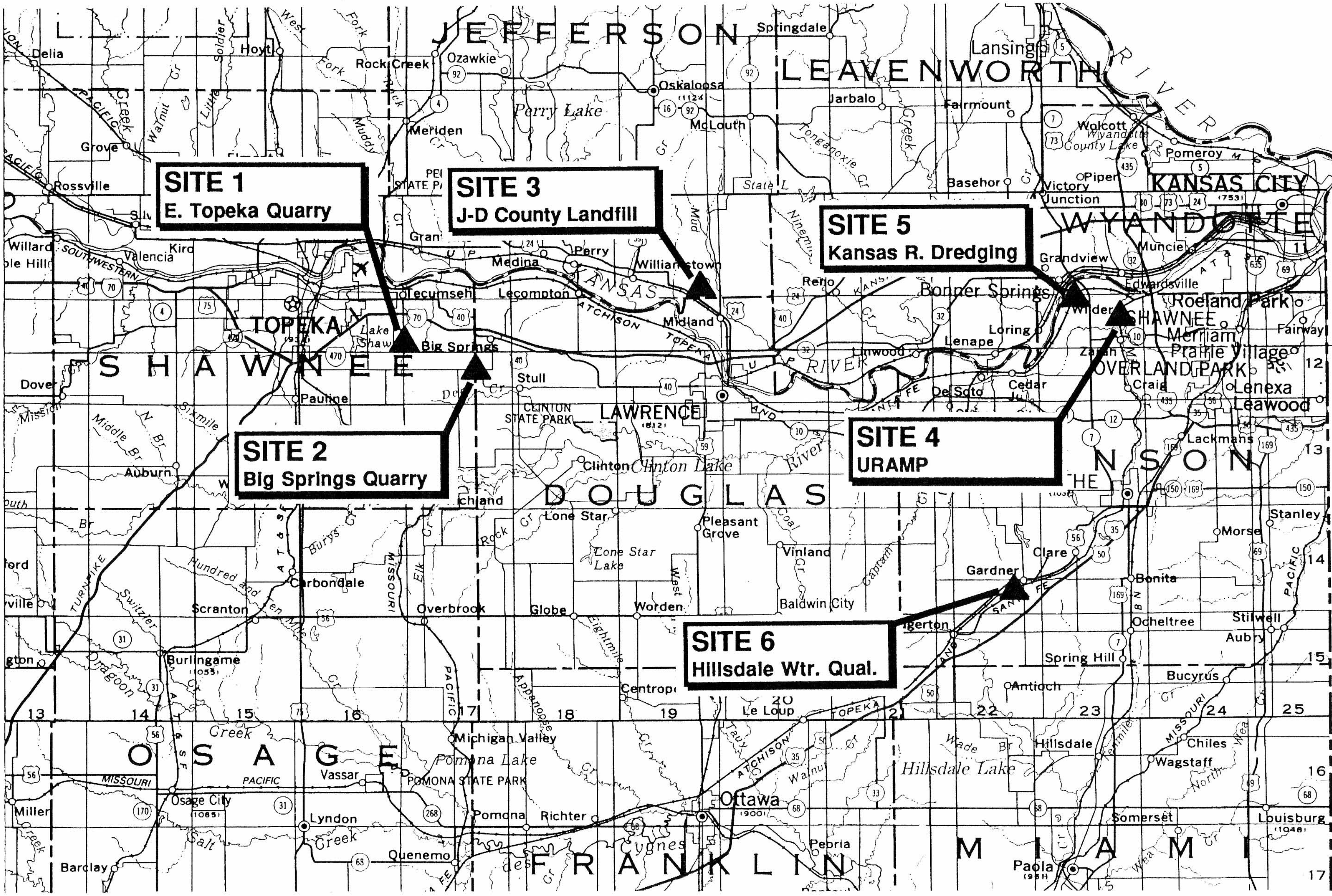
The Division of Environment is responsible for identifying water-quality and water-pollution problems and recommending remediation; for regulating coal mining and the reclamation of lands that have been mined for coal; for regulating non-point-source pollution, such as fertilizer runoff from fields; for regulating runoff from livestock feedlots; for protecting the quality of public water supplies; for cleaning up environmentally contaminated sites; for regulating hazardous-waste storage and remediation; for permitting waste-treatment facilities; and for regulating solid-waste disposal facilities, such as landfills. This agency is also a source of information about water-quality concerns and about water wells drilled in the state.

The Division of Environment is composed of Bureaus of Waste Management, Air and Radiation, Water, Environmental Remediation, and District Operations, along with an Office of Science and Support and a Nonpoint Source Section. The Director of the Division of Environment is Ronald Hammerschmidt.

SCHEDULE & ITINERARY

Wednesday June 4, 1997

7:00 am	Breakfast
7:20 am	Conference Overview *Lee Gerhard*, Director, Kansas Geological Survey
7:45 am	Bus to Topeka
9:00 am	**SITE 1** - East Topeka Limestone Quarry Reclamation, Topeka, KS *Bill Gahan,* Vice President - Kansas District, Martin Marietta Aggregates *Dennis Baker,* State Conservation Commission
9:15 am	**SITE 2** - Big Springs Limestone Quarry *Bill Gahan,* Vice President - Kansas District, Martin Marietta Aggregates *Woody Moses*, Managing Director, Kansas Aggregate Producers' Association
10:15 am	Bus to Site 3
10:45 am	**SITE 3** - Jefferson-Douglas County Landfill *Charlie Sedlock,* General Manager, Hamm Landfill
11:25 pm	Bus to Mill Creek Streamway Park, Barker Road Access
12:00 pm	**SITE 4** - Urbanization Impacts on Wetland and Riparian Resources, Johnson County *Phil Balch*, Wetlands and Riparian Coordinator, State Conservation Commission *Bill Maasen*, Acquisition Specialist, Johnson County Parks and Recreation
12:30 pm	Lunch at Mill Creek Streamway Park, Barker Road Access
1:20 pm	Bus to Bonner Springs
1:30 pm	**SITE 5** - Kansas River Sand Dredging - Bonner Springs, KS *Mike Odell*, General Manager, Holliday Sand and Gravel Company *Robert Smith*, U.S. Army Corps of Engineers *Larry Brady*, Deputy Director, Kansas Geological Survey
3:30 pm	Bus to Gardner
4:00 pm	**SITE 6** - Hillsdale Water Quality Project - Prairie Wetlands, Gardner, KS *Brad Horchen*, Project Manager, Hillsdale Water Quality Project *Greg Foley*, State Conservation Commission
4:40 pm	Bus to Emporia
6:00 pm	Arrive Ramada Inn, Emporia
6:15 pm	Cash Bar
7:00 pm	Dinner at the Ramada Inn
7:30 pm	Evening Session *Senator Sandy Praeger* "Kansas River - Recreation and Development"



DAY 1 - Wednesday, June 4, 1997

Emporia - Topeka - Kansas City - Emporia

East Topeka Limestone Quarry Reclamation

East Topeka Quarry is owned by Martin Marietta Materials, the nation's second largest producer of aggregates (sand, gravel, and crushed stone) used in the building of highways, commercial and residential construction, and other projects. Martin Marietta operates 10 quarries in Kansas.

This quarry, now closed, consists of about 1,000 acres on the southeast edge of Topeka. It was opened in 1952 and took limestone from the Ervine Creek, Rock Bluff, and Ozawkie Limestone Members of the Deer Creek Limestone (see Figure 1, Big Springs Quarry discussion). These rocks were deposited during the Pennsylvanian Period of geologic history, about 300 million years ago. Because they are more dense and more durable than other formations in the area, they were mined primarily for use in asphalt and concrete. This quarry closed in 1992 when these limestones were depleted.

Much of the former quarry has been reclaimed by grading the land's surface and sloping the highwalls that were left behind during quarrying, then planting back to grass. The area around the original plant--where rock was sorted, weighed, and loaded onto trucks for hauling--is still in use, and has not been reclaimed.

The reclamation here was undertaken voluntarily. In 1994, the Kansas Legislature passed the Surface-Mining Land Conservation and Reclamation Act, applying reclamation standards to quarries that were operating as of July 1, 1994. That law is administered by the State Conservation Commission, the state agency responsible for a variety of conservation programs, including stream rehabilitation, watershed-planning assistance, water-rights purchase, watershed-dam construction, and multipurpose small-lakes development.

The Reclamation Act requires that each quarry be registered, that the operator post a bond for each acre to be quarried, that they develop a reclamation plan, then undertake reclamation within three years after the completion of mining. Reclamation is defined as reconditioning the land affected by surface mining, returning it to a usable condition for water-storage lakes, agriculture, recreation, wildlife conservation, residential use, or industrial use. In general, reclamation requires removing mining-related waste and machinery, grading the land to its original slope or to 3:1 slope or less, covering the graded land with topsoil, then planting vegetation.

References

Kansas Conservation Commission, Surface Mining for Minerals Other than Coal in Kansas: The Surface-Mining Land Conservation and Land Reclamation Act, brochure, January 1997.

Martin Marietta Materials, Annual Report, 1996.

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Big Springs Limestone Quarry

Like the East Topeka Quarry, this location is owned by Martin Marietta Materials and takes rock from the Ervine Creek, Rock Bluff, and Ozawkie Limestone Members of the Deer Creek Limestone (Fig. 1). This quarry consists of 1,200 acres in Shawnee and Douglas counties and was opened in 1991, with sales beginning in 1993. Most of the limestone mined here is used for asphalt, concrete, and road rock in the construction of city streets, parking lots, and other projects in Topeka and Shawnee County.

To quarry this limestone, Martin Marietta first removes the soil, clay, and other materials (collectively called "overburden") atop the Ervine Creek Limestone Member. This overburden is later used in reclamation. Holes are drilled in the limestone and blasting then loosens the rock. After the limestone is removed for processing, the underlying shale is moved, also for later use in reclamation. At that point the quarrying process is repeated for the underlying Rock Bluff Limestone Member, the intervening shale is removed, then the Ozawkie Limestone Member is quarried. The maximum depth of excavation is about 60 feet.

Some of the limestone mined here is left in large pieces for rip-rap used in highway construction, but most is taken to an impact crusher that reduces it to about four inches in diameter, then to a roll crusher that reduces it to less than one inch. The limestone used in concrete is then washed to remove the finer particles. All of the crushed rock is loaded onto trucks belonging to private contractors for delivery to construction sites.

After mining has taken place on a 30-acre parcel, shale and overburden are returned to the mined-out location, and the ground is graded to approximate the original topography and drainage. Vegetation is then planted. Because this quarry has produced rock for five years, only a small portion of the mine has gone through the complete reclamation process, although the entire site will eventually be reclaimed.

Like all new quarries in the state, this one is regulated by the State Conservation Commission (see Site 1 for a description of those regulations). Because this quarry straddles the Douglas County/Shawnee County line, it is also subject to special-use permits from both counties, including limits on the hours of operation, a requirement that all truckloads of rock be covered with a tarp, and that truck traffic from the plant be restricted to U.S. Highway 40 to the north, rather than using Stull Road to the south.

This plant employs 22 people and produces about 500,000 tons of limestone per year. In all, the state's rock quarries produced about 26.3 million tons of crushed stone in 1995, worth about $177.5 million. For more information about statewide use of crushed rock, sand and gravel, and other non-fuel minerals, see the enclosed Kansas Geological Survey Public Information Circular 6, "Sand, Grave, and Crushed Stone: Their Production and Use in Kansas."

References

Grisafe, David A., 1997, Sand, Gravel, and Crushed Stone: Their Production and Use in Kansas: Kansas Geological Survey, Public Information Circular 6, 4 p.

Cantrell, David, Economic Impact of the Kansas Aggregate Industry, Kansas Aggregate Producers' Association brochure.

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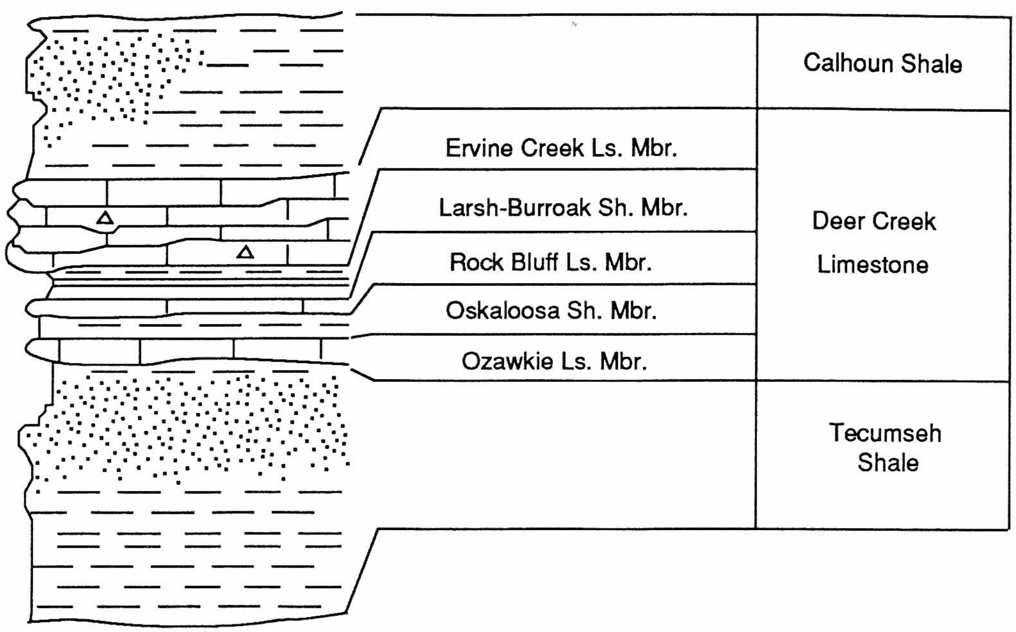

Figure 1. Geologic section at East Topeka and Big Springs quarries (modified from Zeller, 1968).

Jefferson-Douglas County Landfill

Located three miles north of Lawrence in Jefferson County, Kansas (five miles east of Perry), the Jefferson-Douglas County Landfill, operated by Hamm Landfill, spreads across 420 acres of limestone-quarried land. Limestones of the Oread Limestone (Fig. 1) were quarried for aggregate. Although some mining still takes place near the landfill site, the primary operation here is the landfill.

The Hamm Company was started in the early 1940s by Norman Ray Hamm from his home in Perry, Kansas. Initially a custom combine operation, the company branched out, first into earth-moving equipment and then into an 80-acre quarry. Over the years, Hamm Company has continued to grow, adding N.R. Hamm Contractor, Inc. in 1959 and Hamm Asphalt, Inc. in 1969. Hamm Landfill, the most recent addition to the family business, was established in 1981 when the City of Lawrence needed a new landfill site.

The Jefferson-Douglas County Landfill accepts only municipal solid waste; no hazardous or toxic wastes are allowed. Transfer stations scattered throughout the Midwest collect waste that is later transported by truck to the Jefferson-Douglas County Landfill. As a part of routine collection, local haulers deliver municipal solid waste to these specially designed facilities. The waste is unloaded directly onto Hamms' 25-ton, long-haul semi-trailers, built specifically to allow further compaction and higher volume. The landfill is one of the first in the nation to utilize an automated trailer tipper, an elevator device that speeds the unloading process and allows the use of more fuel-efficient and lighter trailers.

At nearly one mile in length, three-quarters of a mile in breadth, and an average 150 feet deep, the landfill has a capacity of 54 million tons, the largest in the region. If all the landfills in Kansas were closed, the landfill could accommodate the state's waste-disposal needs for the next 35 years. At the current disposal rate, the Jefferson-Douglas County Landfill has a life expectancy of 400 years.

Environmentally, the Jefferson-Douglas County Landfill provides a relatively safe site for a sanitary landfill. Isolated atop a naturally tight shale floor, the facility is both high and dry, characteristics that establish natural barriers to ground-water contamination. The base of the landfill consists of 140 feet of shale with the floor of the landfill more than 200 feet above the water table.

The landfill is divided into 35 cells. The first cell (Cell 0) has been filled, and closed in 1993. Cells 1 - 3 are expected to last another 10 years.

Before any waste is buried, a foundation is prepared in the base of the cell. The process begins by first placing three feet of crushed shale, a second layer of synthetic liner, a third two-foot layer of sand, drainage piping for leachate collection, a fourth layer of geotextile filter fabric, and then waste. To provide maximum daily control, the waste is covered each afternoon with compacted shale, a practice that controls disease carrying organisms, odor, and runoff water.

A modern leachate-collection system has been installed. This underground network of pipes catches the water and other fluids that filter down through the waste, and collects them in one of two leachate ponds for treatment. This process avoids seepage to the water table below. The landfill is also in compliance with EPA stormwater-runoff requirements.

Also incorporated into its design are methane pipes to monitor and trap methane gas. Perforated pipes draw off the methane, which is eventually collected or flared. Over time the pipes will be extended, growing in height at the same pace as the landfill. The site currently has 10 methane pipes and 21 ground-water-monitoring wells.

Municipal solid waste is a growing problem, and the importance of source reduction and recycling as strategies to relieve the pressure on landfills cannot be overstated. At the same time, however, a significant portion of municipal solid waste (more than three-fourths by some estimates) goes to landfills, and they will continue to be a primary means of disposal for most communities.

References

Hamm Landfill brochure.

