

2010 Kansas Field Conference

June 2–4, 2010

Flint Hills, Cross Timbers, and Verdigris River Valley

Water/Energy Nexus
Rangeland and Stream-Corridor Management

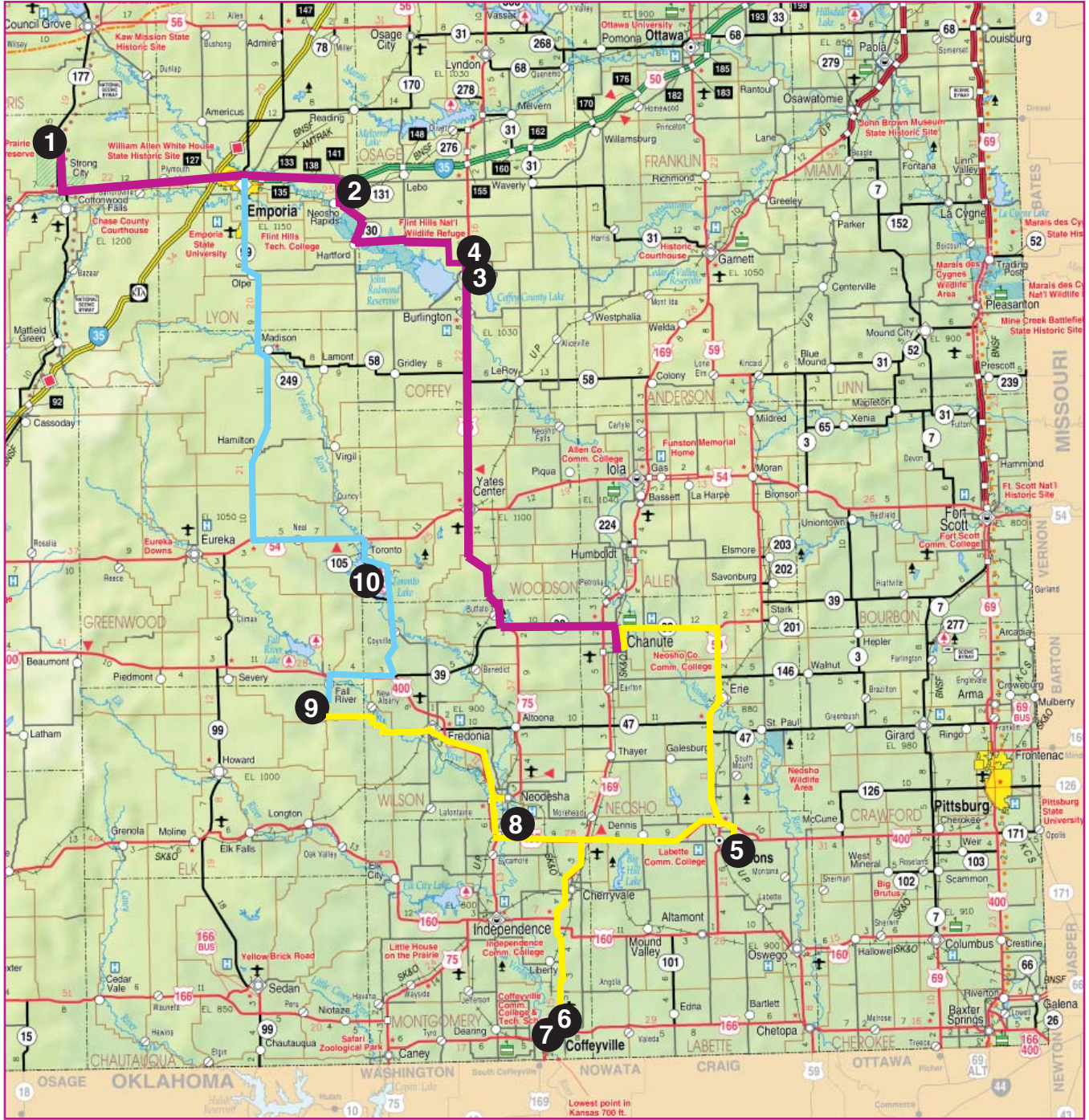
Field Guide

Edited by

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CN	RA	DC	NT	PL	SM	JW	RP	WS	MS	NM	BR	DP
SH	TH	SD	GH	RO	OB	MC	CD	CY	RL	PT	JA	AT
WA	LG	GO	TR	EL	RS	LC	OT	DK	GE	WB	SN	JF
GL	WH	SC	LE	NS	RH	BT	EW	SA	DK	WB	SN	DG
HM	KE	FI	HG	PN	BT	EW	SA	DK	WB	SN	DG	JO
ST	GT	HS	ME	CA	CM	BA	HP	SU	CL	CO	MG	LB
MT	SV	SW	ME	CA	CM	BA	HP	SU	CL	CO	MG	LB



Wednesday, June 2
Stops 1 – 4

Thursday, June 3
Stops 5 – 8

Friday, June 4
Stops 9 – 10

2010 Field Conference

Flint Hills, Cross Timbers, and Verdigris River Valley

Water/Energy Nexus Rangeland and Stream-Corridor Management

June 2 – 4, 2010

Contents

Conference Participants

Participants List	1 - 1
Biographical Information.....	1 - 2

Kansas Field Conference

2010 Field Conference Overview	
“Flint Hills, Cross Timbers, and Verdigris River Valley— Water/Energy Nexus • Rangeland and Stream-Corridor Management”	2 - 1
Sponsors.....	2 - 3
Kansas Geological Survey	2 - 3
Kansas Department of Transportation	2 - 4
Kansas Department of Wildlife and Parks	2 - 4
Kansas Water Office.....	2 - 5

Wednesday, June 2

Schedule and Itinerary	3 - 1
Tallgrass Prairie National Preserve.....	3 - 3
Flint Hills National Wildlife Refuge.....	3 - 14
Proposed Flint Hills Legacy Conservation Area.....	3 - 16
An Overview of Reservoir Sedimentation.....	3 - 18
1st Battalion, 108th Aviation Information from 2009 Annual Report	3 - 20
Stream and Riparian Restoration in the Upper Neosho River Basin.....	3 - 21
Reservoir Sustainability Initiative.....	3 - 23
The Applied Science and Technology for Reservoir Assessment (ASTRA) Program of the Kansas Biological Survey	3 - 25
Wolf Creek Generating Station.....	3 - 28

Thursday, June 3

Schedule and Itinerary	4 - 1
Redevelopment of the Kansas Army Ammunition Plant	4 - 3
Base Realignment and Closure Community Profile	4 - 4
Great Plains Development Authority Newsletter (Spring 2010).....	4 - 8
Kansas Army Ammunition Plant Map of 20-year Build-out Plan	4 - 10

KDOT Project U.S. 169 North of Coffeyville	4 - 11
CVR Energy Petroleum and Nitrogen Fertilizer Production	4 - 14
Verdigris River Basin Flooding, Summer 2007	4 - 17
<i>INSERT</i> — Verdigris basin, 2007 flood	
Verdigris River Stream Corridor Stabilization Project	4 - 19

Friday, June 4

Schedule and Itinerary	5 - 1
Carbon Dioxide Sequestration	5 - 2
<i>INSERT</i> —KGS Public Information Circular 27—Geologic Sequestration of Carbon Dioxide in Kansas	
The Cross Timbers and Chautauqua Hills	5 - 4

Acknowledgments

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Kansas Field Conference

Flint Hills, Cross Timbers, and Verdigris River Valley Water/Energy Nexus • Rangeland and Stream-Corridor Management June 2–4, 2010

PARTICIPANTS

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Pat Apple, Senator, Louisburg
David Barfield, Chief Engineer, Division of Water Resources, Kansas Department of Agriculture
Larry Biles, State Forester, Kansas Forest Service
Sydney Carlin, Representative, Manhattan
Pete DeGraaf, Representative, Mulvane
Marci Francisco, Senator, Lawrence
Rocky Fund, Representative, Hoyt
Bob Grant, Representative, Cherokee
Burke Griggs, Legal Counsel, Division of Water Resources, Kansas Department of Agriculture
Mike Hayden, Secretary, Kansas Department of Wildlife and Parks
Dave Heinemann, Kansas Geological Survey Advisory Council (GSAC)
Bob Henthorne, Chief Geologist, Kansas Department of Transportation
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Mitch Holmes, Representative, St. John
Steve Irsik, Chair, Kansas Water Authority
Laura Kelly, Senator, Topeka
Annie Kuether, Representative, Topeka
Cindy Lash, Principal Analyst, Legislative Research
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Janis Lee, Senator, Kensington
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Ed Martinko, Director, Kansas Biological Survey
Peggy Mast, Representative, Emporia
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Larry Powell, Representative, Garden City
Dennis Schwartz, Member, Kansas Water Authority
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Don Steeples, Senior Vice Provost, University of Kansas
Tracy Streeter, Director, Kansas Water Office
John Strickler, Past Chairman, The Nature Conservancy, Kansas Chapter
Josh Svaty, Secretary, Kansas Department of Agriculture
Vern Swanson, Representative, Clay Center
Ruth Teichman, Senator, Stafford
Jerry Williams, Representative, Chanute

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Biographical Information

Steve Adams

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Kansas Department of Wildlife & Parks
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Responsibilities and Experience

KDWP, 1989–present
Previous: Fisheries biologist, Florida Game & Freshwater Fish Commission, 1986–89
Northeastern State University – BS, 1980
Oklahoma State University – MS, 1983

Pat Apple

Kansas Senate, 12th District
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Responsibilities and Experience

Kansas Senate 2005–present
Chairman, Utilities Committee; Member, Ways and Means, Transportation, and Ethics and Elections committees
Electrical Contractor
Kansas City, Mo. Vo-Tech – Electrician, 1981

David Barfield

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Division of Water Resources, Kansas Department of Agriculture
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Responsibilities and Experience

2007–present: Chief Engineer—directs Division of Water Resources staff over state's water resources, including four interstate compacts, more than 47,000 water rights, and the safety of thousands of dams and other water structures
1992–2007: KDA–DWR, Interstate Watch Issues Team Leader
1987–1992: KDA–DWR, Head of Dam Safety
1974–1987: KDA–DWR, Tech Services Engineer
1981–1984: Regional Engineer, Republic of Bophuthatswana, Dept. of Works and Water Affairs
1978–1981: Consulting Project Engineer, RCM Associates

University of Kansas – Civil Engineering, BS, 1978
University of Kansas – Water Resources Engineering, MS, 1991

Larry Biles

State Forester
Kansas Forest Service
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Responsibilities and Experience

Previous: Kansas Forest Service, 1970s; USDA–Forest Service, 1980s; USDA–Extension Service, 1990s & early 2000s
University of Missouri – Forestry, 1967
Kansas State University – Ornamental Horticulture, 1974

Sydney Carlin

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Responsibilities and Experience

Appropriations, Agriculture & Natural Resources Budget, Aging & Long Term Care, and Arts & Cultural Resources committees
Previous: Business owner, CFO, Carlin & Jones Career Assoc.; Agent, Kansas City Dental Care
Neosho County Community College – 1 year
Kansas State University – BS, 2000
Kansas State University, graduate school

Pete DeGraaf

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Responsibilities and Experience

Appropriations, Insurance, and Financial Institutions committees
President, Shepherd's Staff Ministries; Financial Counseling
United State Air Force Academy – BS, Behavioral Science, 1979

Marci Francisco

Senator, 2nd District
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Responsibilities and Experience

Agriculture and Natural Resources committees
Staff member of the KU Center for Sustainability
University of Kansas – B.E.D., 1973
University of Kansas – B.Arch, 1977

Rocky Fund

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Responsibilities and Experience

Agriculture & Natural Resources, Energy & Utilities,
and Federal & State Affairs committees; Rural
Water District Manager
Previous: Aircraft builder/repairman, horseshoer, art
teacher
Wichita State University – BFA, 1978

Bob Grant

Kansas House of Representatives, 2nd District
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Responsibilities and Experience

State Representative, 17 years; Commerce and
Labor, Federal and State Affairs, and Insurance
committees
Previous: 1967-1992, Kansas Army Ammunition
Plant; Catering business, bar and grill owner,
1985-2005
Southeast High School – 1966
Labette Community College – AA, 1971
Pittsburg State University

Burke Griggs

Legal Counsel
Division of Water Resources, Kansas Department of
Agriculture
109 SW 9th Street, 4th Floor
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Responsibilities and Experience