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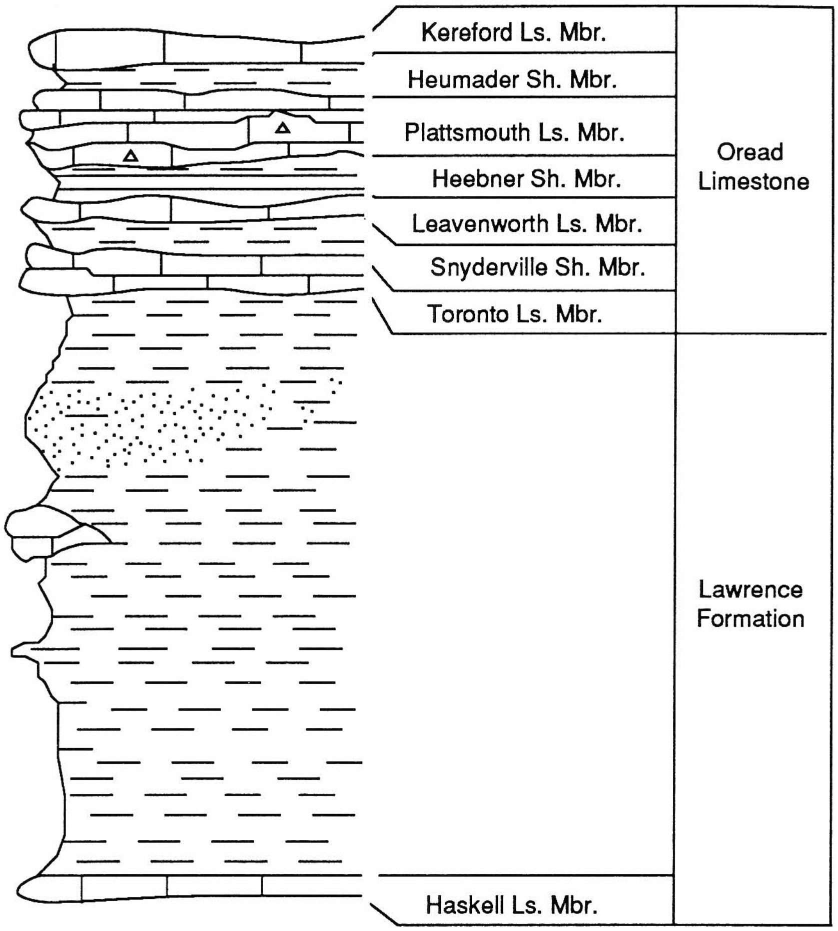

Figure 1. Geologic section at the Jefferson-Douglas County Landfill (modified from Zeller, 1968).

Urbanization Impacts on Wetland and Riparian Resources Johnson County, Kansas

In 1995, the Kansas Water Office, in conjunction with the State Conservation Commission, Kansas Department of Wildlife and Parks, and Johnson County Parks and Recreation Department, initiated the Urban Resource Assessment and Management Project (URAMP). URAMP is a cooperative effort involving local, county, state, and federal agencies, and private representatives whose purpose is to address urban development and its impacts on wetland and riparian resources.

Two watersheds in Johnson County, Tomahawk Creek and Wolf Creek, were selected for comparison purposes and range of issues offered by their diversity in land use (Fig. 1). Tomahawk Creek watershed is a rapidly urbanizing area, whereas Wolf Creek is rural in nature. Funded by the U.S. Environmental Protection Agency (EPA), URAMP is a pilot study intended to produce model riparian and wetland protection strategies and management practices for local communities to utilize in land-use planning and development.

The Urban Resource Assessment and Management Project was divided into three phases:

Phase I - Biological Assessment. The Kansas Department of Wildlife and Parks sampled 33 sites along Tomahawk and Wolf creeks in Johnson County, Kansas, in August 1996. Fifteen sites were sampled in Tomahawk Creek and in Wolf Creek. Five additional sites were sampled within other watersheds in the county to provide data that would represent the best available biotic and habitat conditions for selected streams in the URAMP study area.

The biological assessment included:

- Water-quality testing
- Fish sampling, identification, and enumeration
- Aquatic insect, mollusk, and other invertebrate sampling
- Habitat evaluation and surrounding land-use evaluation
- Streamflow measurements

Tests were conducted on the sampling data to determine the current status of the fisheries and macroinvertebrate (aquatic insects, worms, clams, snails, and other animals that can be seen with the unaided eye) communities and the inchannel physical habitat. Phase I results concluded that Tomahawk Creek (urban) has lower biological quality than Wolf Creek (rural) based on species numbers, kinds of species, the distributions of the fish and macroinvertebrate populations, water quality, and physical-habitat quality.

Phase II - Watershed Assessment. The engineering and planning firm of George Butler Associates, Inc., Lenexa, Kansas, conducted the Phase II work. Phase II consisted of assessing urban-development impacts and their causes, reviewing existing urban-development policies, and providing alternative methods of management that may reduce negative impacts on riparian and wetland areas.

Urban Impact Analysis. Geographic Information System (GIS) technology was used to inventory a variety of data and to perform spatial analyses of urban impacts to wetland and riparian areas. Data entered into the geographic-information system included: changes in woodland cover, changes in wetland distribution, stream channelization and enclosure, vegetation quality, and changes in watershed hydrology. The examination of urban impacts to wetland and riparian areas between 1975 and 1994 concluded that land development in Tomahawk Creek (urban) watershed cumulatively had more negative impacts to these resources than in Wolf Creek (rural) watershed.

Policy Review. Five federal, six state, six county, and six local government programs have a direct effect on wetland and riparian areas in Johnson County. The majority of state and federal programs that have the specific role and objective of protecting wetland and riparian areas are voluntary. Regulatory and permitting agencies that affect wetland and riparian areas generally do so through their water-quality, stream-obstruction, flood-control, and endangered-species programs. Local governments support environmental preservation but are also concerned with managing for public health and safety, operation and maintenance costs, administrative flexibility, and economic-development needs. Therefore, while a variety of effective techniques and procedures apparently exist, no single program or mechanism addresses the protection, preservation, management, and permitting of disturbances to wetland and riparian areas.

Alternatives. Using the results of the urban-impact analysis and policy review, alternative (more effective) wetland and riparian management strategies and policies were collected to provide a "menu of options" for local communities to utilize in land-use planning and development. Specific land-use tools such as conservation easements, stream buffers, and sediment and erosion controls were recommended, with emphasis on a comprehensive holistic approach to watershed management.

Phase III - Conference and Demonstration Project. Phase III was the culmination of the URAMP. This portion of the project was in the form of a conference held April 22-23, 1997, in Overland Park, Kansas, to disseminate project findings, conclusions, recommendations, and management techniques to members of county and municipal governments, planners, engineers, stormwater-management personnel, developers, builders, and the general public. The conference included a diverse group of professionals who discussed the applications of soil bioengineering, wetland and riparian preservation, and watershed management.

In conjunction with the conference, a soil bioengineering demonstration project was completed at a site on the Mill Creek Streamway Park (Barker Road access), an 18-mile scenic corridor of green space from the City of Olathe to the Kansas River. The demonstration site is on Mill Creek, where the creek is scouring the bank near a pedestrian bridge. A combination of different streambank-erosion protection measures were used to stabilize the bank and prevent further erosion. The project was designed and completed by Robbin B. Sotir and Associates, Soil Bioengineering Consultants, from Marietta, Georgia.

References

Urban Resource Assessment and Management Project Fact Sheet, vol. 1, no. 1, April 1996.

Urban Resource Assessment and Management Project Fact Sheet, vol. 2, no. 2, June 1996.

Urban Resource Assessment and Management Project Fact Sheet, vol. 3, no. 3, February 1997.

Urban Resource Assessment and Management Project Brochure prepared by George Butler Associates, Inc.

Executive Summary, Urban Resource Assessment and Management Project, Phase II: A watershed-assessment study of Tomahawk and Wolf Creek watersheds in Johnson County, Kansas, prepared by George Butler Associates, Inc. for the Kansas Water Office.

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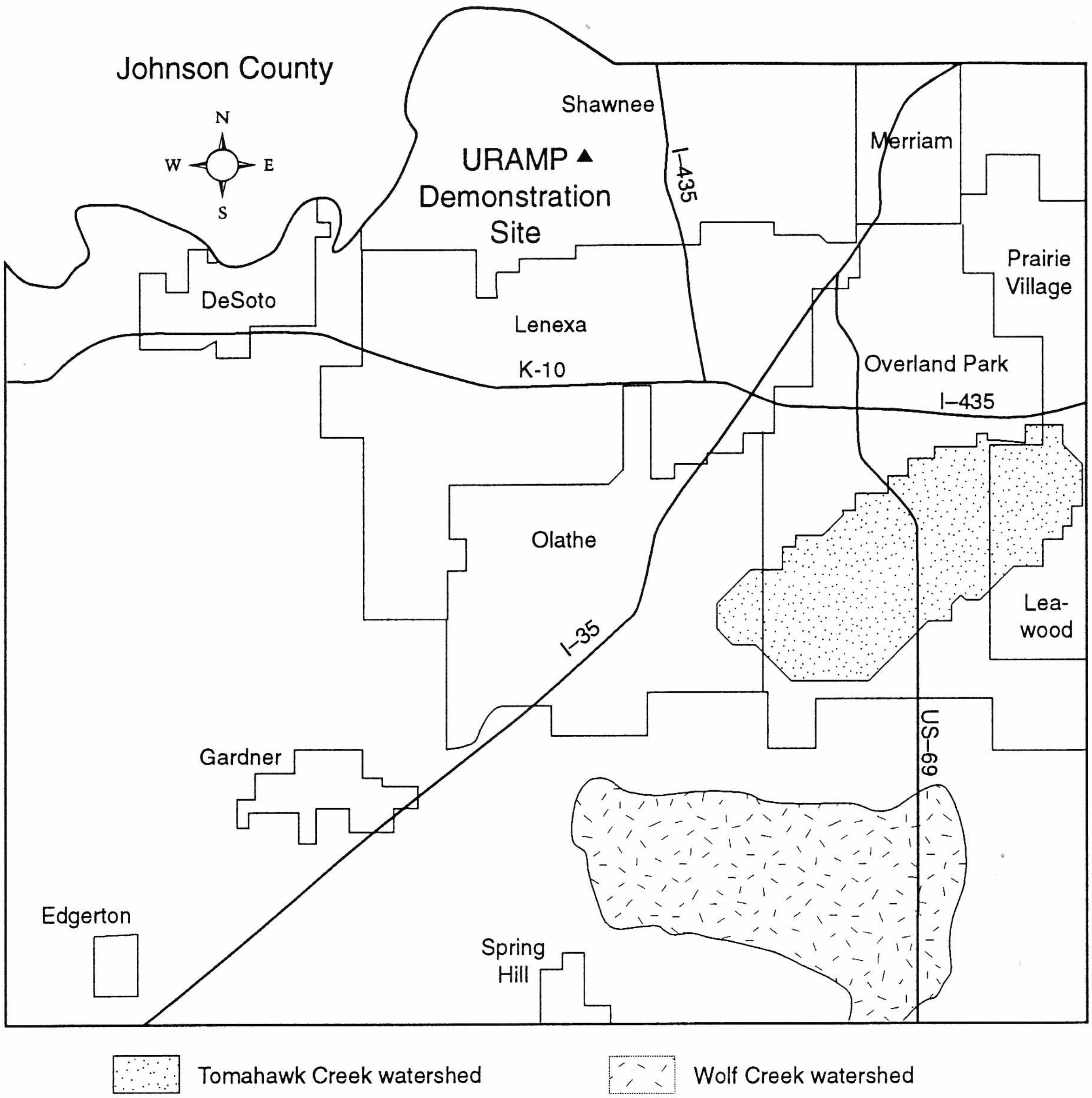

Figure 1. URAMP Study Area, Johnson County, Kansas.

Kansas River Sand Dredging
Bonner Springs, Kansas

Holliday Sand and Gravel Company operates eight dredging facilities in Kansas, Missouri, and Oklahoma. This site, south of Bonner Springs (but in Johnson County), was opened in the 1940s and purchased by Holliday in 1952. In its early years, it supplied sand and gravel for the construction of the Kansas Turnpike. Today, 60% to 80% of the sand and gravel produced here is used in ready-mix concrete production, with the rest used for commercial asphalt.

The plant is located at a spot where the Kansas River becomes narrower. That constriction causes the river to move faster, and the additional velocity allows the river to carry more and larger grains of sand and gravel, replenishing sand deposits even in times of low river flow. Most of the dredged material comes from sand that was previously deposited several miles upstream. That sand was created from rocks that were originally much farther to the west. Over time, the Kansas River and its tributaries carried these rocks to the east, breaking and rounding them, to eventually be deposited as sand, gravel, silt, and other unconsolidated rocks that form the alluvial material that neighbors the river channel. Today's river then erodes into that alluvium, moving the sand and gravel downstream, where it now replenishes the sand removed by dredging.

The sand deposit here is 10-15 feet thick, lying over the top of the bedrock on the river floor. This sand is valuable for construction because of its high silica content (greater strength) and because the higher river velocity brings in somewhat larger, coarser sand and gravel that can be used in concrete.

The production process begins on the river with a barge-mounted dredge that operates somewhat like a giant vacuum cleaner, suctioning the sand from the river floor. The suction on the dredge is provided by a centrifugal pump that is powered by an electric motor. The dredge is located on a barge that is controlled by a wire cable connected to both river banks. The barge uses that cable to pull itself forward and from side-to-side, going from one side of the river to the other, sometimes crossing the river as often as once every 24 hours.

As the sand is removed from the river bottom, a slurry of 90 percent water and 10 percent sand moves through a pipeline to the shore at the rate of about 16 feet per second. Most of the water is returned directly back to the river. At the plant on the river bank, the sand and gravel are separated, screened, and stockpiled until they are sold.

The Holliday plant here at Bonner Springs currently produces 300,000 tons of sand per year under a quota established in the 1990s by the U.S. Army Corps of Engineers. The Corps is the primary governmental agency responsible for regulating dredging on navigable rivers. In issuing dredging permits, the Corps considers issues of wetlands, culture, endangered species, floodplain use, water-quality implications, and public interest. The Corps' Kansas City District office restricted production here because of concern about impact on the river and the surrounding ecosystem, as well as the impact on bridges, pipelines, and bank erosion.

A few miles down the river, Holliday Sand and Gravel operates its Muncie plant, established in 1973. Most of the coarse sand there was depleted after about 15 years, but the plant still operates, producing much finer sand, about half of which is cleaned, dried, and sold for use in the production of fiberglass at a facility in McPherson, Kansas. Downstream from the Muncie plant, a weir was constructed for water-supply purposes, slowing the river's velocity and creating a lake effect, so that the river cannot carry heavier (larger) sand, but is restricted to moving in the finer sand that is mined here.

Seven companies are currently authorized to operate dredges at nine locations in the Kansas River. In the mid-1990s, requests for additional dredging on the stretch of the Kansas between Lawrence and Topeka led to discussion of dredging's impact on the river and associated recreation. As a result, the 1996 session of the Kansas Legislature directed the Kansas Geological Survey, the Kansas Biological Survey, the Kansas Water Office, the Kansas Department of Wildlife and Parks, and the Kansas Department of Commerce to study the river's recreational potential. That results of that study will be released in a report to the Legislature in January 1998.

References

U.S. Army Corps of Engineers, Kansas City District, Commercial Dredging Activities on the Kansas River: Final Regulatory Report and Environmental Impact Statement, January 1990.

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Hillsdale Water Quality Project

The Hillsdale Water Quality Project was initiated by a group of citizens in Johnson, Miami, and Franklin counties who were concerned about the future of the Hillsdale Lake as a drinking-water supply and recreation area. Hillsdale Lake has an accelerated rate of eutrophication, or aging, resulting from point source and nonpoint sources of pollutants, especially phosphorus. The pesticides atrazine and alachor have also been detected in Hillsdale Lake. The watershed is composed of 92,000 acres in Johnson, Miami, Franklin, and Douglas counties. As a water-supply source, the lake can provide 17.3 million gallons of water each day for municipal and industrial need of the surrounding communities.

Large concentrations of nutrients, such as phosphorus, can accelerate growth of algae in Hillsdale Lake and cause depleted oxygen levels, odor and taste problems in drinking water, and loss of fish species. Nutrients in the Hillsdale watershed come from point sources, such as wastewater-treatment plants, and nonpoint sources, such as runoff from cropland treated with fertilizers and animal waste from confined feedlots and pastures.

The U.S. Environmental Protection Agency approved the project for funding through the Section 319 grant program of the Clean Water Act. Funding of $780,000 was provided from January 1993 through June 1997. In addition, the project has been approved for $228,000 in funding from July 1997 through June 1998. The project is administered by the Kansas Department of Health and the Environment and sponsored locally by the Lake Region Resource Conservation and Development Council.

Working with federal and state agencies, the Hillsdale Water Quality Project is able to coordinate several conservation programs. The Water Quality Improvement Program, administered by the Farm Service Agency (formerly the ASCS), provided $151,050 to individuals in the watershed for implementing management practices that reduce nonpoint source pollutants from agriculture. The Environmental Quality Incentives Program (EQIP) administered by the Farm Service Agency has been approved for the watershed. EQIP will provide cost-share and incentive payments for producers implementing management and structural practices included in their individual conservation plans. The Hillsdale project has provided cost-share funds for demonstration practices through Environmental Protection Agency funding. The state provides additional funding through the State Water Resource Cost Share Program and its Nonpoint Source Program, which is allocated through the local conservation districts. Landowners also contribute funds to implement practices. The Natural Resources Conservation Service provides technical assistance to implement the state and federal programs.

Some accomplishments of the project include:

- Six Implementation Committees and a Citizens Management Committee (CMC) have been established and continue to recruit individuals living and working in the watershed. The committees review resource concerns, identify alternative solutions, establish goals, and promote the implementation of pollution-control practices through an information program and development of long-term planning strategies for the protection of the watershed.

- Technical teams, composed of individuals from federal, state and local agencies with professional expertise in conservation practices, engineering, wildlife management, and water monitoring and analysis have been established to act as advisors for resource-implementation committees.