Represents DWR & Kansas in interstate water litigation
and interstate river compacts; represents DWR
in state court; advises KDA on water policy and
legislation
Previous: Assistant professor of history, Boston
College, 1997-2003; Attorney, Stevens & Brand,
LLP, Lawrence, 2006-08
Stanford University – BA, 1990
Yale University – PhD, 1998
University of Kansas Law School – JD, 2006

Mike Hayden

Secretary
Kansas Department of Wildlife & Parks
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Topeka KS 66612
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Responsibilities and Experience

Previous: Speaker of the Kansas House, 1983-87;
Governor of Kansas, 1987-1991; Assistant
Secretary of Interior for Fish, Wildlife and Parks;
President, American Sportfishing Assoc.
Kansas State University – BS, Wildlife Conservation,
1966
Ft. Hays State University – MS, Biology, 1974

Dave Heinemann

Geological Survey Advisory Council (GSAC)
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Responsibilities and Experience

Legislative representative for American Cancer
Society and Stand Up For Kansas
Previous: Special Assistant to the Secretary of
Revenue, 5 years; Executive Director, KCC, 2
years; General Counsel, KCC, 2 years; State
Representative, 27 years; Speaker Pro Tem, Kansas
House Commission, 11 years; GSAC member,
1991-2007
Augustana College – BA, 1967
University of Kansas – 1967-68
Washburn Law School – JD, 1973

Bob Henthorne

Chief Geologist
Kansas Department of Transportation
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Responsibilities and Experience

Head KDOT engineering geology section
29 years at KDOT, starting from inspector
Marysville (KS) High School
University of Kansas – BS, 1983

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Responsibilities and Experience

Chair, Energy and Utilities Committee; Chair,
Kansas Electric Transmission Authority; Member,
Agriculture & Natural Resources Budget
Committee
Farm-ranch owner-manager
University of Kansas – 1958-1960
Colorado State University – BS, 1962

Mitch Holmes

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Responsibilities and Experience

Appropriations, Federal & State Affairs, Local
Government, and Joint Environment & Energy
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Previous: Military service, ethanol production worker,
computer programmer, college instructor, sales
Hutchinson Community College – AA, 1984
Friends University – BS, 1988
DePaul University – Post-graduate certificate, 1995

Steve Irsik

Chair, Kansas Water Authority
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Responsibilities and Experience

Farmer, rancher, and agricultural business
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Economics, 1969

Laura Kelly

Kansas Senate, 18th District
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Responsibilities and Experience

Ways and Means, Judiciary, and Public Health &
Welfare committees
Previous: Director, Kansas Recreation and Park
Association, 1986-2004
Indiana University – MS, 1976
Bradley University – BS, 1971

Annie Kuether

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Responsibilities and Experience

Energy & Utilities and Judiciary committees
Webster Groves High – 1970
Bowling Green State University, Ohio

Cindy Lash

Principal Analyst
Kansas Legislative Research Department
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Responsibilities and Experience

Staff the Senate Utilities Committee, House Energy
& Utilities Committee, and Kansas Electric
Transmission Authority
Previous: Kansas Legislative Post Audit, 1983-2007;
KLRD, 2007-present
Rutgers – BA, 1975
University of Kansas, Graduate Studies

Wayne Lebsack

President
Lebsack Oil Production, Inc.
603 S. Douglas Street
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Responsibilities and Experience

General Manager, Lebsack Oil Production, Inc.;
Trustee, The Nature Conservancy, Kansas

Chapter; Chair, Kansas Preserves Stewardship Committee
Oil and gas exploration, ground-water exploration, and pollution research
Colorado School of Mines – Geol. Eng., 1949
Colorado School of Mines – Geol. Eng., 1951

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Responsibilities and Experience

22 years in Kansas Senate; Utilities, Ways & Means, Natural Resources, Agriculture, and Security committees; Kansas Electric Transmission Authority
Kansas State University – BS, Education, 1970

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Responsibilities and Experience

Oversees water planning efforts, operation of State-owned reservoir storage and agency operating
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University of Kansas – BS, 1992

Judith Loganbill

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Responsibilities and Experience

Federal & State Affairs, Education, and Government Efficiency & Fiscal Oversight committees
Reading resource teacher, Wichita
Previous: Elementary teacher
Bethel College – BS, 1975
Northern Arizona University – MA Ed, 1981

Brad Loveless

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Responsibilities and Experience

Manages environmental siting for generation and line construction, carbon planning, endangered species, avian protection, and environmental stewardship programs
Kansas Association of Conservation and Environmental Education (KACEE) Board Member
The Ohio State University – BS, Zoology, 1981
University of Kansas – MS, Biology, 1985

Ed Martinko

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Responsibilities and Experience

State Biologist and Director, Kansas Biological Survey; Professor of ecology and environmental studies; Ex officio water authority
College of Emporia – BS, 1967
University of Colorado – MA, 1970
University of Kansas – PhD, 1976

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Responsibilities and Experience

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Responsibilities and Experience

Chair, National Resources Committee: Vice Chair, Ways & Means Committee; Utilities Committee member; Chair, Joint Committee on Energy & Environmental Policy

Self-employed farmer

Previous: Sedgwick County Commissioner

Wichita State University – BBA, 1983

Friends University – MSES, 1998

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Responsibilities and Experience

Sets House calendar and floor debate; Vice Chair, Appropriations; Interstate Cooperation, and Legislative Budget committees

Previous: Sr. Vice President & General Manager, Kline Enterprises

Washburn University – BBA, 1965

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Chief of Staff for Kansas Senate Majority Leader

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Responsibilities and Experience

Photographer/Graphic Designer, Communications

Previous: City council member

University of Kansas, BS, Journalism – 1990

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Responsibilities and Experience

Agriculture & Natural Resources and Energy & Utilities committees

Ranch management and ranching

Kansas State University – BS, 1969

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Responsibilities and Experience

Vice Chair, Agriculture Committee; Federal & State Affairs, Local Government, and Joint Administrative Rules & Regulations committees

Farmer & rancher

Previous: Kansas House member; county commission;

school board member; Soil Conservation Board;

FLBA board

Grinnell High School – 1961

Fort Hays State University

Catherine Patrick

Director, Division of Operations

Kansas Department of Transportation

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Responsibilities and Experience

Responsible for coordinating annual construction and maintenance programs to ensure consistency with operational objectives

Previous: Field Engineer, Asst. Bureau Chief, construction and maintenance, Topeka/Bonner Springs Metro Engineer, Northeast Kansas District Engineer

Kansas State University – Civil Engineering, 1987

Don Paxson

Vice Chair

Kansas Water Authority

2046 U.S. Highway 24

Penokee KS 67659

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Responsibilities and Experience

Vice Chair, Kansas Water Authority and Chair of KWA Budget Committee

Paxson Electric & Irrigation for 37 years; Farming High School – 1956

Larry Powell

Kansas House of Representatives, 117th District

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Responsibilities and Experience

Chair, Agriculture and Natural Resources Committee
Rancher, environmentalist, custom cutter, machinery dealer, farmer

Garden City Community College

Kansas State University

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Responsibilities and Experience

Kansas Water Authority; Kansas Rural Water Association; Rural Water District #8 General Manager; Director, National Rural Water Association
Rural Water General Manager, 34 years; various other water & utility trade activities

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Assistant Professor of Biology
Pittsburg State University
Geological Survey Advisory Committee (GSAC) Member
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Responsibilities and Experience

2001-present: Undergraduate & graduate instructor in biology department; GSAC board; secondary education liaison
Previous: Secondary science (earth & space) teacher, Winfield, KS
Pittsburg State University – BS, Biology Education, 1990
Kansas State University – PhD, 2001

Don Steeples

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University of Kansas
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Responsibilities and Experience

Oversees KU parking, facilities, police, space management, ROTC, center for sustainability, and instructional support
Rooks County wheat farmer since 1975
Previous: KGS, 17 years; KU Geology, 17 years
Kansas State University – BS, 1969
Stanford University – MS, 1974
Stanford University – PhD, 1975

Tracy Streeter

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Responsibilities and Experience

KWO Director 2004-present; Development of Kansas Water Plan, drought management, water marketing in 13 Kansas reservoirs, and staff to Kansas Water Authority
Previous: Executive Director of SCC, 1995-2004
Highland Community College – AA, 1983
Missouri Western State University – BS, 1985
University of Kansas – MPA, 1993

John Strickler

Trustee, The Nature Conservancy, Kansas Chapter
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Responsibilities and Experience

Treasurer, KACEE (Kansas Association for Conservation and Environmental Education); Chair, Kansas Forest Service Advisory Council
Previous: Special Assistant for Environment and Natural Resources to Gov. Hayden, 2 years; Acting Secretary, Kansas Department of Wildlife and Parks, 1987 and 1995; Kansas Forest Service, KSU, 33 years; U.S. Forest Service, 4 years
University of Missouri – BS, 1957
Kansas State University – MS, 1968

Josh Svaty

Secretary
Kansas Department of Agriculture
109 SW 9th Street
Topeka KS 66612
785-296-3902
josh.svaty@kda.ks.gov

Responsibilities and Experience

Administrator for KDA regulations and policies; advocate for agriculture; work with legislature for agriculture; Family farming
Previous: Seven years as Kansas State Representative, 108th District
Sterling College – BA, 2002

Vern Swanson

Kansas House of Representatives, 64th District
1422 5th Street
Clay Center KS 67432
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Responsibilities and Experience

Energy & Utility and Transportation committees
Previous: Sales for 31 years
Emporia State University – BS, 1966

Ruth Teichman

Kansas Senate, 33rd District
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Stafford KS 67578
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Responsibilities and Experience

Chair, Financial Institutions & Insurance Committee;
Natural Resources, Ways & Means, Education, and
Joint Pension & Benefits committees
Director, Farmers National Bank
Previous: School board, 20 years; Stafford Hospital
secretary for lab & medical records; Buyer for
Pegues Department Store
Kansas State University – BS, 1965

Jerry Williams

Kansas House of Representatives, 8th District
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Chanute KS 66720
620-431-0172
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Responsibilities and Experience

Appropriations, Agriculture & Natural Resources
Budget, and Aging & Long Term Care committees
Previous: Education, aging social services, and
farming/ranching
Southeastern Oklahoma State University (Durant,
Okla.) – BS/MS, 1964/1966
Emporia State University – ED S, 1971
Wichita State University – MS S, Gerontology – 1985

Kansas Geological Survey Staff**Rex Buchanan**

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Responsibilities and Experience

Interim Director; Supervises publication and public
outreach activities, media relations, and non-
technical communications
Kansas Geological Survey, 32 years; University-
Industry Research, University of Wisconsin, 3
years; Salina Journal, 4 years
Kansas Wesleyan University – BA, 1975
University of Wisconsin–Madison – MA, 1978
University of Wisconsin–Madison – MS, 1982

Cathy Evans

Information Writer and Editor
Outreach and Public Service
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Responsibilities and Experience

Write news releases and educational materials; edit
publications; assist with field conference and
guidebook
Previous: University Press of Kansas; Spencer
Museum of Art
University of Kansas – BA, 1978
University of Kansas – MS, 1990

Shane Lyle

Senior Research Assistant
Geology Extension
Kansas Geological Survey
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Responsibilities and Experience

Geology Extension Coordinator; Kansas Field
Conference

Kansas Geological Survey, 4 years
Previous: Environmental and Engineering Geology,
12 years
Kansas State University – BS, 1993

Bob Sawin

Senior Research Associate
Geology Extension/Stratigraphic Research
Kansas Geological Survey
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Responsibilities and Experience

Geology Extension; Kansas Field Conference;
geologic mapping
Kansas Geological Survey, 18 years; Petroleum
Geology, 15 years; Engineering Geology, 6 years
Kansas State University – BS, 1972
Kansas State University – MS, 1977

**Flint Hills, Cross Timbers, and Verdigris River Valley
Water/Energy Nexus • Rangeland and Stream-Corridor Management**

June 2–4, 2010

Welcome to the 2010 Field Conference, co-sponsored by the Kansas Geological Survey (a division of the University of Kansas), the Kansas Water Office, the Kansas Department of Transportation, and the Kansas Department of Wildlife and Parks. Previous Field Conferences have focused on specific topics, such as energy or water, or specific regions of the state. This year's Field Conference is centered on the connection between water and energy issues. While it's possible to consider water and energy separately, the connection between the two is critical, and central to the understanding of each. Increased energy use results in increased water use; the demand for additional water can curtail energy availability. We'll discuss these issues, as well as others that are critical to the part of east-central Kansas that we'll be traveling through. The result should be a better understanding of the state's water and energy issues, and a better understanding of this part of the state.