- Project volunteers have assisted with the development of a total Resource Management System plan. The first step of the plan was the identification of resource concerns. The committees have taken into consideration all the resources in the watershed and their interdependence. This process enabled volunteers to map out goals for the protection of resources as they relate to water quality.

- A water-quality monitoring system has been established. The strategy was developed in cooperation with the EPA, the U.S. Geological Survey, the Corps of Engineers, and the Kansas Department of Health and Environment. Samples are collected from five major tributaries and the lake. Analysis of the samples is completed by the Johnson County Environmental department. Along with the regularly scheduled water-monitoring study, the U.S. Geological Survey and the Corps of Engineers have conducted and underwritten the cost of special monitoring studies.

- A strategic plan for an information and education program for watershed residents has been initiated. A quarterly newsletter, water-quality fact sheets, informational booklet, and a video have been utilized to inform the public about water-monitoring results, implementation of pollution-control practices, and development of a long-term plan for lake protection. Approximately 4,100 households receive the newsletter. Nearly 1,500 people are reached annually through community education programs.

- Prairie Wetland, a constructed wetland, will reduce pollutants from point and nonpoint sources in and around the City of Gardner. The wetland is a cooperative project of local and state agencies, Kansas City Power and Light Corporation, and a private landowner.

- Community support has grown for the project as evidenced by contributions totaling $5,500 for water monitoring from the cities of Gardner and Spring Hill, rural water districts Miami #2 and Johnson County #7, and the Johnson County Wastewater Authority. In addition, local businesses have donated funds for an annual public meeting. Contributions from businesses and attendance at the projects' annual meeting have doubled each year since 1993.

- Two volunteer stream teams from Gardner-Edgerton and Paola high schools will conduct voluntary monitoring programs in the watershed.

- Through the utilization of Geographic Information System (GIS) data, the project will more accurately track land uses and model environmental changes to assist local people with decision-making efforts for the watershed.

- As of January 1997, 78 acres of waterways, 227,554 linear feet of terraces, 10 acres of grassed buffer strips, 561 acres of seeding cropland to grass, and 11 grade-stabilization structures have been implemented in the watershed. In addition, one dump site has been cleaned up, 12 septic systems upgraded, two abandoned wells plugged, two wetlands have been constructed, and four livestock-waste systems have been completed. All these practices reduce pollutants from entering streams and work to protect water quality. These practices represent an $827,000 financial investment by area producers, the EPA, and State Conservation Commission (through cost-share funds). In addition, volunteers have contributed over 12,000 hours of time, worth an estimated $150,833.

Prairie Wetland, Gardner, Kansas

This artificial wetland project comprises approximately 30 acres owned by Kansas City Power & Light Corporation (KCP&L). Prairie Wetland serves as a demonstration project for the positive effects a wetland ecosystem has on water quality. In addition, the wetland provides a habitat area for plant and animal species and is a nature study area for the surrounding communities.

The artificial wetland is bordered by agricultural and urban areas. The area will receive nonpoint-source runoff from cropland, urban lawns, and streets. In addition, the effluent from the Gardner wastewater-treatment plant, a point source, flows through the constructed wetland. It is believed that the wetland plants will use the nutrients from runoff and the effluent, and, therefore, reduce the amount of pollutants entering Hillsdale Lake.

The wetland comprises three cells: A, B, and C. The retention time in Cell A is completely dependent upon stormwater runoff. During dry weather, low-flow conditions, only the wastewater treatment plant effluent will enter the wetlands. The average retention times during these periods are 22.6 and 22.8 days for cells B and C, respectively, for a total of 45.4 days. During a two year, 24-hour storm, in which approximately 3.6 inches of precipitation would fall, 50 percent of the wetland's volume is displaced.

The total cost of the wetland was $113,871. Of that amount, the Hillsdale Water Quality Project contributed $12,000 through the EPA 319 grant. Cost-share funds of approximately $66,850 were provided by the State Conservation Commission through the Johnson County Conservation District. This project has been a joint effort between many public and private concerns. The following groups worked together to develop the wetland: KCP&L, Johnson County Conservation District, State Conservation Commission, Kansas Department of Wildlife and Parks, Kansas Department of Health and Environment, Hillsdale Water Quality Project, Lake Region Resource Conservation & Development, Natural Resources Conservation Service, Connelly Ranch Inc., and Schlagel and Associates Engineers.

References

Hillsdale Water Quality Project, EPA 319 Grant Summary.

Putnam, J.E., 1997, Occurrence of phosphorous, other nutrients, and triazine herbicides in water from the Hillsdale Lake Basin, northeast Kansas, May 1994 through May 1995: U.S. Geological Survey Water-Resources Investigations Report 97-4019, 66 p.

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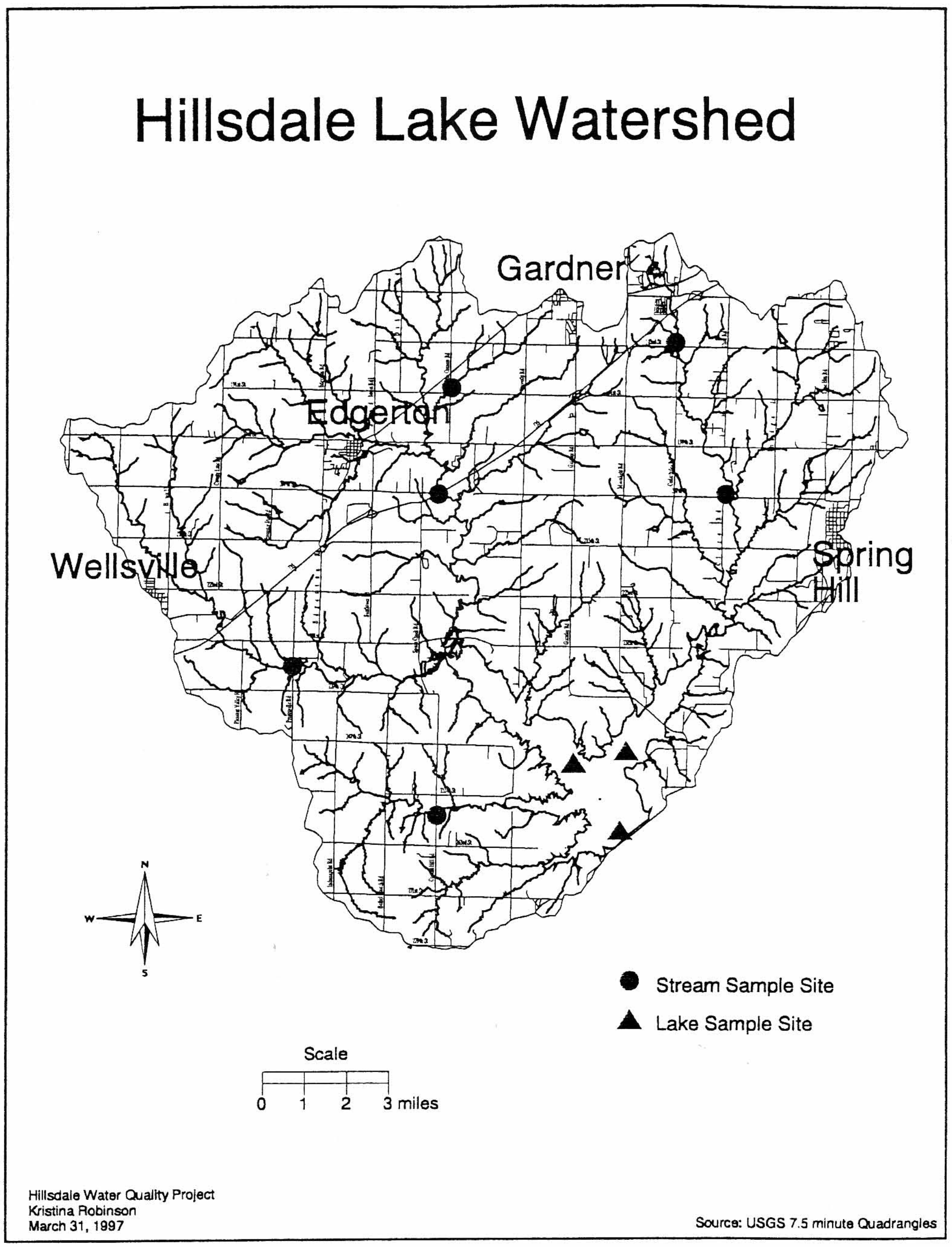

Figure 1. Hillsdale Lake Watershed.

Kansas Geological Survey

Public Information Circular 6

January 1997

In Kansas, nearly 23.6 million tons of crushed stone and 12.3 million tons of sand and gravel were produced in 1994

Sand, Gravel, and Crushed Stone: Their Production and Use in Kansas

David A. Grisafe

Geologic Investigations Section, Kansas Geological Survey

Introduction

The average American uses more than a million pounds of cement, sand, gravel, and crushed stone over the course of a lifetime. These geologic materials are used throughout society, from concrete in buildings to crushed stone for roads. Much of the demand for these materials comes from areas of growing population where new construction and road-building are most common. Because sand, gravel, and other geologic commodities come from the earth, their production often raises a conflict between people's desire for an undisturbed landscape and the demand for these resources.

Mines and quarries that produce sand, gravel, and crushed stone are extremely common in Kansas. However, most people know very little about such operations. To help provide information about these resources, this circular discusses sand, gravel, crushed stone, and lightweight aggregate, a man-made material manufactured from shale. This publication describes the type and amount of these materials used in Kansas; their source, processing, and usage; and environmental issues related to their production.

These materials—sand, gravel, crushed stone, and lightweight aggregate—are known collectively as aggregate. By definition, aggregate is a construction material that is hard and inert (that is, it does not react chemically with materials around it). It is used to make concrete, mortar, asphalt, or similar products. Buildings nearly always include concrete, concrete block, and mortar. Most roads are constructed from concrete or asphalt that contain sand and crushed stone. Alone, aggregate is used as the support for railroad beds, road covering, or fill; large quantities of sand and gravel and crushed stone are used on unpaved county roads throughout the state.

Limestone, dolomite, and sandstone—the rocks used to make crushed stone—occur naturally, as do sand and gravel. Lightweight aggregate is manufactured from shale, a soft rock composed mostly of clay minerals that occurs naturally. Sand, gravel, and crushed stone require little processing compared to many commodities, but vast quantities are used in construction. Thus, they are high volume/low-unit-cost commodities. That is, sand, gravel, and crushed stone are sold in large quantities at a low cost per ton. Over two billion tons of sand, gravel, crushed stone, and lightweight aggregate were used or sold in the U.S. during 1994. In Kansas, nearly 23.6 million tons of crushed stone and 12.3 million tons of sand and gravel, worth over $130 million, were produced in 1994; that's an average of about 14 tons of aggregate per person in the state.

Crushed Stone

Crushed stone is used throughout Kansas, but most of it is quarried from limestone in the eastern third of the state. Smaller amounts are also produced from dolomite (a rock that looks similar to limestone) and sandstone in central Kansas, and from relatively soft limestones in northwestern and north-central Kansas. In addition, some crushed stone is produced in northwestern Kansas where the Ogallala Formation is naturally cemented together. In general, Kansas counties with larger annual production of crushed stone are found around the state's larger cities, especially in the highly developed corridor from Topeka to Kansas City and in an area east of Wichita (fig. 1).

Crushed stone is produced by blasting rock from quarry or mine walls and then crushing and screening the rock to the desired sizes for different applications. Many producers collect the extremely fine, dust-like material remaining from the crushing operation and sell it to farmers for agricultural lime, which helps reduce the acidity of their soil.

Crushed limestone, crushed clay or shale, and other ingredients are mixed together and baked in kilns to produce a coarse material that is ground, then bagged for sale as cement (fig. 2). Gypsum is often added to cement as a retarding agent to keep it from setting too rapidly. About 1.8 million tons of cement, valued at more than $100 million, were produced in Kansas in 1994. Water, crushed stone, sand, and gravel are added to the cement to make concrete. To make mortar (the material that is used to cement bricks or concrete blocks together), finer

Consumption of crushed stone in Kansas has risen from about 800 pounds per person in 1920 to about 18,500 pounds in 1994

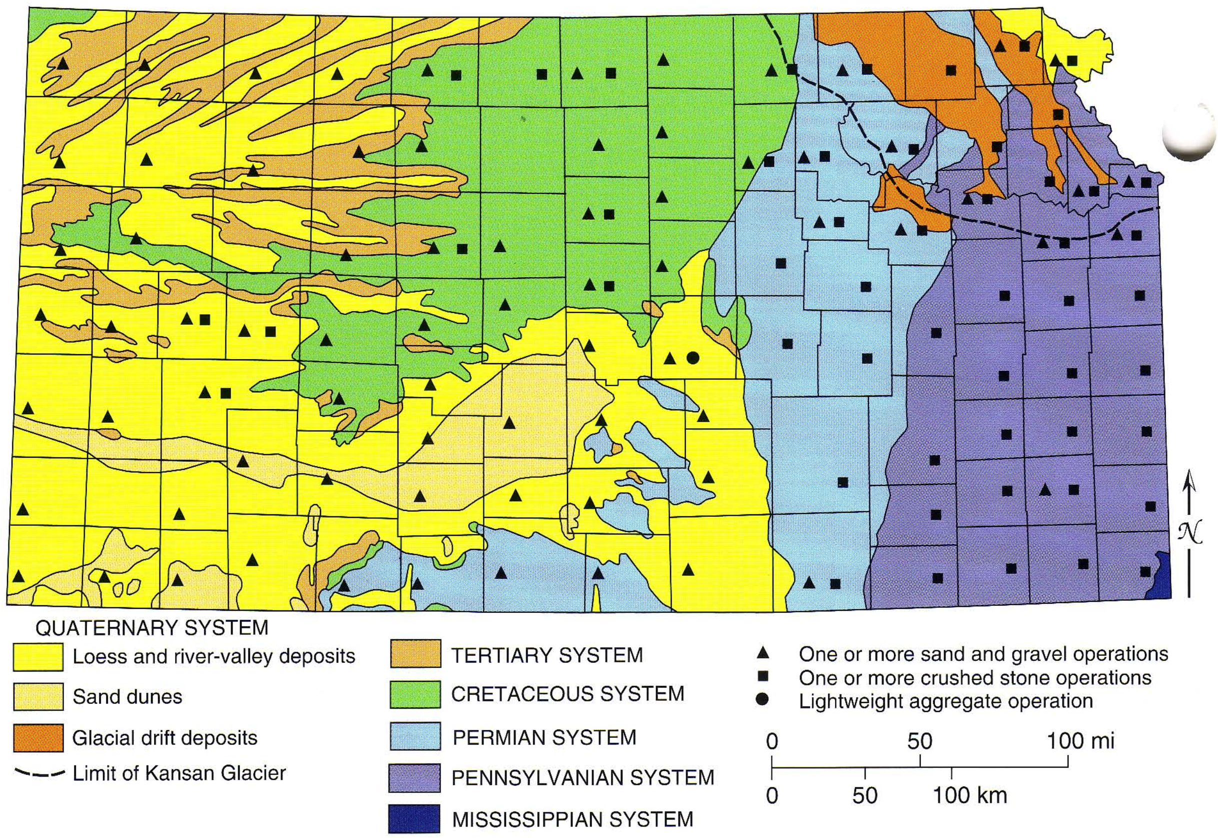

Figure 1—*Surface geology of Kansas, showing counties producing aggregate.*

grains of sand are used instead of gravel in the mixture, producing a smoother finish.

Over time, the state has used more and more crushed stone, although the amount varies depending on economic and construction activity. Based on annual production reported to the U.S. Bureau of Mines and census figures, consumption of crushed stone in Kansas has risen from about 800 pounds per person in 1920 to about 18,500 pounds in 1994, more than a tenfold increase. At the same time, the state's population has grown, so that total production has jumped from about 700,000 tons in 1920 to 23.6 million tons in 1994.

Lightweight Aggregate or Expanded Shale

Lightweight aggregate is manufactured from certain types of shale. After mining and crushing, the shale is fed into a kiln where it is heated to temperatures that cause it to swell. Although best known to the average Kansan as the lightweight, red to brown, volcanic-looking rock that is often used for landscaping, its main use is as an aggregate in lightweight concrete, such as in the terminal buildings at the Kansas City International Airport in Missouri, and in lightweight concrete blocks. The only active plant is located near Marquette in McPherson County.

Sand and Gravel

Sand and gravel are formed by the weathering of rocks. Most of the sand in Kansas river systems, such as the Kansas or the Arkansas, comes from rocks that have been washed out of the Rocky Mountains to the west. These rocks are weathered (broken, ground up, and rounded) as they are carried along by the rivers, producing sand and gravel. Kansas rocks also contribute to sand deposits in some locations. For example, chert (or flint) from rocks in the Flint Hills weathers and forms sand that is carried into the Neosho River, which drains part of the Flint Hills.

Much of the sand and gravel production in western Kansas comes from small, dry pits where front-end loaders are used to fill trucks (fig. 3). Other operations, particularly in central and eastern Kansas, produce large amounts of sand and gravel by dredging the channel or neighboring floodplains of the larger rivers, especially the Kansas and Arkansas.

River dredges operate by suctioning sand from the river bed and moving it to a plant on the river bank for washing and sorting. River dredging is a relatively inexpensive method of producing sand because it does not require the removal of overlying rock and soil,

Figure 2—*Cement plant in Allen County.*

called overburden. River dredging is also considered, by some, to be self-healing, because the space left by sand removal is gradually filled by sand from upstream or sediments that settle out when the river is moving slowly, a process called recharge. This material may be dredged later.