Day 1

We'll begin and end this year's Field Conference in Emporia, on the edge of the Flint Hills. In fact, our first stop will be at one of the icons of the Kansas Flint Hills: the Tallgrass Prairie National Preserve, north of Strong City. This will serve not only as an opportunity to see the Flint Hills and the preserve, but it will double as an opportunity to discuss range management, burning, and air-quality issues, which have become increasingly important here. After lunch at the ranch, we'll head east through the Osage Cuestas physiographic region (which, in many areas, looks fairly similar to the Flint Hills). After driving through the Flint Hills National Wildlife Refuge on the upper end of John Redmond Reservoir, we'll head to the Coffey County Lake north of Burlington, home to the state's only nuclear electrical-generating plant. We'll use this location to learn about issues related to streambank stabilization in the Neosho River, sedimentation of Kansas reservoirs (and a study of the reservoir bottoms by the Kansas Biological Survey), the connection between nuclear power and water, and the economics associated with nuclear power plants.

From Wolf Creek we'll head south, driving just east of a location known as Rose Dome, a feature known in geology as an "intrusive." This is where a pipe of igneous rock forced its way to the surface, through existing rock, about 100 million years ago. It is somewhat similar to a volcano, though it never extruded lava at the earth's surface. Instead, it lifted up the topography in a circular feature and left igneous rock (unusual in Kansas) at the surface. At Wilson County State Park we'll talk about a bridge relocation project; Kansas Department of Transportation (KDOT) staff will talk about the geology and geotechnical investigation required to relocate a bridge. From here, it's on to Chanute for the evening.

Day 2

We'll begin the second day by continuing southeast to Parsons (birthplace of movie star Zasu Pitts; nearby Cherryvale is the home town of Vivian Vance, of "I Love Lucy" fame, and silent film star Louise Brooks). We'll visit the Kansas Army Ammunition Plant. This facility was opened in World War II and produced ammunition for that war, along with the Korean, Vietnam, and Gulf wars. It was recommended for closure by the Base Relocation and Closure Commission in 2005, and one of the parcels is being transferred to the Kansas Department of Wildlife and Parks. We'll learn about their plans for the land. From here it's south to Coffeyville, where we'll spend a portion of the morning looking at KDOT construction projects on the east side of town, have lunch at the Brown Mansion, then tour the local refinery. Refineries are a major source of carbon dioxide, a prominent greenhouse gas. This stop will set the stage for a discussion of carbon dioxide capture and storage later in the trip. As we travel north, we'll also discuss the flooding that affected Coffeyville in the summer of 2007, and floodplain-management issues. We'll look at a stream-corridor stabilization project that was initiated in response to flooding in the Verdigris River.

From here we'll head back to the north, discuss wind-farm site-selection issues, then spend the evening

at Flint Oak, a lodge and hunting facility. In spite of its name, the facility is not in the Flint Hills, but instead is on the edge of the Chautauqua Hills physiographic region, an area of Pennsylvanian-aged sandstone hills that crop out from north to south in southeast Kansas. These hills are characterized by a vegetative pattern of tallgrass prairie and hardwood forest that is known as the Cross Timbers (thus the title for this year's trip). You'll have time to see the lodge and wander the grounds before supper.

Day 3

After breakfast at Flint Oak, we'll convene for a discussion of geologic sequestration of carbon dioxide (or CO₂) in Kansas. Deep injection of CO₂, either to produce additional oil through enhanced production or to store it even deeper in formations that only hold saline water, is an area of considerable research in the country, and in Kansas. With its thick sedimentary rocks and subsurface geology well understood from years of oil and gas exploration, Kansas could be at the forefront of sequestration. We'll learn about the national picture for CO₂ sequestration, then discuss current research projects in CO₂ sequestration in Kansas and the regulatory issues they pose. After that, with Flint Oak serving as a model, we'll discuss the potential for additional ecotourism in Kansas.

From here it's east to the Cross Timbers State Park. This is an ideal location to see the thick sandstones that form the basis of the Chautauqua Hills, to discuss the type of vegetation that characterizes the Chautauqua Hills, and to see the old growths of oaks and other trees that make up the forest here. The park also provides access to Toronto Lake, and will serve as a fitting end to our discussions of the connection between water and energy, and the way they are used by the people of Kansas.

About the Kansas Field Conference

Some issues are best understood by seeing them firsthand. The 2010 Field Conference marks the 16th year the Kansas Geological Survey (KGS) has worked with co-sponsors to give policymakers the opportunity to see and experience some of the natural-resource issues with which they grapple. Participants have been selected to provide a range of legislative, government, education, and private-business expertise. Local and regional experts in natural-resource issues will meet us at each site and describe the location and the issues related to

it. The objective is to let participants see the results of their decisions and to talk with local, State, and Federal governmental officials, environmental groups, business people, and citizens' organizations. The result should give participants a broader, more-informed perspective useful in formulating policies. In addition, the Field Guide you are holding provides background on sites and issues and serves as a handy reference long after the Field Conference is over.

During the Field Conference, participants are expected to be just that—participants. We want you to contribute to the discussion, to ask questions, and to otherwise join in on deliberations. **The bus microphone is open to everyone, and we encourage everyone to participate.**

Please remember that in the course of the Field Conference, we do not seek to resolve policy or regulatory conflicts. We do try to provide opportunities to familiarize policymakers with resource problems. By bringing together experts on energy and water, we hope to go beyond merely identifying issues. We want this combination of first-hand experience and interaction among participants to result in a new level of understanding of the state's natural-resources.

In doing this, we attempt to present, as nearly as possible, all sides of contentious issues. Please know that the opinions presented during the Field Conference are not necessarily those of the KGS or Field Conference co-sponsors. Nonetheless, we do believe it is important for participants to hear various viewpoints on complex topics.

The Kansas Field Conference is an outreach program of the KGS, administered through its Geology Extension program. Its mission is to provide educational opportunities to individuals who make and influence policy about natural-resource and related social, economic, and environmental issues in Kansas. The KGS's Geology Extension program is designed to develop materials, projects, and services that communicate information about the geology of Kansas, the state's natural resources, and the products of the KGS to the people of the state.

The Field Conference was begun in 1995 with the support of Lee Gerhard, then the Survey's director and state geologist. It is modeled after a similar program of national scope, the Energy and Minerals Field Institute, operated by the Colorado School of Mines. The KGS

appreciates the support of Erling Brostuen, retired Director of the Energy and Minerals Field Institute, in helping develop the Kansas project.

The KGS Field Conference has been recognized by

- The National Institute of Standards and Technology as among 50 Best Practices for Communication of Science and Technology for the Public, 2001; and
- The Division of Environmental Geosciences of the American Association of Petroleum Geologists, which presented the Field Conference with its Public Outreach Award in 1998.

The KGS appreciates your attendance at this year's Field Conference and your willingness to share your insights for its improvements. Your input has helped make the Field Conference a model that has been adopted by other state geological surveys.

Sponsors

Kansas Geological Survey

Since 1889, the Kansas Geological Survey (KGS) has studied and reported on the state's geology. Today the KGS mission is to study and provide information about the state's geologic resources and hazards, particularly ground water, oil, natural gas, and other minerals. In many cases, the Survey's work coincides with the state's most pressing natural-resource issues.

By statutory charge, the KGS role is strictly one of research and reporting. The KGS has no regulatory function. It is a division of the University of Kansas. The KGS employs more than 65 scientific researchers and technical staff and 25 graduate research assistants and hourly student employees. It is administratively divided into research and research-support sections. KGS programs can be divided by subject into water, energy, geology, and information dissemination.

Water—Water issues affect the life of every Kansan. Western Kansas agriculture and industry rely heavily on ground water; in eastern Kansas, growing populations and industry generally use surface water. KGS water research and service include an annual water-level-measurement program (in cooperation with the Kansas Department of Agriculture, Division of Water Resources); modeling the impact of regulatory

decisions; studies of recharge rates, phreatophytes, and water quality in the Arkansas River; depletion of the Ogallala aquifer; the interaction between streams and aquifers; and other topics. Much of that work is done with funding from the Kansas Water Plan. The Survey also collects, archives, and disseminates water-well logs in cooperation with the Kansas Department of Health and Environment.

Energy—Kansas produced more than \$6 billion worth of oil and natural gas last year. Because much of the state has long been explored for oil and gas, maintaining that production takes research and information. The KGS does research on the state's petroleum reservoirs, new methods of providing information, and new methods of exploring for and producing oil and gas. The KGS recently completed a multi-year study of the resources of the Hugoton Natural Gas Area, a study that resulted in the drilling of a substantial number of additional wells. Researchers are also characterizing the subsurface for possible sequestration of carbon dioxide. Unconventional natural gas, such as coalbed methane or low-BTU gas, is also a focus of ongoing research. The KGS works with the Kansas Corporation Commission to enable online reporting of oil and gas information, and has a branch office in Wichita, the Wichita Well Sample Library, that stores and loans rock samples collected during the drilling of oil and gas wells in the state. Much of the KGS energy research is funded by the U.S. Department of Energy.

Geology—Much of the KGS's work is aimed at producing basic information about the state's geology, information that can be applied to a variety of resource and environmental issues. The KGS develops and applies methods to study the subsurface, such as high-resolution seismic reflection; undertakes mapping of the surficial geology of the state's counties; and studies specific resources, such as road and highway materials. The KGS reports on nonfuel minerals (salt, gypsum, aggregates, etc.) and is charged with studying geologic hazards, including subsidence, earthquakes, and landslides. Much of this work is funded through the U.S. Geological Survey, the U.S. Army Corps of Engineers, and the U.S. Department of Defense.

Geologic Information—To be useful, geologic information must be disseminated in a form that is most appropriate to the people who need it. The KGS provides information to the general public, policymakers, oil and gas explorationists, water specialists, other governmental agencies, and academic specialists. Information

is disseminated through a publication sales office, automated mapping, the state's Data Access and Support Center (DASC; located at the KGS), a data library, electronic publication, the KGS web site, and Geology Extension.

KGS staff participating in the 2010 Field Conference include the following:

Shane Lyle, Senior Research Assistant, Geology Extension

Cathy Evans, Writer/Editor, Public Outreach

Bob Sawin, Senior Research Associate, Public Outreach/
Stratigraphic Research

Rex Buchanan, Interim Director

Kansas Geological Survey
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785-864-5317 (fax)
www.kgs.ku.edu

Kansas Department of Transportation

The Kansas Department of Transportation (KDOT) was founded in 1917. It is charged with providing a statewide transportation system to meet the needs of Kansans. Its primary activities are road and bridge maintenance; transportation planning, data collection, and evaluation; project scoping, designing, and letting; contract compliance inspection of material and labor; Federal program funding administration; and administrative support. In addition to dealing with roadways for automobile traffic, KDOT is responsible for other modes of transportation, including aviation, rail, and bicycles/pedestrians. The Department has more than 3,000 employees. KDOT's headquarters are in Topeka with six district offices, 26 area offices, and 112 sub-area offices across the state. KDOT is responsible for maintenance of about 9,600 miles of highway.

The agency is organized into divisions of public affairs, administration, aviation, engineering and design, operations, and planning and development. Within the Division of Operations is the Bureau of Materials and Research. This Bureau is responsible for approved materials, pavement management, testing, and research. Within that Bureau is a geotechnical unit that includes a geology section. That section supplies information and recommendations regarding surface and foundation geology, hydrology, and bridge-deck conditions to the Bureau of Design for project-plan preparation;

conducts special surveys on selected subjects such as soil shrinkage, rock expansion, and pile-foundation requirements; and constructs new water wells in rest areas and rehabilitates and maintains existing wells for all KDOT facilities. Robert Henthorne is the chief geologist within the unit.

Because the State's ten-year Comprehensive Transportation Program ended in 2009, Governor Kathleen Sebelius created a task force to examine transportation in Kansas and develop recommendations. That 35-member task force made recommendations that were aimed at keeping roads and bridges safe and in good repair, developing new business models, and working within today's current fiscal realities. In early 2009, Kansas received about \$378 million from the American Recovery and Reinvestment Act of 2009, or so-called stimulus funding. Five State highway projects were targeted for use of that money, including improvements to U.S. 69 in Overland Park, I-135 and 47th Street in Wichita, K-23 in Gove County, K-61 in McPherson County, and K-18 between Ogden and Manhattan. In addition, some money will go to local jurisdictions and public transportation.