Other dredges operate on the floodplain—the land space neighboring the river that is inundated during flooding—which may contain considerable deposits of sand and gravel. In floodplain dredging, a pit is dug in land on the floodplain. Ground water fills the pit, and a dredge is floated on the water, again removing sand from the bottom for processing. Sand produced by a floodplain dredge may cost about 50% more than sand produced by river dredging because floodplain dredging has greater start-up costs. Land must be purchased or leased, and a large, shallow, sloped pit must be excavated to the water table before putting the dredge in place. Also, floodplain dredging usually requires the removal of up to 20 feet of overburden, adding to production expenses. Pits have a limited lifetime because the deposit usually changes to a less sand-rich body or the sand becomes too fine. Pits are not refilled with new material, as are river bottoms, and they require reclamation when mining is complete.

Nearly all Kansas counties have at least one sand and gravel operation (see fig. 1). As with crushed stone, most sand is produced in counties with large populations, where both the source and the demand are located. Between 1984 and 1994, for example, the population of the 12 counties along the Kansas River grew by over 125,000. This growth increased the demand for aggregates, particularly sand and gravel, for use in building roads, schools, homes, and other buildings.

Across the state, use of sand and gravel has increased dramatically, from about 1,200 pounds per person in 1920 to 9,200 pounds in 1990. Total statewide production grew from about 1,000 tons to about 11.5 million tons today. Production may have dropped slightly since the 1980's, in part because the U.S. Army Corps of Engineers gradually implemented limits on Kansas River dredge operations during 1991–94. These restrictions limited the removal of sand to the amount that was recharged. This is to stabilize the elevation of the riverbed to prevent the exposure of features such as pipelines.

Nearly all Kansas counties have at least one sand and gravel operation

Use of sand and gravel has increased dramatically, from about 1,200 pounds per person in 1920 to 9,200 pounds in 1990

Regulatory and Environmental Issues

Until recently, individual counties regulated sand and gravel, crushed stone, and lightweight aggregate operations in Kansas. In 1994, the State Conservation Commission was charged with such responsibilities, providing a uniform set of rules for all non-fuel mining in Kansas, including reclamation. The exception is river dredging, where the U.S. Army Corps of Engineers remains responsible for permitting and production limits.

Most sand, gravel, and crushed stone operations in Kansas do not create significant safety, health, and environmental problems. Improvements in blasting technology now allow smaller charges at stone quarries, eliminating potential damage to nearby structures. Federal Mine Safety and Health and Occupational Safety and Health agencies monitor all mining operations in Kansas. Environmental impact statements are required for all proposed operations. Probably the biggest objections to such mining are

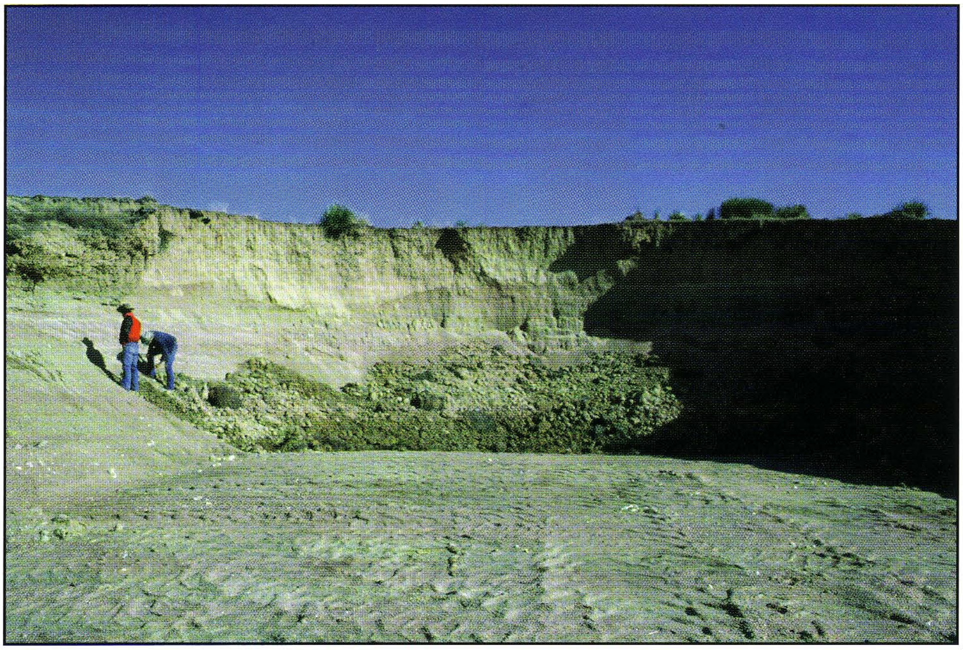

Figure 3—*Small gravel pit in geologically recent materials near Sand Canyon in Cheyenne County.*

concerns about traffic, noise, and dust when an operation is located near residential areas. Because the demand for these resources is often near highly populated areas, the potential for conflict over these issues is great. To deal with these concerns, planners and managers can restrict mining to less populated areas, though that increases the distance from mining operations to the market. Those costs now amount to about $0.10 per ton per mile.

Recently, the environmental consequences of dredging on the Kansas River have become a contentious issue. Environmental organizations and individuals have raised issues related to damage that dredging may cause to the river, such as bank erosion, lessened water quality, and the effect on wildlife. They have also expressed concern about the impact of dredging sites on canoeists and other recreationists and raised issues related to safety, traffic, and noise. Interest in the Kansas River is especially high because it is one of a handful of rivers in the state that are open to the public for recreation.

The consequences of dredging depend, in part, on the nature of the river. Muddy river beds contain large amounts of clay that can absorb chemicals—such as herbicides, pesticides, and fertilizer—that run off into the river, and the agitation associated with dredging might release those chemicals into the river. Because the Kansas River bed is predominantly sand, the chemicals are not absorbed and dredging does not have a significant impact on water quality. Also, because of the lack of clay, very little material collected by dredging, perhaps as little as one percent, is returned to the river, minimizing the amount of turbidity caused by dredging.

State agencies in Kansas are currently studying the recreational potential of the Kansas River and will undoubtedly consider the role of dredging and other issues. It is important to remember that people in the Topeka-Kansas City corridor use more than two million tons of sand and gravel each year. Decisions about the river and mining operations have both economic and environmental consequences. Limiting the amount of sand dredging in the river, for example, may create environmental conditions that society desires. But such measures have an economic cost. Society must decide if those are costs that it is willing to pay.

Sources of Additional Information

Grisafe, D. A., 1977, Kansas building limestone: Kansas Geological Survey, Mineral Resources Series 4, 42 p.

Grisafe, D. A., Ross, J. A., and Beene, D. L.,1995, Non-fuel industrial minerals of Kansas: Kansas Geological Survey, Map M-39, scale: 1:1,000,00.

_____,1995, Abandoned non-fuel pits and quarries in Kansas: Kansas Geological Survey, Map M-40, scale: 1:1,000,000.

U.S. Geological Survey, 1923, Mineral Resources of the United States, 1920, Part 2 (Nonmetals): Washington, D.C., U.S. Government Printing Office, 529 p.

U.S. Bureau of Mines, 1995, Minerals Yearbook, Area Reports—Domestic 1993–94, v. 2: Washington, D.C., U.S. Government Printing Office, p. 97–101.

Decisions about the river and mining operations have both economic and environmental consequences

The mission of the Kansas Geological Survey, operated by The University of Kansas in connection with its research and service program, is to conduct geological studies and research and to collect, correlate, preserve, and disseminate information leading to a better understanding of the geology of Kansas, with special emphasis on natural resources of economic value, water quality and quantity, and geologic hazards.

The Geology Extension program furthers the mission of the KGS by developing materials, projects, and services that communicate information about the geology of Kansas, the state's earth resources, and the products of the Kansas Geological Survey to the people of the state.

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January 1997

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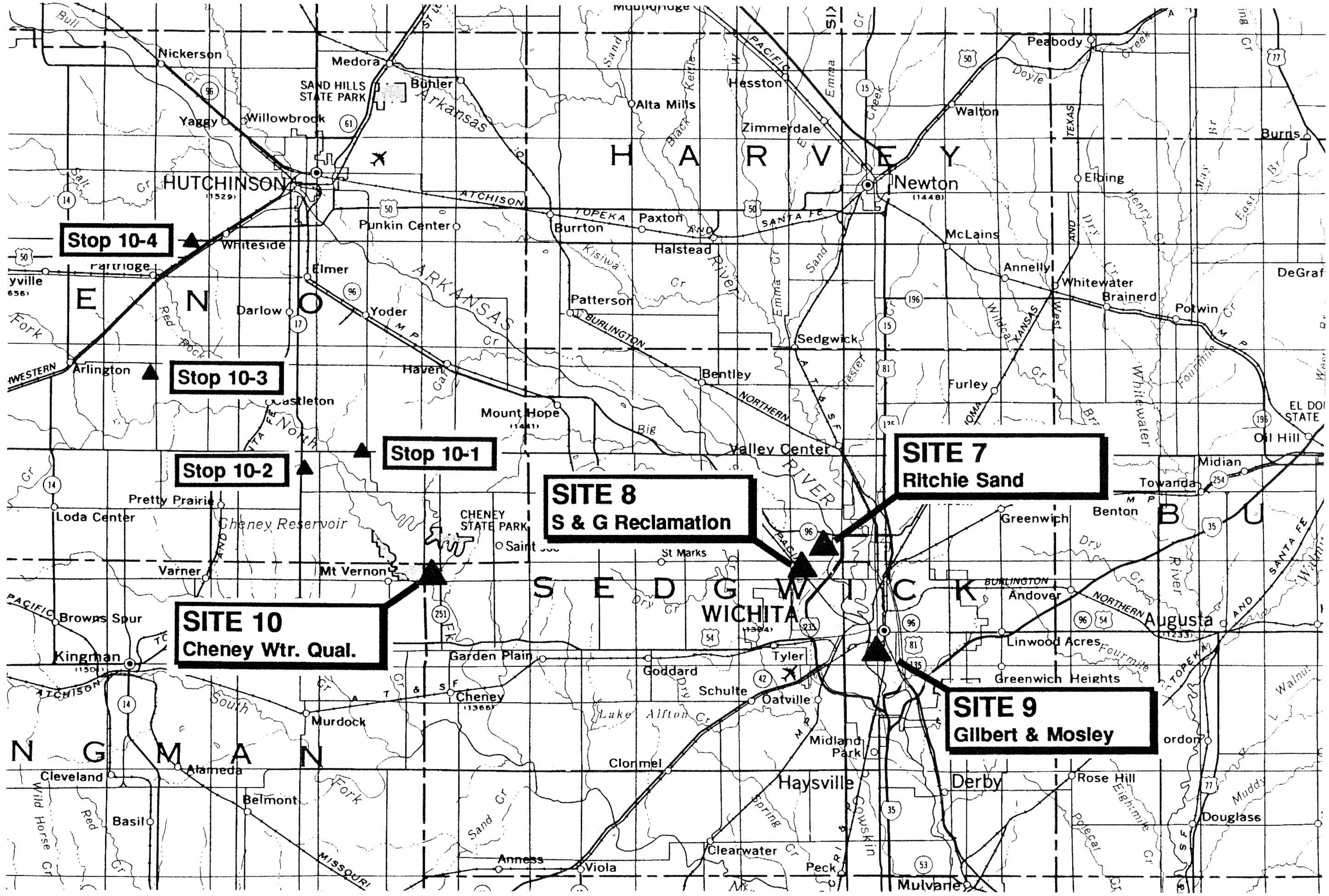
SCHEDULE & ITINERARY

Thursday June 5, 1997

7:15 am	Breakfast
8:00 am	Bus to Wichita
9:30 am	**SITE 7** - Ritchie Sand and Gravel Operation, Wichita, KS *Steve Hatfield*, General Manager, Ritchie Sand, Inc. *Woody Moses*, Managing Director, Kansas Aggregate Producers' Association
10:45 am	Bus to Site 8
11:00 am	**SITE 8** - Sand and Gravel Reclamation and Redevelopment *Steve Hatfield*, General Manager, Ritchie Sand, Inc.
11:30 am	Bus to Botanica
11:45 am	Lunch at Botanica
1:00 pm	**SITE 9** - Gilbert and Mosley Ground Water Contamination Area - Downtown Wichita *Jack Brown*, Director, Wichita-Sedgwick County Department of Community Health *Chris Jump*, Environmental Geologist, Bureau of Environmental Remediation, KDHE
1:45 pm	Bus to Cheney Lake
2:30 pm	**SITE 10** - Cheney Lake Water Quality Project *Lyle Frees*, Project Manager, Cheney Lake Water Quality Project *David Warren*, Director, Wichita Water and Sewer Department *Greg Foley*, State Conservation Commission
4:15 pm	Bus to Wichita
5:15 pm	Arrive Red Coach Inn, Wichita
6:00 pm	Bus to Dinner - Lake Terrace Place
7:00 pm	Dinner
7:45 pm	Evening Session *David Warren*, Director, Wichita Water and Sewer Department



DAY 2 - Thursday, June 5, 1997

Emporia - Wichita - Cheney Lake - Hutchinson - Wichita

Ritchie Sand and Gravel Operation

Ritchie Sand Inc. was founded in the early 1950s to provide sand for the parent company's asphalt-paving business. Ritchie Sand's plant at West Street and K-96 highway in northwest Wichita is the largest sand-production facility in Kansas. Having mined out two previous sites, Ritchie's current sand operation is 11 years old. The reserves at this site were purchased almost 30 years ago. In 1996, the site's annual production was 2.05 million tons. About 30 percent of the material Ritchie Sand produces in a year goes to other Ritchie subsidiaries.

Ritchie Sand's plant is located on about 600 acres of ancient floodplain skirting the present-day Arkansas River valley. The sand deposit, which averages about 40 feet thick and is overlain by as much as eight feet of clay, contains little to no silt and a small amount of gravel. For every 6,000 tons of material produced, only about 25 to 50 tons is in the 3/4 to 1-1/2 inch range.

Excavations on the ancient floodplain intersect the water table four to six feet below the ground surface. Brooks Landfill, located one and a half miles north of the plant, uses its own excavator and bottom-dump trailers to strip the clay-rich overburden from the sand deposit, which it uses for daily landfill cover.

After six years of dredging adjacent to the plant, the company moved the dredge across the road to mine additional reserves. Dredging at this new location has opened up an 80-acre lake in five years.

Sand is mined with a floating dredge that was built in 1974. A 200-horsepower cutterhead, mounted near the end of the suction pipe, loosens the sand so it can be suctioned to the surface. A 1,250-horsepower electric motor drives the in-hull pump to push the sand slurry 2,200 feet to shore through an 18-inch floating pipeline. An insulated 4,150-volt power cable strung along the pipeline provides power to the electric dredge.

On shore, a 1,000-horsepower booster pumps the sand slurry under the road to the top of the plant, about 1,200 feet away. The pipeline, which handles about three million tons of sand before it needs replacing, discharges into a feed box that splits the slurry between two, 6 by 20 feet, triple-deck screens. Material larger than 1 1/2 inches, which is mostly clay and sticks, is sent to the adjacent worked-out lake. The fines, normally considered waste, are sold as fill sand.

Ritchie Sand dispatches about 50 trucks from the plant, 20 of its own and up to 30 hired. The facility not only supplies its sister asphalt and ready-mix division in Wichita, but also trucks sand throughout southeast Kansas, backhauling coarse aggregate (mostly limestone), which does not occur naturally in sufficient amounts in the Wichita area.

References

Drake, B., 1996, Creative solutions help producer stay ahead: Rock Products, v. 99, no. 3 (March), p. 36-40.

Ritchie Companies, Inc. brochure.

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Sand and Gravel Reclamation and Redevelopment

After the sand and gravel reserve has been removed from a site, and because the deposits are in the floodplain and for the most part below the water table, a substantial body of water is left as a result of mining. Just like the limestone quarries, the sand and gravel operations are also governed by the 1994 Surface-Mining Land Conservation and Reclamation Act administered by the State Conservation Commission. They are required to post bond, develop a reclamation plan, remove waste and machinery, and start reclamation efforts within three years after the completion of mining.

Sand and gravel operations that existed before July 1, 1994, are "grandfathered" and exempt from reclamation requirements. Several companies that are exempt from reclamation have chosen to reclaim their sites anyway. Unfortunately, Kansas is littered with many sites that were abandoned years ago. Rusting equipment and machinery and dilapidated structures create eyesores and safety hazards along streams and rivers that were mined for sand and gravel. Currently, Kansas has no regulations that require these sites to be cleaned up.

Because the demand for "lake-front" property is high is Wichita, depleted sand and gravel operations are being utilized as residential developments. Many of the newer sand and gravel operations have incorporated residential development into their reclamation plan. Some developers actually hire companies to dredge an area for development, with the sand and gravel being a secondary product.

Depleted sand and gravel operations are also utilized for wildlife and recreational purposes. Sedgwick County's Zoo Park near 21st Street and Zoo Boulevard is an example of an abandoned sand and gravel operation that has been used for these purposes.

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Gilbert and Mosley Ground Water Contamination Area
Downtown Wichita

The Gilbert and Mosley Site is a commercial, industrial, and residential area of approximately 1,800 acres located in and near downtown Wichita, in Sedgwick County, and is composed of an irregularly shaped area with the approximate boundaries of Second Street North (north), 31st Street South (south), Hydraulic Avenue (east), and Wichita Street (west) (Fig. 1). The site is named for the intersection of Gilbert and Mosley streets near the center of the contaminated area.

Routine testing by Wichita-based Coleman Company, Inc. in 1990 detected chemical contamination in ground water near the Company's plant facilities north of downtown. Prompted by Coleman's findings, the Kansas Department of Health and Environment (KDHE) conducted an investigation to assess the contaminants' potential threat to human health and the environment.