Major accomplishments in 2009 include the completion of the four-lane freeway of U.S. Highway 69 between Louisburg and Fort Scott, implementation of the Intelligent Transportation System in Wichita, launching of an online community for transportation professionals, and awards from the American Society of Civil Engineers and the Associated General Contractors of America. The current Secretary of the Kansas Department of Transportation is Deb Miller, the first female director in the agency's history.

Kansas Department of Transportation
Dwight D. Eisenhower State Office Building
700 S.W. Harrison Street
Topeka, KS 66603-3754
785-296-3566
785-296-0287 (fax)
www.ksdot.org

Source: 2010 Annual Report, Kansas Department of Transportation.

Kansas Department of Wildlife and Parks

The Kansas Department of Wildlife and Parks is responsible for management of the state's living natural resources. Its mission is to conserve and enhance Kansas' natural heritage, its wildlife, and its habitats.

The Department works to assure future generations the benefits of the state's diverse living resources; to provide the public with opportunities for the use and appreciation of the natural resources of Kansas, consistent with the conservation of those resources; and to inform the public of the status of the natural resources of Kansas to promote understanding and gain assistance in achieving this mission.

The Department's responsibility includes protecting and conserving fish and wildlife and their associated habitats while providing for the wise use of these resources, and providing associated recreational opportunities. The Department is also responsible for providing public outdoor-recreation opportunities through the system of State parks, State fishing lakes, wildlife-management areas, and recreational boating on all public waters of the state.

In 1987, two State agencies, the Kansas Fish and Game Commission and the Kansas Park and Resources Authority, were combined into a single, cabinet-level agency operated under separate comprehensive planning systems. The Department operates from offices in Pratt, Topeka, five regional offices, and a number of State park and wildlife area offices. The Department employs about 420 people in five divisions: Executive Services, Administrative Services, Fisheries and Wildlife, Law Enforcement, and Parks.

A cabinet-level agency, the Department of Wildlife and Parks is administered by a Secretary of Wildlife and Parks and is advised by a seven-member Wildlife and Parks Commission. All positions are appointed by the Governor with the Commissioners serving staggered four-year terms. As a regulatory body for the Department, the Commission is a nonpartisan board, made up of no more than four members of any one political party, advising the Secretary on planning and policy issues regarding administration of the Department. Regulations approved by the Commission are adopted and administered by the Secretary. Mike Hayden is the Secretary of Wildlife and Parks.

Kansas Department of Wildlife and Parks
Secretary
Landon State Office Building
1020 S. Kansas Avenue
Topeka, KS 66612-1327
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Kansas Department of Wildlife and Parks
Operations Office
512 SE 25th Avenue
Pratt, KS 67124-8174
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620-672-6020 (fax)

Kansas Water Office

The mission of the Kansas Water Office (KWO) is to provide the leadership to ensure that water policies and programs address the needs of all Kansans. The KWO evaluates and develops public policies, coordinating the water-resource operations of agencies at all levels of government. The KWO administers the Kansas Water Plan Storage Act, the Kansas Weather Modification Act, and the Water Assurance Act. It also reviews plans of any State or local agency for the management of water and related land resources in the state. The KWO advises the Governor on drought conditions and coordinates the Governor's drought-response team. The Drought Monitoring Program collects climate data from a variety of sources, monitors drought activities, and publishes a weekly Drought Report during periods of drought.

The KWO develops the Kansas Water Plan, which is revised periodically and addresses the management, conservation, and development of water resources in the state. Numerous water-related public and private entities, as well as the general public, are involved in its preparation and planning. The Water Plan is approved by the Kansas Water Authority, a 13-member board whose members are appointed, along with 11 nonvoting *ex officio* members who represent various State water-related agencies. Besides approving the Water Plan, the Authority approves water-storage sales, Federal contracts, administrative regulations, and legislation proposed by the KWO. Much of the input for the Water Plan comes from 12 Basin Advisory committees composed of volunteer members from each of the state's drainage basins. During this year's Field Conference, we will be in the Verdigris and Neosho basins.

Current programs and projects at the KWO include

- Public water-supply system GIS mapping assistance
- The Upper Arkansas River Conservation Reserve Enhancement Program
- Reservoir sustainability initiative
- Watershed unit projects
- Water planning

- Water conservation
- Water conservation education
- Water assurance
- Drought monitoring
- Water marketing
- Weather modification

Tracy Streeter is the Director of the KWO.

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Topeka, KS 66612-1249
785-296-3185
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Schedule and Itinerary

Wednesday, June 2, 2010

- 6:00 a.m. Breakfast at Montana Mike's Steakhouse adjacent to Holiday Inn Express and Fairfield Inn
- 7:15 a.m. Conference Overview
Rex Buchanan, Interim Director, Kansas Geological Survey
- 8:00 a.m. **Bus leaves Fairfield Inn and Holiday Inn Express for Site 1**
- 8:30 a.m. **SITE 1 • Tallgrass Prairie National Preserve, Strong City**
Wendy Lauritzen, TPNP Superintendant, U.S. Dept. of the Interior, National Park Service
Allan Polom, Director, The Nature Conservancy, Kansas Chapter
Brian Obermeyer, The Nature Conservancy
Rep. Tom Moxley, 18th District
Bob Sawin, Kansas Geological Survey
Tom Gross, Kansas Department of Health and Environment
Larry Biles, Kansas Forest Service
- 11:00 a.m. Lunch at Tallgrass Prairie National Preserve
- 12:00 p.m. Bus to Site 2
- Bus Session – Eastern Kansas Water Supply
David Barfield, Chief Engineer, Kansas Department of Agriculture, Division of Water Resources
- 12:45 p.m. **SITE 2 • Flint Hills National Wildlife Refuge, Neosho Rapids**
Vic Elam, Refuge Manager, U.S. Fish and Wildlife Service
- 1:05 p.m. Bus to Site 3
- 1:30 p.m. **SITE 3 • Coffey County State Lake**
Reservoir Sedimentation
Earl Lewis, Assistant Director, Kansas Water Office
Susan Metzger, Manager/KWO Watershed Unit
Lt. Col. David Leger, 1st Battalion, 108th Aviation Regiment, Kansas Army National Guard
- Reservoir Bathymetry
Mark Jakubauskas, Research Associate Professor, Kansas Biological Survey
Frank (Jerry) deNoyelles, Deputy Director, Kansas Biological Survey
- Water Use in Nuclear Power Generation
Matt Sunseri, President, Wolf Creek Nuclear Operating Corporation
- 3:40 p.m. Bus to Site 4