The investigation showed that downtown Wichita was sitting on a polluted, underground plume more than four miles long and one and a half miles wide. Contamination extended beneath 8,000 parcels of land, including more than 550 businesses -- banks, hotels, retailers, and offices -- and hundreds of residential properties. Tests showed the polluted mass was spreading southward at a rate of one foot per day. Initial figures estimated it could cost up to $200 million, and take as long as 20 years, to clean up the damage.

Preliminary tests found the primary contaminants to be chlorinated solvents and petroleum constituents, chemicals known to increase the risk of cancer and other health problems. While the pollution posed no immediate threat to Wichita's drinking water, it created considerable economic threat to area property owners, and the viability of downtown Wichita.

More than 500 area businesses were named by KDHE as Potentially Responsible Parties (PRPs), which created issues of legal and financial liability. Faced with their own questions of liability, banks immediately stopped lending to businesses and home buyers in the area. Just a few months earlier, a well-publicized court decision established Superfund liability for lending institutions based on their "participation in financial management to a degree indicating a capacity to influence the corporation's treatment of hazardous waste." That decision left local lenders with a disincentive to make loans in the Gilbert and Mosley site. Property values within the area were predicted to plummet by 40%.

The Gilbert and Mosley site also threatened the City with the stigma of environmental problems, tarnishing Wichita's internal and external image. The impact on economic development would be immediate, with no one willing or able to buy, sell, or improve properties. Not only would the City feel the immediate effects on property values, and subsequently on tax revenues and budgets, but with development activity in the area virtually frozen, the problem would only worsen. Because of the number of parties involved, unending litigation could have escalated costs and increased delays. Unless a solution was developed quickly, the federal government would invoke Superfund, aggravating what already promised to be a long and costly approach.

The City had two choices. First, it could encourage potentially responsible parties -- the PRPs -- to cooperate to clean up the site. Second, it could allow the State to rank the site for National Priority Listing, placing it on the agenda for Superfund clean-up.

Wichita's past experiences suggested neither option was satisfactory. Several years earlier, contaminants had been discovered at another site (29th and Mead), and EPA identified approximately 100 PRPs. Although a PRP group was established, most businesses refused to participate, claiming they did not contribute to the contamination. Because of failure to reach a timely agreement, the site was placed on the a National Priorities List, paving the way for full implementation of Superfund. Civil lawsuits followed, complicating the situation and tying up property for the foreseeable future. With Superfund involvement, lending institutions red-lined the area, and property values plunged. To date, lawsuits are pending, property values are deflated, and the banks sit tight, awaiting clean up. With more than 500 PRPs involved in the Gilbert and Mosley site, the prospect of reaching an agreement seemed even less likely.

So why not let EPA intervene through implementation of Superfund? Based on the history of Superfund sites, the City did not like the odds. Previous examples of Superfund cleanups suggest:

- Superfund tends to significantly slow the process, delaying cleanup and greatly increasing costs to property owners.
- Superfund promotes litigation. When an area is declared a Superfund site, every property owner can be potentially held liable for part, if not all, of the total clean-up cost. The uncertainty often results in many lawsuits and counter-suits attempting to assign blame and recover costs.
- Superfund can negatively impact the tax base. Questions of liability not only hurt property values, but also promote a bank-imposed real estate freeze that seriously threatens the City's tax base. It can be many years, if ever, before property values return to pre-Superfund levels.
- Superfund discourages local action. It undermines the role of local leadership and stifles initiative. In an issue affecting the heart of a City's business community, both economically and geographically, Superfund's extended involvement can damage a community's enthusiasm as well as its economy.
- Superfund would postpone indefinitely the City's plan for economic development and downtown revitalization.

The challenge facing City leaders was to avoid Superfund intervention and all its pitfalls, while protecting the local economy and innocent property owners, and cleaning up the site.

A unique partnership between the public and private sectors was established, involving intergovernmental partnerships with local, state and federal government support, along with participation from the private sector -- banks, responsible parties (industry), and the real-estate community. The plan's fundamental premise would be the City of Wichita's acceptance of responsibility for the clean-up of the Gilbert and Mosley site in exchange for funding commitments from public and private sector partners.

With City government in a leadership role, public and private partnership responsibilities were defined as follows:

- Establish an agreement with the State (KDHE) acting on behalf of EPA.
- Establish an agreement with the principal PRP to pay for its part of the clean-up.
- Develop an agreement with financial institutions to re-establish lending in the area.
- Request a change in state law to permit Tax Increment Financing (TIF) , a widely used economic development tool, to provide a secondary method of financing the cleanup. After improvements are made, the difference between the original property values and the new, higher restored values provides the tax base to pay for the improvements.
- Secure citizen involvement.
- Secure a qualified consultant for the job.

Cleanup has involved containment of the existing plume and two bioremediation pilot projects. Proposed treatment options include a combination of bioremediation and pump-and-treat technologies.

Today, banks are again lending money for investment and development in the area. Since the City launched the plan, several new restaurants, retail stores, and offices have opened in the area. New businesses have come to Downtown; existing businesses have expanded. Even state and federal government investment has been restored with a state office building and a federally subsidized transit center. Because of Wichita's initiative, the Gilbert and Mosley cleanup has achieved the following results:

- Wichita's citizens have been protected.
- The City's tax base has been preserved.
- Property values in the Gilbert and Mosley area have been preserved and restored.
- No permanent damage has resulted to the site.
- The environment will be protected for future generations.
- To the extent that they can be identified, those responsible for the pollution are paying to clean it up. The remaining costs are being covered by the TIF.

Although Wichita set out to restore the environment, solving the related financial and political problems proved to be a far more difficult task. Wichita's solution required the coordination and cooperation of the business community, financial lenders, property owners and taxpayers, and government at all levels.

The City of Wichita received the Ford Foundation's Innovations in State and Local Government Award in 1992 for its environmental clean-up plan for the Gilbert and Mosley Site.

References

Local Government's Role in Groundwater Clean-up - Wichita's Success Story, pamphlet.

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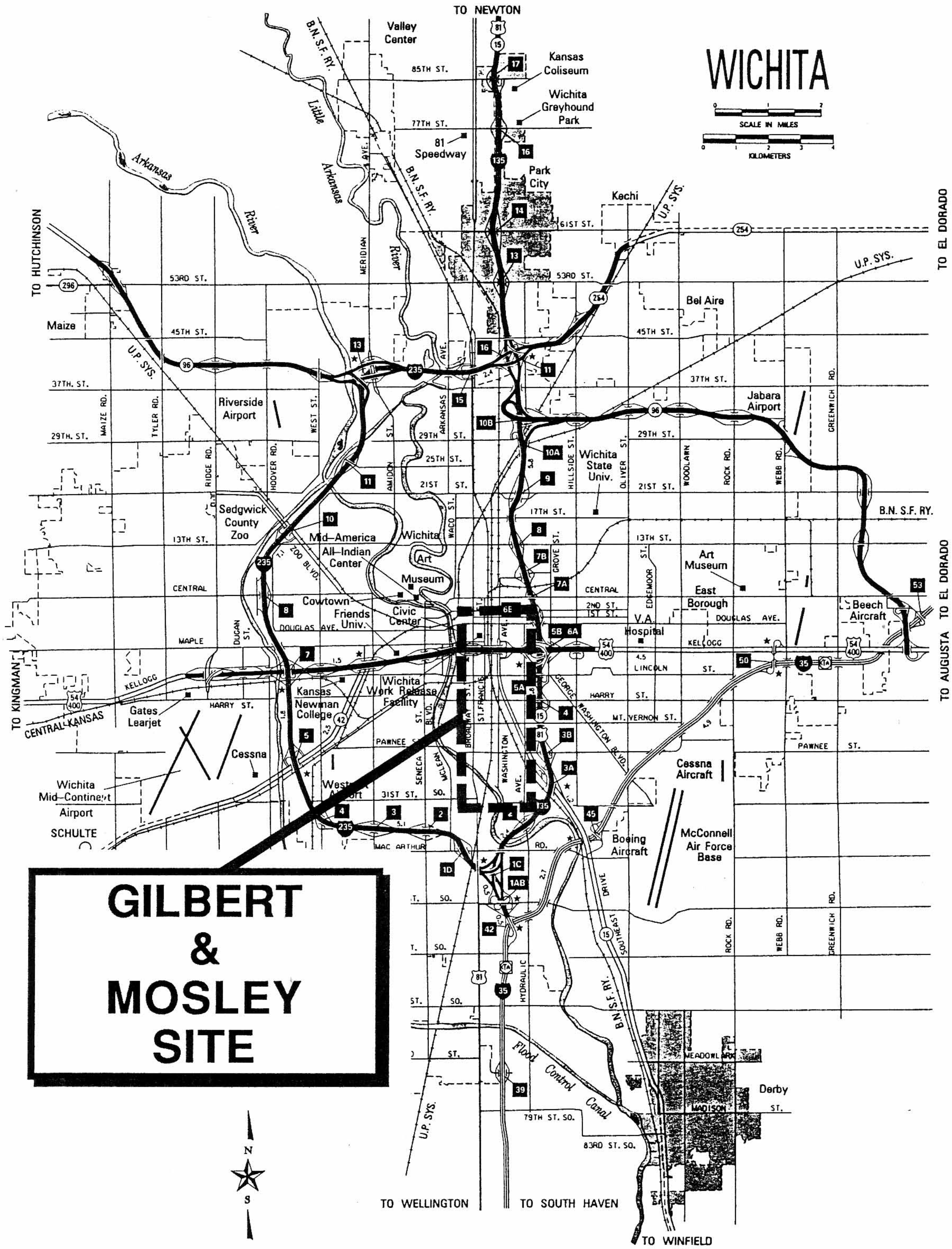

Figure 1. Map of downtown Wichita showing location of the Gilbert and Mosley ground-water contamination area (modified from Kansas Transportation Map).

Cheney Lake Water Quality Project

The North Fork Ninnescah River watershed above Cheney Lake covers 633,449 acres within five counties in south-central Kansas (Fig 1). Over 99% of the watershed is used for agricultural purposes, varying greatly from diversified crop and livestock farms and small dairies, to rangeland and large acreages under center-pivot irrigation.

The North Fork Ninnescah River watershed drains east into Cheney Lake, which was designed and constructed in 1962 through 1964 by the Bureau of Reclamation as a 100-year multipurpose project to act as a water-supply system for the City of Wichita, and provide for flood control and a wildlife/recreation area. The City draws 60 percent of its daily water supply from Cheney Lake.

In 1992 a joint meeting was held by the Reno County Conservation District and the Reno County ASCS (now Farm Service Agency) committee to discuss pollutants in the watershed and Cheney Lake. A task force was set up to study the problem and prepare a plan to identify and alleviate sources of pollution in the watershed. The task force included representatives of the Reno County Conservation District, Sedgwick County Conservation District, Reno County ASCS (FSA), Reno County Health Department, Wichita Water and Sewer Department, Reno County Extension Service, Kansas Department of Wildlife and Parks, Kansas Department of Health and Environment, Soil Conservation Service (now Natural Resources Conservation Service), State Conservation Commission, Equus Beds Water Quality Association, Bureau of Reclamation, U.S. Fish and Wildlife Service, U.S. Geological Survey, U.S. Environmental Protection Agency, Kansas Water Office, and a committee of landowners.

Two primary pollutants, phosphates and sediment, were identified as affecting both the quality and quantity of water in Cheney Lake.

Technical assistance from members of the task force was utilized to study the pollution problems and make recommendations for remedial action. Those recommendations were based on information from the Agricultural Nonpoint-Source Pollution Modeling Program.

A master plan was prepared for watershed-pollution management to alleviate the degradation of Cheney Lake and double its life. Implementation of the plan began in July 1994 under the leadership of the Citizens' Management Committee (CMC), which operates as a subcommittee of the Reno County Conservation District. The CMC is made up of farmers and business people with rural interests. Funding for the watershed program has come from various government grants and direct financial assistance from the Wichita Water and Sewer Department.

The most significant achievement of the Cheney Lake Water Quality Project is the partnership of rural and urban stakeholders. Because the City of Wichita recognized the value of correcting pollution problems prior to water entering Cheney Lake, the City agreed to provide incentive payments to farmers for implementing pollution-management practices (termed "best management practices" or BMPs), which are often non-income generating assets for farmers. For farmers, implementation carries the obligation of maintaining the practices for the long term. The farmers benefit because they install practices that improve the farms sustainability and the City benefits because the amount of pollution entering Cheney Lake is reduced and the life of the reservoir extended.

Accomplishments of the Cheney Lake Water Quality Project include:

- Construction of eight animal-waste systems and 13 household systems,
- Construction of 39 miles of gradient terraces, three diversions, 41 waterways, and 31 concrete structures,
- 180 acres of grass,
- 776 acres of nutrient management and 1,123 acres of pest management.

These practices have reduced sediments by 6,000 tons per year and have prevented 77,000 tons of manure from entering the watershed annually. This translated into 49 tons of nitrogen and seven tons of phosphorus that are a part of this waste.

The Kansas Wildlife Federation recognized the Citizens' Management Committee with their Water Conservationist Award for 1995. The CMC was also one of three watersheds in a national competition of 63 watersheds to receive CF Industries National Watershed Award in 1996. The key to the success of the Cheney Lake Water Quality Project is the willingness of each program participant to seek solutions that are mutually beneficial and that accomplish the project's ultimate goal of cleaner water.

Description of Tour Stops

Start the tour of the Cheney Lake watershed at the pump house at Cheney Lake Dam.

Stop10-1. Howard Lehner - CRP Fence

The value of properly managed rangeland versus tilled cropland in terms of water quality has long been understood. The expense of changing land use from cropland to rangeland can be a deterrent for most producers. The Conservation Reserve Program (CRP) has provided an opportunity for environmentally sensitive cropland to be planted to permanent cover of native grass. At the conclusion of the CRP contract, boundary fencing is necessary if the land is to be used as rangeland instead of being converted back to cropland. Through an EPA 319 Grant and with Kansas Department of Health and Environment and the City of Wichita funding, this CRP-boundary fencing project demonstrates that previously cropped land can be converted to properly managed rangeland.

Stop 10-2. Terry Krehbiel - Livestock Filter Strip

Small lots for feeding cattle during the winter can be found all over Kansas. These lots are not used continuously, but can contribute to nonpoint pollution. With the assistance of the Kansas Department of Health and Environment, Kansas State University, Terry Krehbiel, and others, a livestock filter strip was built between the lot and the stream. The filter strip is currently being monitored to determine its effectiveness in reducing nonpoint pollution. Since pollutants leave the lot only when it rains, they (now called nutrients) are captured in the filter strip and utilized by the brome hay that is eventually fed back to the livestock.

Stop 10-3. Sig Collins - CRP Grazing Trial

As Conservation Reserve Program (CRP) contracts start to expire in 1997, unless eligible for new contracting, producers must decide whether to convert their land to grazing or return it to crop production. In 1994, a grazing trial was started with producer Sig Collins to determine what kind of livestock production could be realized from grazing CRP grasslands. Several agencies and organizations supported this experiment. The trial has allowed other CRP contract holders to see, in their community, what kind of livestock production opportunities are available from CRP grasslands. The trial will continue in 1998.

Stop 10-4. Howard Miller - Dairy Waste Management System

Howard Miller has 65 cows in his milking herd and has recently installed a waste-management system that includes a manure-storage area and a wastewater lagoon. These improvements have helped streamline the management of the dairy. With the manure-storage area, manure can be stockpiled for three or four months, and then hauled to the fields when time allows. Mr. Miller is also participating in a field trial to dewater his lagoon. The lagoon will be used as supplementary water on permanent forage, which will in turn be fed back to his cows.

References

Summary of Cheney Lake - N.F.Ninnescah Watershed Project handout.

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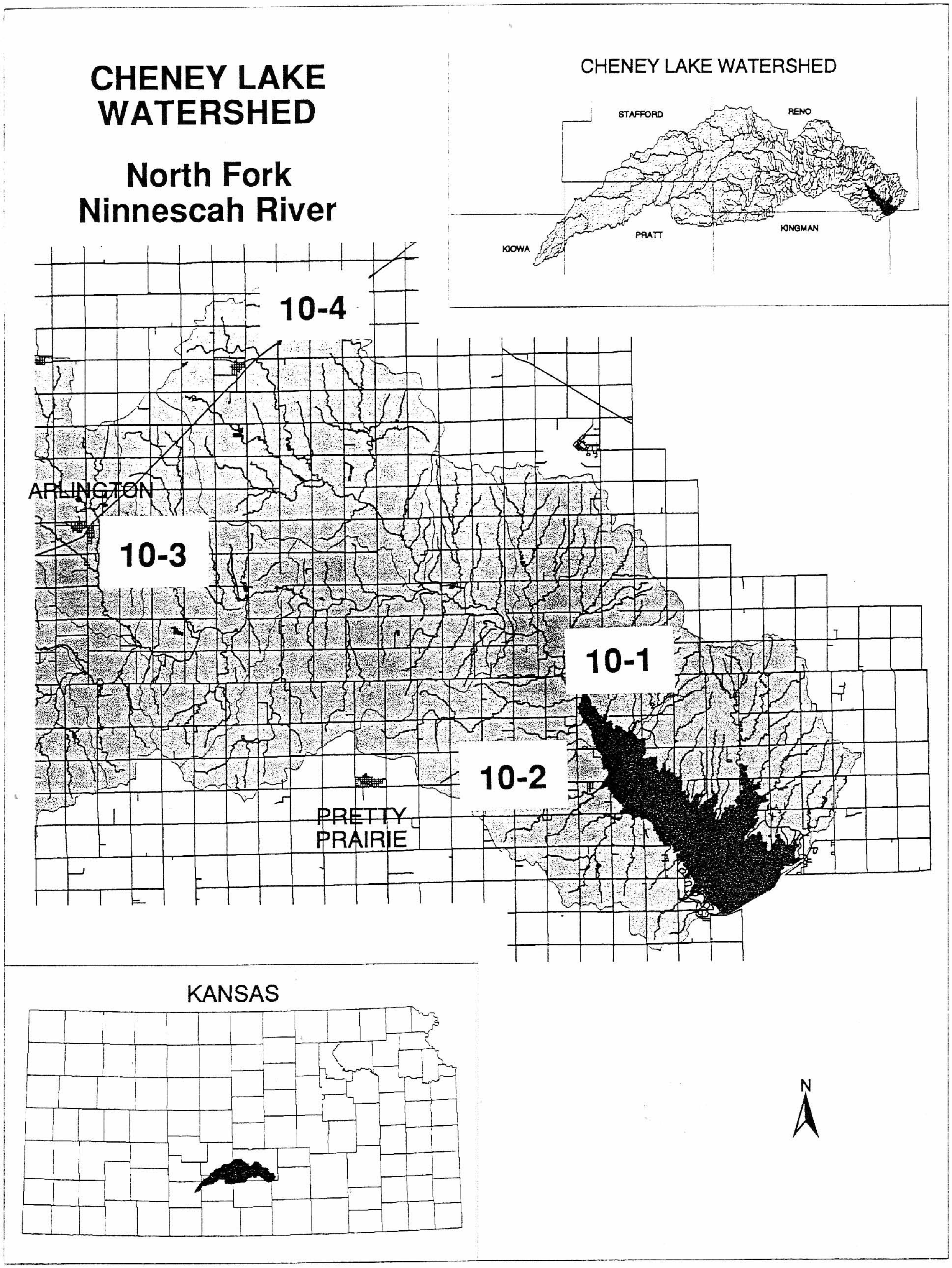
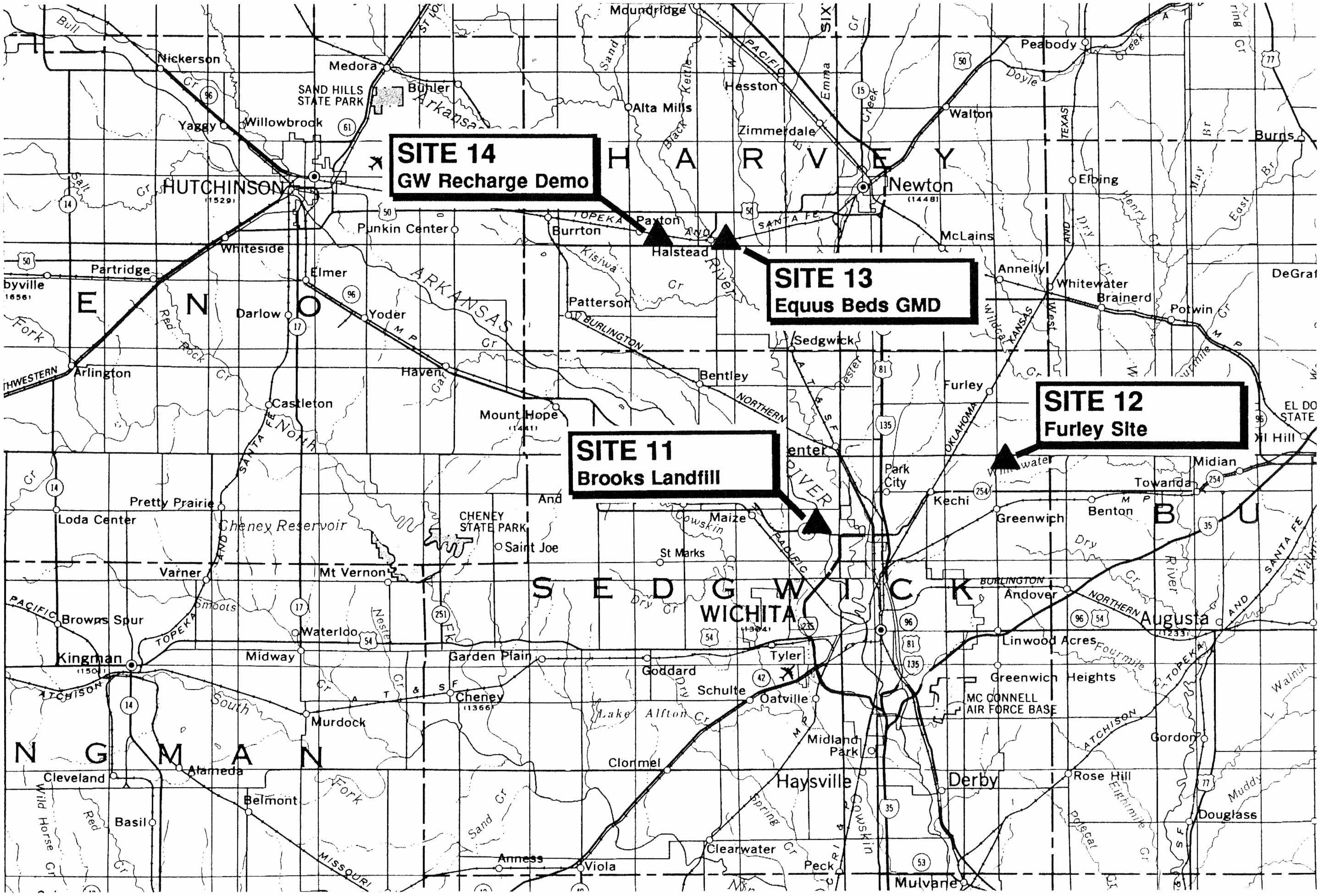


Figure 1. Cheney Lake Watershed, location of tour stops.

SCHEDULE & ITINERARY

Friday June 6, 1997

7:15 am	Breakfast
8:00 am	Bus to Brooks Landfill
8:15 am	**SITE 11** - Brooks Landfill, Wichita, KS *Joe Pajor*, Natural Resources Director, Wichita Public Works Department *Jack Brown*, Director, Wichita-Sedgwick County Department of Community Health *Leo Henning*, Kansas Department of Health and Environment
9:00 am	Bus to Site 12
9:15 am	**SITE 12** - Proposed New Landfill - Furley Site *Joe Pajor*, Natural Resources Director, Wichita Public Works Department
9:25 am	Bus to Halstead
10:00 am	**SITE 13** - Equus Beds Groundwater Management District, Halstead, KS *Mike Dealy*, Manager, Equus Beds Groundwater Management District *Jerry Blain*, Supt. of Production and Pumping, Wichita Water Dept. *Don Whittemore*, Chief, Geohydrology Section, Kansas Geological Survey
11:00 am	Bus to Site 14
11:05 am	**SITE 14** - Equus Beds Groundwater Recharge Demonstration Project *Mike Dealy*, Manager, Equus Beds Groundwater Management District *Jerry Blain*, Supt. of Production and Pumping, Wichita Water Dept.
11:45 am	Bus to Halstead
12:00 am	Lunch at Halstead City Park
1:00 pm	Bus to Emporia
2:30 pm	**Arrive Ramada Inn, Emporia**



DAY 3 - Friday, June 6, 1997

Wichita - Halstead - Emporia

Brooks Landfill

Located on the northwest edge of Wichita, Brooks Landfill has been in continuous operation as a municipal waste landfill for over 30 years. The landfill is just northwest of the intersection of Kansas Highway 96 and the Arkansas River (Fig. 1). Built in 1966, the landfill was operated by the City of Wichita until 1981. Since then, the landfill has been operated by private contractors.

The landfill is underlain by alluvial material (mostly sand and gravel) ranging in thickness from 40 to 50 feet. Ground water within the alluvium occurs about 10 to 15 feet below the ground surface and moves slowly (about 400 feet per year) through the alluvium in a southeasterly direction. The alluvium is underlain by the Wellington Formation, which consists mostly of shale but can contain beds of limestone, gypsum, and salt.

The Arkansas River flows from north to south just east of the landfill and is restricted to a braided channel between flood control levees on both sides of the river. Surface drainage near the landfill and highways is controlled by manmade structures.

In March 1996, monitoring wells detected contaminants in the ground water southeast of the landfill. The source of the contamination was traced to the southwest corner of Cell B. Contaminants from the landfill were not found in samples taken from the Arkansas River and private wells downgradient of the landfill. Of most concern is Meridian Gardens subdivision, which is in the pathway of the contamination plume. Several residents of Meridian Gardens have private wells.

Chemicals leaking from the landfill that are of most concern are arsenic, *cis*-1-2-dichloroethene (DCE), and vinyl chloride. The arsenic contamination is limited to a small area at the eastern edge of the landfill. The DCE and vinyl chloride contamination extends 5,900 feet downgradient of the landfill (Fig. 1). Vinyl chloride and DCE are formed when common industrial solvents break down. These chemicals can cause health problems for humans. The volume of contaminant that has escaped the landfill is estimated to be about 475 million gallons.

Several alternatives have been proposed for cleanup of ground-water contamination from Brooks Landfill, including long-term monitoring and connecting residences in Meridian Gardens to public water.

At the leading edge of the plume, a pumping well south of K-96 Highway will be used to control further migration of the contamination. Where the contamination plume leaves the eastern edge of the landfill, an air sparging system will be used. With air sparging, air is injected into the ground water. As the air travels upward through the water, it removes or "strips" the volatile contamination. If shown to be effective, the sparging system may be converted to an *in situ* bioremediation system using methane gas instead of air. Methane gas forms when materials buried in the landfill decay. Methane is captured from the landfill and injected into the ground water to stimulate the growth of bacteria that will attack and break down the contaminants.

In addition to source control at the eastern edge of the landfill, potential remedial measures at or near the source in the southwest corner of Cell B will be evaluated. The City estimates the cost of cleanup will be $2-3 million.

The City has a permit from the Kansas Department of Health and Environment to use the landfill until April 1998. After that, yearly renewal of the permit for each of the next five years depends on successful cleanup of the existing contamination and whether continued use of the landfill creates more pollution. Brooks Landfill is scheduled to close in 2001. Currently, the city is considering building a transfer station as a collection point and shipping its trash out of the area, or building a new landfill.

References

Release Assessment Report, Brooks Landfill, May 1996, by Camp Dresser & McKee.

Brooks Landfill Groundwater Contamination Fact Sheet, August 12, 1996, 4 p.

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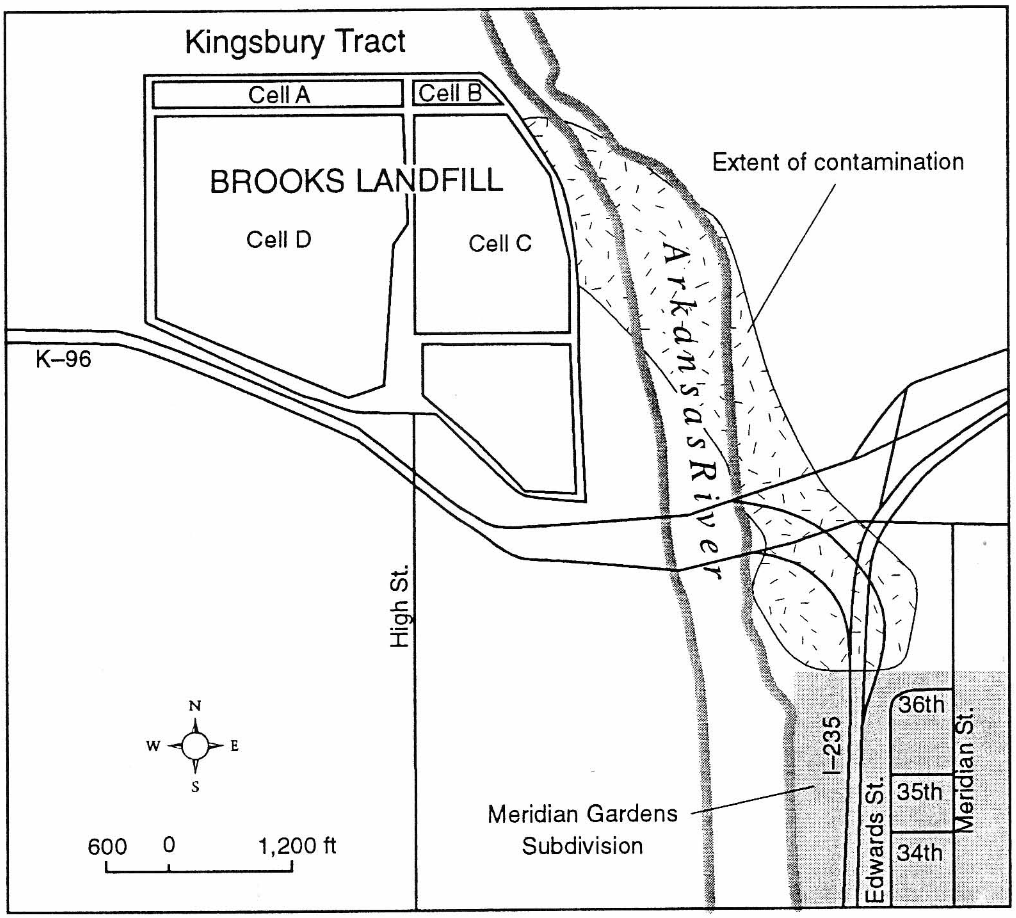

Figure 1. Brooks Landfill and contamination plume.

Proposed New Landfill - Furley Site

State law will require Brooks Landfill, Wichita's municipal waste facility, to be closed within the next five years. The City is now evaluating options for municipal waste disposal. Two solutions that are currently being considered are building a trash transfer station that will be used to ship trash out of the area, and a new landfill.

During the summer of 1996, the City bought options on about 1,200 acres of farmland three miles south of Furley, Kansas, for possible use as a new landfill. Furley is located about 10 miles northeast of Wichita. Furley is known for another landfill -- this one built to handle hazardous waste -- that was in operation during the 1970s and 1980s and was closed because contaminants were leaking from the site. This site is located about one-half mile northeast of the property the City has optioned.

The optioned property is between Greenwich Road on the west, 85th Street North on the north, 127th Street East on the east, and 77th Street North on the south edge of the property.

Geologically, this site is located in the Wellington Formation, a thick unit of shale that contains thin beds of limestone and gypsum. Thick salt beds of the Wellington are present in the subsurface. While a thick shale such as the Wellington Formation usually provides a safer location for a landfill (Fig. 1A) than one sited in alluvium (Fig. 1B), only a site-specific geologic and engineering study can determine the feasibility of a site for landfill use.

Figure 1 illustrates the difference between a landfill, such as the Jefferson-Douglas County Landfill, that is placed in a shale above the water table, and one located in floodplain alluvium near the water table, like Brooks Landfill. Shales are relatively impermeable and usually contain any contaminants that may leak from the solid waste. On the other hand, sand and gravel found in many alluvium deposits are usually very porous and can often allow contaminants to readily enter the ground water.

Reference

Ground Water - Issues and Answers, American Institute of Professional Geologists booklet, 25 p.

Lane, C.W. and Miller, D.E., 1965, Geohydrology of Sedgwick County, Kansas: Kansas Geological Survey Bulletin 176, 100 p.

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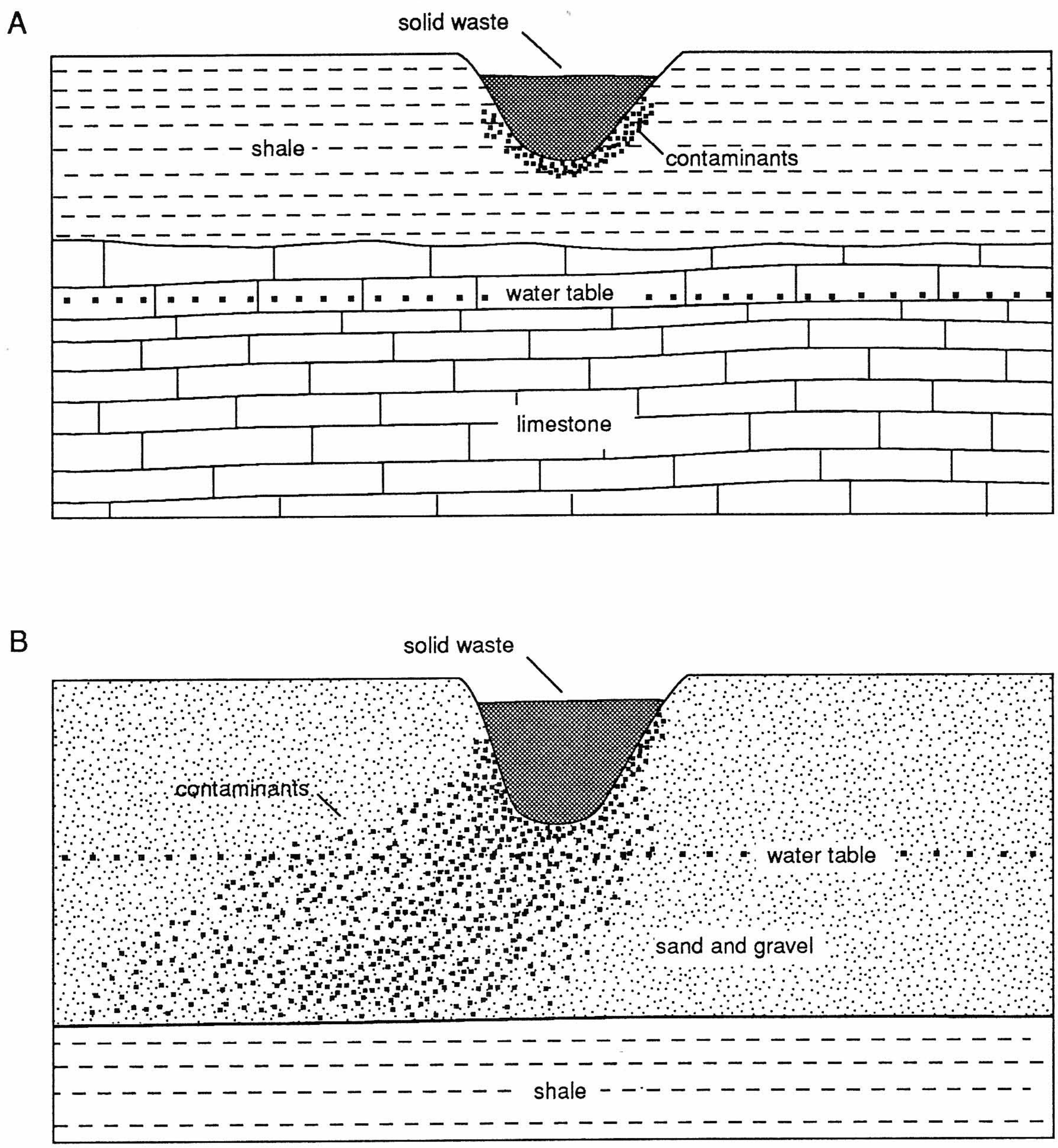

Figure 1. A. Example of a relatively safe landfill site. B. Unsafe landfill site, contaminants can easily enter the groundwater (illustration from American Institute of Professional Geologists).

Equus Beds Groundwater Management District

Groundwater Management Districts (GMDs) are locally managed political subdivisions in Kansas that have been formed to manage ground-water resources. GMDs are not affiliated with any state agency, but do cooperate with other water-related agencies and are bound by the state's ground-water laws and regulations. The Legislature authorized formation of GMDs by the Groundwater Management District Act of 1972. There are five GMDs in Kansas (Fig. 1): Big Bend Groundwater Management District No. 5, Equus Groundwater Management District No. 2, Southwest Kansas Groundwater Management District No. 3, Western Kansas Groundwater Management District No. 1, and Northwest Kansas Groundwater Management District No. 4.

Equus Beds Groundwater Management District No. 2

The Equus Beds Groundwater Management District No. 2 is located in south-central Kansas and occupies portions of McPherson, Harvey, Reno, and Sedgwick counties (Fig. 2). It covers about 900,000 acres. The Equus Beds GMD lies almost entirely within the Arkansas River Lowlands physiographic province, except for the extreme eastern edge, which is in the Flint Hills province.

The Equus Beds Groundwater Management District was formed in 1975 to manage ground-water supplies within its boundaries. The Equus Beds aquifer is the principal source of fresh and usable water within the District. The aquifer is managed on two fundamental principles: 1) the Aquifer Safe Yield Principle, which limits ground-water withdraws to annual ground-water recharge; and 2) the Ground Water Quality Principle, which seeks to maintain by protection and remediation the naturally occurring water quality of the aquifer.

The purpose of the Equus Beds Groundwater Management District No. 2 and its Board of Directors is to properly manage ground-water resources of the District for the benefit of the resource and the public interest.

The District relies on the following actions to achieve its goal:

- manage the Equus Beds aquifer on a "safe yield" principle,
- educate and inform the public on ground-water issues,
- monitor both quality and quantity of water in the aquifer,
- investigate or study the aquifer's physical and hydrologic characteristics,
- investigate alternative sources of water,
- encourage reclamation or recycling of waste water,
- investigate ways to improve recharge and prevent its deterioration,
- support legislative changes that enhance good ground-water management practices,
- cooperate with appropriate local, state, and federal agencies and organizations.

References

Equus Beds Groundwater Management District No. 2, Management Program, May 1, 1995.

Resource Contact

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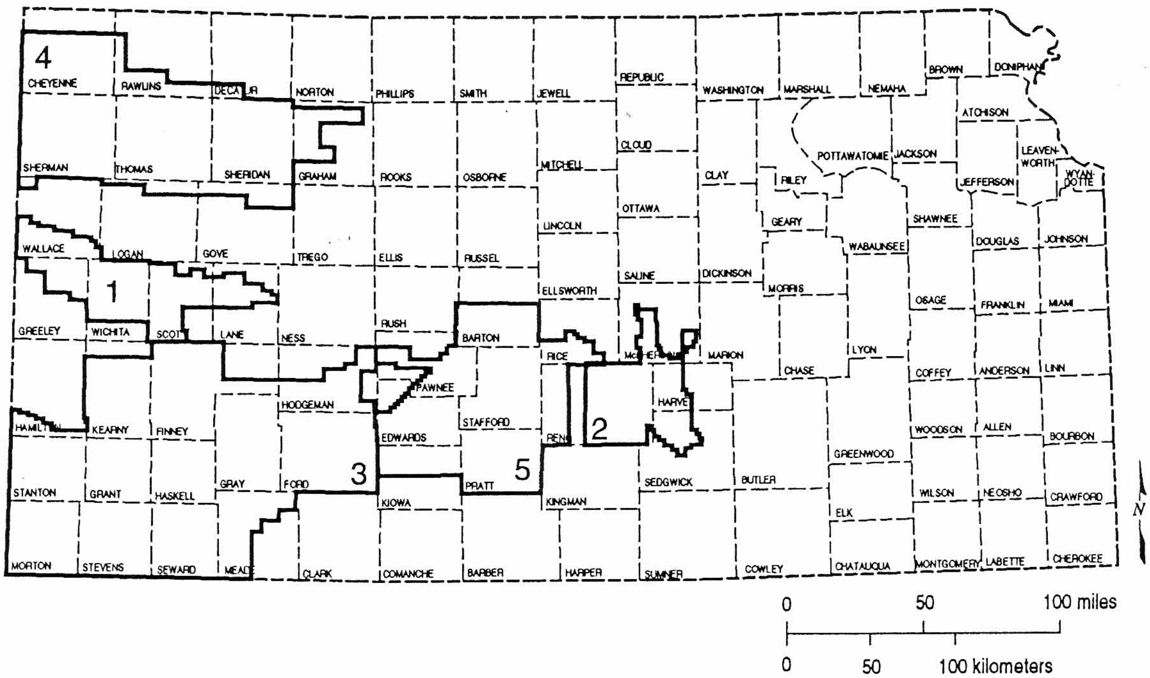

Figure 1. Groundwater management districts in Kansas.

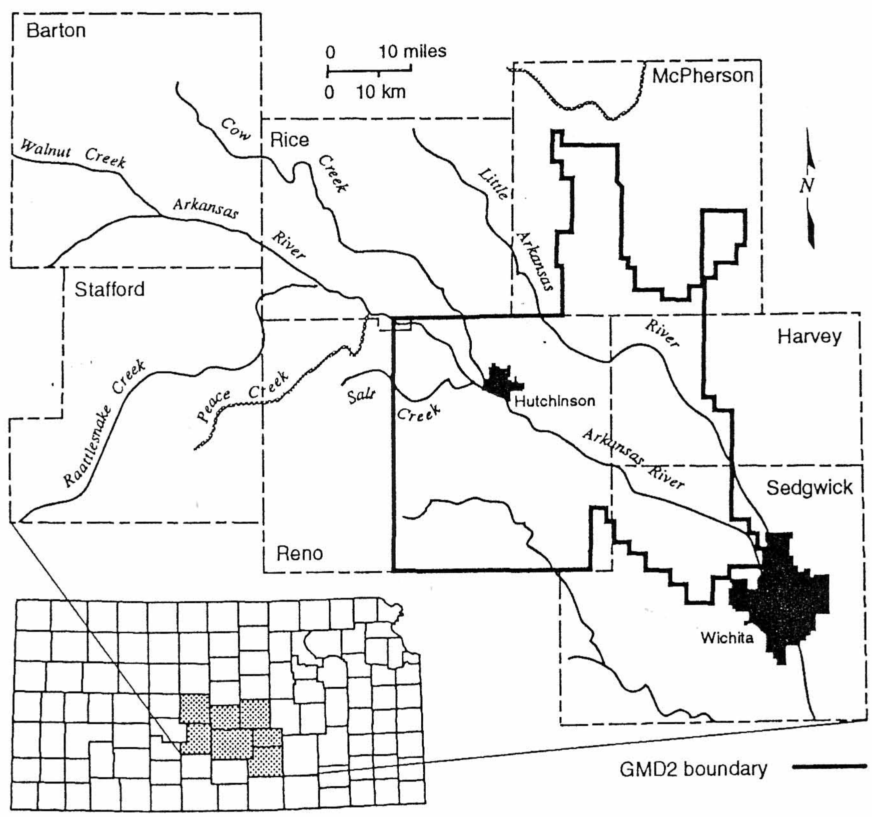

Figure 2. Equus Beds Groundwater Management District No. 2

Equus Beds Groundwater Recharge Demonstration Project

The City of Wichita currently obtains about 40 percent of its water supply from Cheney Reservoir, and the rest from the Equus Beds aquifer (Fig. 1). The Equus Beds are deposits of uncosolidated silts, sand, and gravel that were carried by streams onto the plains of central Kansas during the past few million years of geologic history. Because these beds contain the fossilized bones and teeth of Ice Age horses, they were called the Equus Beds. The pore space in the Equus Beds stores water and creates the Equus Beds aquifer, which lies beneath about 900,000 acres of McPherson, Harvey, Reno, and Sedgwick counties. Water in the Equus Beds is generally of high quality, though it is threatened by natural salinity from the Arkansas River to the southwest, oil-field brine from wellfields in the Burrton area, and ground-water levels that have dropped 20 to 40 feet in some areas since the 1950s. About 55 percent of the water removed annually from the Equus Beds is used for irrigation, 39 percent is used by municipalities (Wichita, Halstead, Newton, Hutchinson, McPherson, Valley Center, and others), and six percent for industry. Water use in the Equus Beds aquifer is regulated by the Equus Beds Groundwater Management District No. 2, headquartered in Halstead.

The City of Wichita predicts that the water supply demands for it and surrounding communities will increase from 62 million gallons per day in 1991 to 125 million gallons per day by the year 2050. To help satisfy that demand, the City is exploring other water-supply options, including this demonstration project that is designed to test the feasibility of a full-scale ground-water recharge project. Recharge is movement of water back into an aquifer, either through natural means, such as precipitation and infiltration, or artificial means, such as this project.

The concept being studied here (Fig. 2) is the removal of water from the Little Arkansas River, either directly from the river or from wells drilled into the river's alluvium (the sand, gravel, and silt deposits that neighbor the river). The Little Arkansas has its headwaters in northern Rice County and flows to the southeast and joins the Arkansas River at Wichita. During times of high flow, water moves out of the river, into the alluvium; because the water is held in the alluvium that forms the banks of the river, this water is referred to as "bank storage." The wells in this demonstration project remove water from this alluvium and would remove only that water in excess of the amount determined by the State to be the normal flow of the Little Arkansas. Water from those wells and an intake on the Little Arkansas is then carried, via pipeline, to an infiltration basin or a recharge well to the west of here, where it is fed into the Equus Beds aquifer.

The demonstration project is funded by the city of Wichita at a cost of $3.4 million. It is designed to operate for a two- to three-year period, collecting data and testing the project's feasibility. If the project is feasible, it will be followed by a $106 million recharge and storage project that is designed to add up to 104 billion gallons of water to the aquifer. That recharge would take place over approximately the next 12 years, attempting to improve water quality and to recharge aquifer levels to approximately those of the 1950s.

References

Equus Beds Groundwater Recharge Project, City of Wichita, Kansas, brochure, November 1993.

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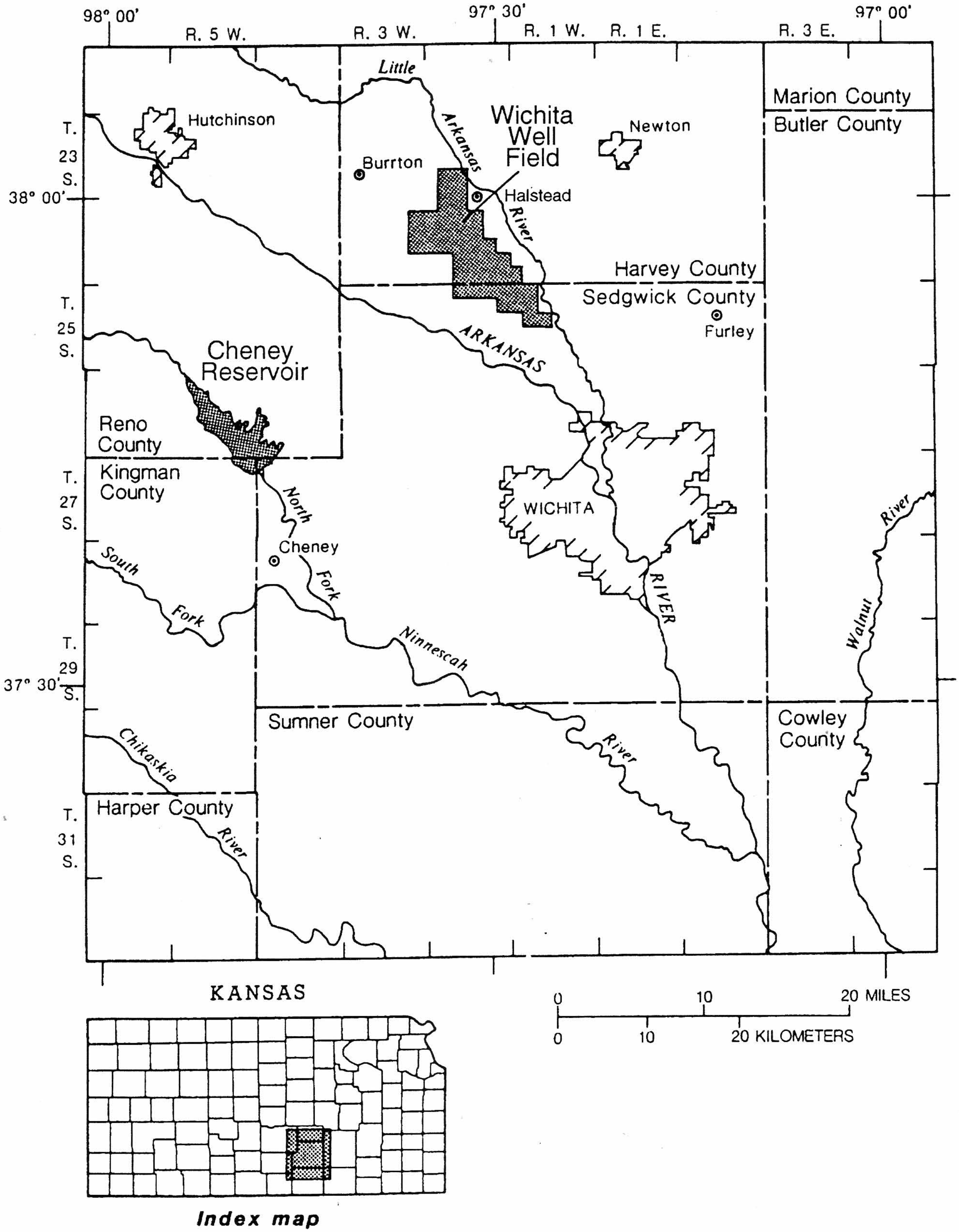

Figure 1. Wichita water supply sources (modified from U. S. G. S. Water-Resources Investigation Report 88–4225).

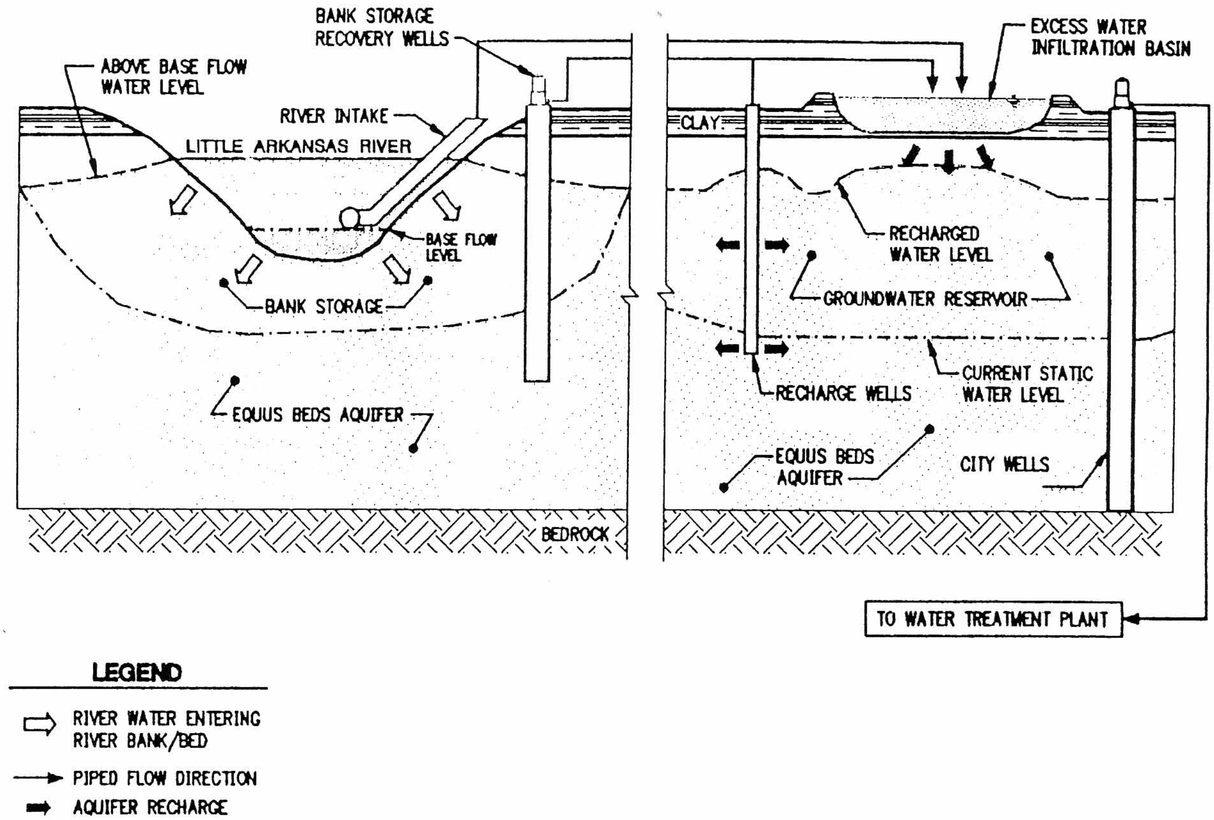

Figure 2. Schematic diagram of the Equus Beds Groundwater Recharge Demonstration Project (modified from Burns and McDonnell diagram).

Kansas Geological Survey

Public Information Circular 2

June 1995

Salt Contamination of Ground Water in South-central Kansas

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Proper management of ground water reduces, and frequently avoids, intrusion of saltwater into freshwater supplies

Introduction

The natural contamination of fresh ground water by saltwater is an important water-quality issue in many areas of Kansas. This saltwater comes from naturally occurring salt minerals in the subsurface. Proper management of ground water reduces, and frequently avoids, intrusion of saltwater into freshwater supplies. This circular provides water users and public officials with a basic explanation of how saltwater enters water supplies, and outlines methods that might diminish or prevent natural salt contamination of freshwater aquifers. South-central Kansas, the focus of this publication, contains unconsolidated (uncemented) sand and gravel aquifers of the Great Bend Prairie, the Equus Beds, and the Arkansas River valley. Many of the same explanations and methods apply in other parts of Kansas where natural salt contamination is a problem.

Areas of south-central Kansas where salt contamination of freshwater aquifers might occur are illustrated in fig. 1. South-central Kansas is shown in detail because of the high occurrence of salt-contamination problems in this region. "Natural" sources of saltwater contamination of freshwater aquifers are the focus of this circular. Locations of "unnatural" salt contamination also have been included in fig. 1.

Terms printed in ***italicized boldface type*** are defined in the glossary at the end of the circular.

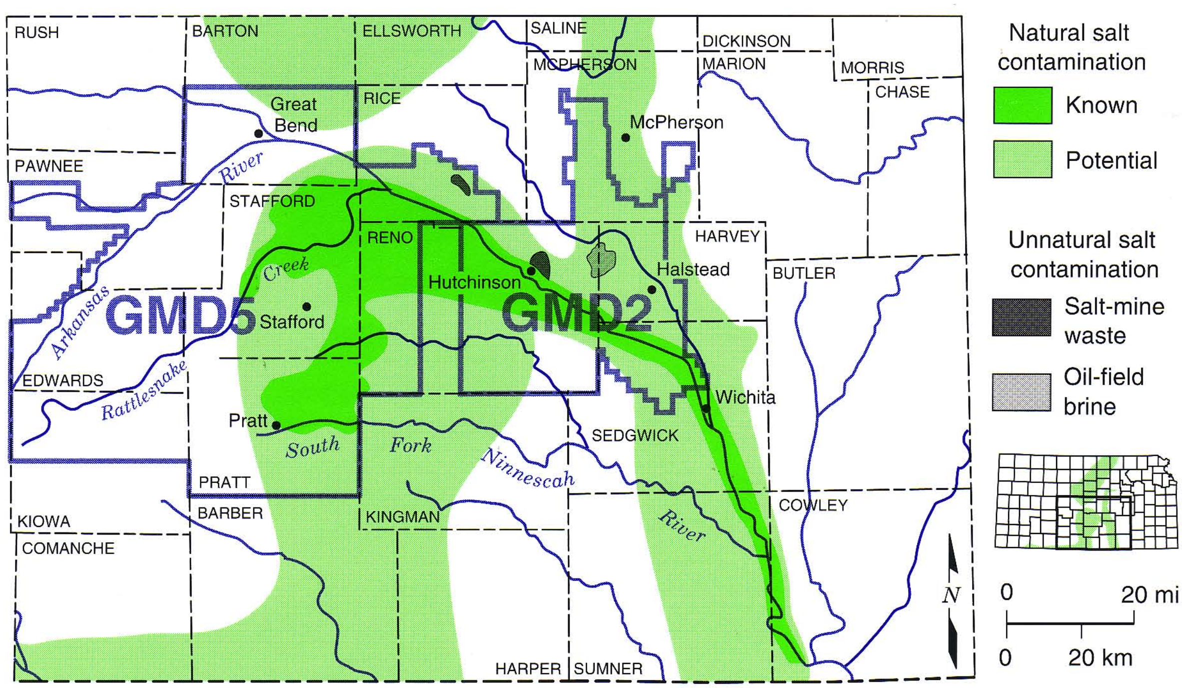

FIGURE 1—Areas with known or potential saltwater contamination in south-central Kansas. Areas identified as "known" natural salt contamination have saltwater within the freshwater aquifer. In the areas labeled "potential" natural salt contamination, subsurface bedrock formations containing salt or saltwater are in contact with the overlying freshwater aquifers. Groundwater Management District boundaries (GMD) 2 and 5 are shown in blue.

Natural sources of salt contamination of freshwater aquifers include salt- and salt-bearing bedrock formations

Salt

When talking about "salt," most people think of table salt or rock salt—sodium chloride—but the term is often used to mean almost any dissolved minerals or inorganic constituents found in water. The salt content of water, also referred to as ***salinity*** or ***total dissolved solids*** (TDS), is an important water-quality factor. Excessive salt content can make water unpleasant, harmful to plants and animals, or uneconomic to use. In addition, high-salinity water contributes to the deterioration of domestic plumbing and water heaters, and municipal and industrial water-works equipment. Table 1 illustrates how salinity limits the use of water for domestic and agricultural uses.

TABLE 1 *(right)—Water-quality threshold indicators for domestic and agricultural uses. Chloride concentration (Cl) is the primary indicator of salinity; corresponding TDS values are approximations for sodium chloride type ground water.*

TDS (mg/L) (ppm)	**Cl** (mg/L) (ppm)		**Water Use Limits**
		>3000	Unsuitable for most domestic/ agricultural purposes
5700	3000		
		>2200	Poor water for livestock
3900	2000		
		>1500	Poor water for poultry
2100	1000		
		>500	Generally unsuitable for irrigation
1200	500		
		>350	May adversely affect many crops
		140–350	Moderately tolerant plants usually show slight to substantial injury
700	250	**250**	**DRINKING WATER STANDARD**
		70–140	Sensitive plants usually show slight to moderate injury
		<70	Generally safe for most purposes

Sources of Saltwater Contamination

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 cause 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, the emphasis of this publication, include salt- and saltwater-bearing bedrock formations.

Ground-water Behavior and Saltwater Contamination

. . . under natural conditions, ground water flows slowly—usually a few inches or feet per day—through small openings, or pores, in the aquifer

Ground water in Kansas does not flow in rivers or streams as water does on the surface. Instead, under natural conditions, ground water flows slowly—usually a few inches or feet per day—through small openings, or pores, in the aquifer. The mostly horizontal flow is modified by vertical movement—downward in areas of ***recharge*** created by precipitation, and upward with ***discharge*** to creeks, rivers, wetlands, or wells (fig 2). Where recharge is high and freshwater moves downward, aquifers may be flushed of their salt content. By contrast, surface discharge can create circulation patterns that cause saltwater to

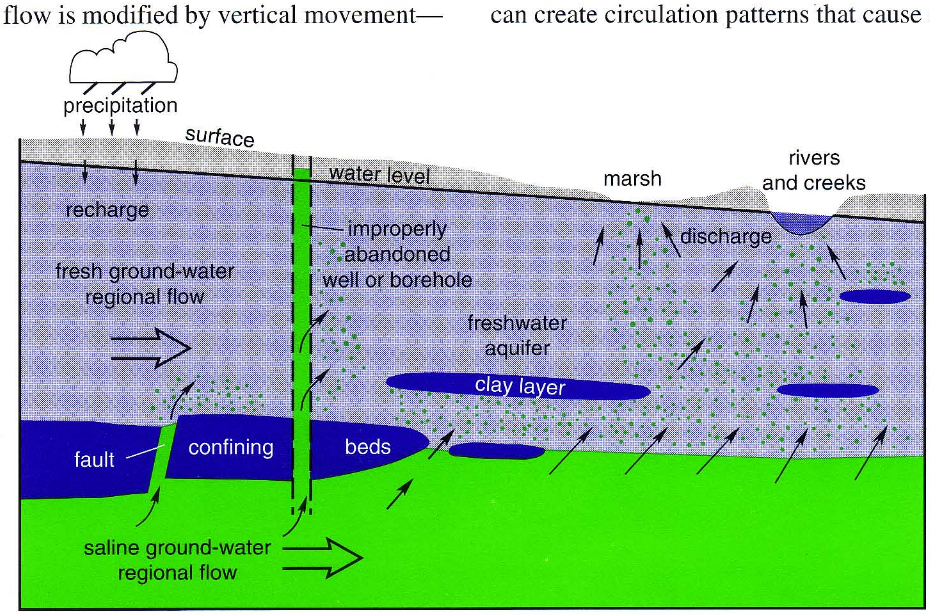

FIGURE 2—*Schematic illustration of factors influencing movement of saltwater from a bedrock aquifer to the overlying freshwater aquifer and surface-water discharge areas.*

move upward. This is why many of the salt-contamination areas shown in fig. 1 are associated with streams, rivers, and marshes.

Saltwater is found in deep bedrock formations almost everywhere, while freshwater is usually found only near the earth's surface. In most places freshwater aquifers are separated from saltwater-containing aquifers by barriers called ***confining beds***. Confining beds are clay or bedrock layers that slow or prevent the vertical movement of water between aquifers. Where the confining bed is absent or penetrated by natural features such as faults or fractures, or by human-made features such as improperly abandoned wells, saltwater may leak upward and contaminate the freshwater aquifer.

Within an unconsolidated aquifer, thick and extensive clay layers can function as confining beds. Where saltwater has moved above a clay layer, the clay can serve as a ***perching horizon***, maintaining the saltwater higher than would otherwise be expected (fig. 2). Unlike large regional layers of confining bedrock, these clay layers are variable and unpredictable in their size and distribution.

Because saltwater is denser than freshwater, it remains near the bottom of aquifers and flows ***downgradient*** unless it is drawn upward by natural discharge or pumping. In some areas, the aquifer may contain substantial amounts of saltwater near its base, but the freshwater in the uppermost part of the aquifer may not be affected.

In south-central Kansas, bedrock formations containing saltwater and salt layers are in contact with the overlying freshwater aquifer. In these areas, confining beds can be thin, discontinuous, or absent (fig. 2), and freshwater aquifers are potentially vulnerable to natural salt contamination.

Once an area is contaminated, remediation by human modification is difficult, and natural processes are slow

Predicting Saltwater Contamination

Many factors affect the nature, development, and predictability of natural salt contamination. Understanding the hydrology and geology of aquifers is important. Uncertainties in water use and management are caused by variations in the distribution of natural features (clay layers, faults, fractures, salt- and saltwater-bearing formations, ground-water flow patterns) and human-induced problems (improperly abandoned wells, bore holes).

Groundwater Management Districts 2 and 5 have established ground-water-quality monitoring networks and data bases to provide basic information to ground-water users. Additional information is available from other local, state, and federal agencies.

Pumping Wells in Areas Vulnerable to Saltwater Contamination

Pumping a well too hard can cause ***upconing*** of saltwater into the freshwater aquifer. Figure 3A illustrates a situation in which saltwater at the base of the freshwater aquifer does not rise much above the level of a partially confining clay layer. High-capacity wells in fig. 3B, however, create ground-water flow that pulls saltwater up through openings in the confining bed. Eventually, saltwater moves along the top of the clay layer and enters the well.

High-capacity irrigation or municipal-supply wells have zones of influence that may extend more than a mile from the well. These wells can dramatically alter water-table elevations and ground-water-flow directions. Because ground water moves relatively slowly, it may take several years for an underground source of salt contamination to be diverted to the well or nearby wells. Once an area is contaminated, remediation by human modification is difficult, and natural processes are slow.

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. Thus, upconing of saltwater can be more severe during extended droughts.

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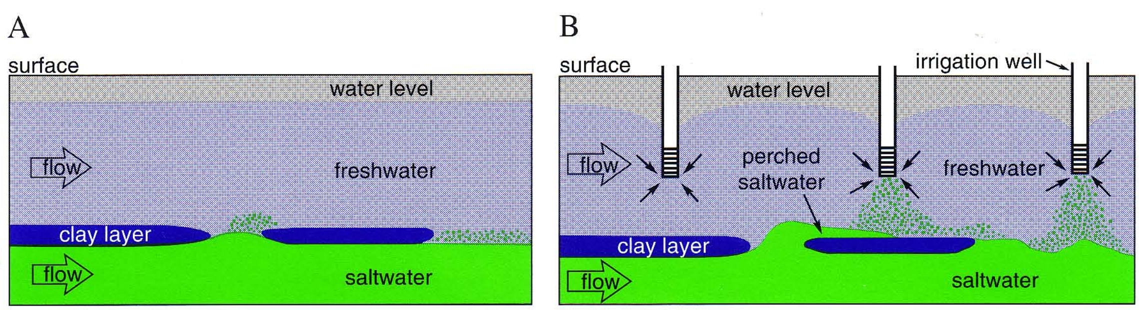

FIGURE 3—A) The undisturbed aquifer contains saltwater at its base, but saltwater does not rise much above the level of the discontinuous clay layer. B) During pumping, saltwater moves toward the discharge points, and upconing beneath the pumping wells occurs.

Precautions and Procedures

How can ground water be used with reasonable safety in potentially vulnerable areas, especially in view of the uncertainties involved in predicting salt contamination? There is no easy answer, but users can take steps to minimize or avoid saltwater problems. Domestic or stock wells are unlikely to have a major impact on water quality, but it is a different story for irrigators and other high-volume users. As has been discussed, high-volume wells can create their own problems. A number of common-sense precautions can be followed:

1) **Assess Well Location and Surrounding Area**—Check with locally knowledgeable people or agencies for saltwater problems in the vicinity of the proposed well. If problems are present, determine whether the source of salt contamination was identified. Investigate a larger area (a few miles) surrounding the proposed well, especially in the ***upgradient*** direction. Learn and comply with any local or state requirements or recommendations.
2) **Install the Well Carefully**—Wells that penetrate a confining bed, encounter saltwater, or are not properly plugged can be major contributors to unnecessary salt contamination. Drilling operations should log wells carefully, monitor water quality, and complete or plug holes according to state requirements for proper well construction and plugging procedures.
3) **Design for Minimum Water-quality Impact**—Screen wells as shallow as practical and pump slowly to minimize upconing. In areas of known salt contamination of the deeper aquifer, safe pumping may require multiple smaller wells rather than a single large well (see fig. 4). If only one well is used, pumping at lower rates for longer periods of time could be advantageous.
4) **Irrigate Conservatively**—Using less water not only preserves the quantity of the resource, it also protects its quality and can prolong the useful life of the well.
5) **Test Water Quality and Keep Records**—Test for salinity at the beginning and end of each season, and more frequently if a saltwater problem is suspected. If water quality deteriorates, early detection allows time to modify operating or crop patterns and minimize loss. If saltwater problems are related to drought, climatic conditions should be a factor in water-use planning.

For information and assistance with saltwater-contamination problems, contact the local Groundwater Management District (GMD2 316/835–2224; GMD5 316/234–5352), the Division of Water Resources (316/234–5311), the Kansas Department of Health and Environment (913/296–1500), the Kansas Ground Water Association (316/548–2669), or the Kansas Geological Survey (913/864–3965). The problems, and the appropriate solutions, depend on the source of the salt contamination. The best defense, however, is to avoid problems in the first place by planning new wells carefully and operating existing wells prudently.

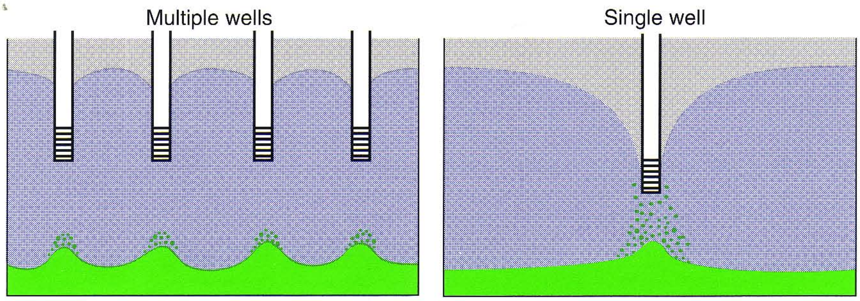

FIGURE 4—Dispersed, low-volume pumping produces less serious salt contamination than does concentrated withdrawal.

Glossary

Confining bed—A layer of relatively impermeable (incapable of transmitting fluids) material overlying an aquifer.

Discharge—Movement of ground water from the subsurface to the land surface, usually from a spring or to a marsh, river, or stream.

Downgradient—In reference to the movement of ground water, the "downstream" direction from a point of reference (a well).

Perching horizon—A relatively impermeable (incapable of transmitting fluids) lens or layer of clay or bedrock in otherwise permeable (capable of transmitting fluids) sediments that slows or prevents the downward movement of water.

Recharge—The addition of water into the aquifer, usually from precipitation percolating into the ground.

Salinity—The total quantity of dissolved salts in water, usually measured by weight in milligrams per liter or parts per million.

Total dissolved solids—The total quantity of all dissolved material in water, usually measured by weight in milligrams per liter or parts per million.

Upconing—The upward movement of ground water from a deeper to shallower position in the aquifer, usually induced by pumping a well or discharge to the surface.

Upgradient—In reference to the movement of ground water, the "upstream" direction from a point of reference (a well).

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