- 3:45 p.m. **SITE 4 •** Dwight D. Eisenhower Learning Center, Wolf Creek Generating Station
Economics of Nuclear Expansion
Mark Ruelle, Executive Vice President and Chief Financial Officer, Westar Energy
- 4:30 p.m. Bus to Motel
- Bus Session – Geotechnical Bridge Design Investigation
Bob Henthorne, Chief Geologist, Kansas Department of Transportation
- 5:30 p.m. Arrive at Tioga Suites Hotel
- 5:40 p.m. Bus to Super 8 Motel
- 5:45 p.m. Arrive at Super 8 Motel
- 6:20 p.m. Bus to Dinner at Tioga Suites Hotel
- 6:30 p.m. Social Gathering at Tioga Suites Hotel
- 7:00 p.m. Supper at Tioga Suites Hotel
- 8:00 p.m. Bus to Super 8 Motel

Tallgrass Prairie National Preserve

The Tallgrass Prairie National Preserve, established in 1996, consists of 10,894 acres in Chase County (fig. 1). The preserve is found on both the east and west sides of Kansas Highway 177 just north of Strong City. The ranch headquarters and barn are located about 2.5 miles north of U.S. Highway 50. Fox Creek drains a portion of the preserve east of the highway, while Palmer Creek cuts through the preserve's extreme north end. Except for the riparian zones along the creeks and a small amount of bottom ground along Fox Creek that has been cultivated (today it is primarily in brome grass), the preserve is native prairie.

History

Native American trails cut through the preserve and some evidence of prehistoric activity has been found here, though archeological investigations are not complete. The oldest homestead here was established in 1860 just east of today's ranch headquarters. In the 1870s, Stephen F. Jones moved to

Chase County and established a large-scale livestock ranch in the area now covered by the preserve. Jones named his property the Spring Hill Ranch, for springs that issued in the hill just west of the headquarters, and in 1881 built a three-story mansion in the "Second Empire" style of nineteenth-century architecture (fig. 2). He then added a three-story barn and other outbuildings. Jones also donated the land for the Fox Creek School, about one-half mile north of the headquarters.

Jones eventually moved to Kansas City in 1888 and sold the ranch to Barney Lantry, a Strong City rancher. In 1906, Lantry sold it to a ranching outfit headquartered in the Red Hills of southwestern Kansas whose brand was Z—, and the ranch is often referred to as the Z Bar to this day.

Efforts began as early as the 1960s to establish a national park of some sort in the Flint Hills as a way to preserve and provide public access to a part of the tallgrass prairie. However, local opposition to the

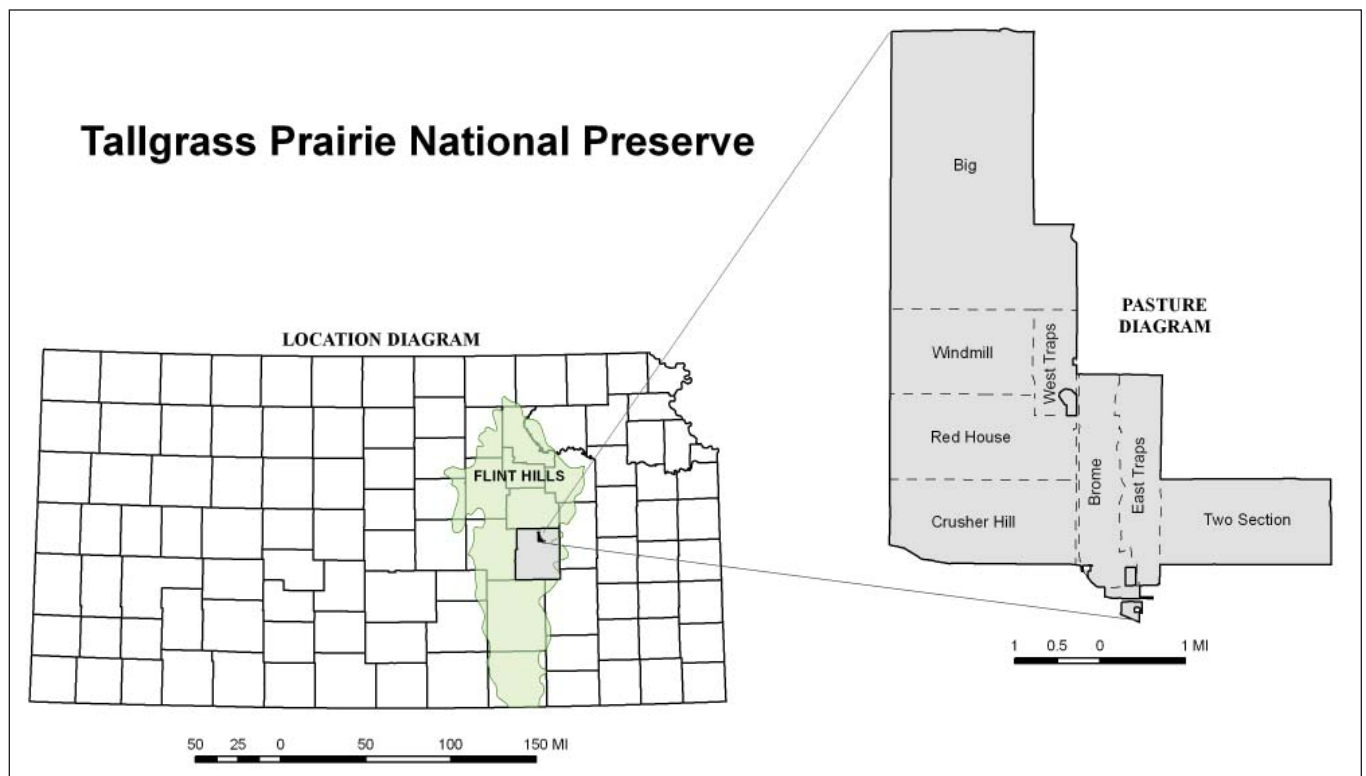


Figure 1. Location of Tallgrass Prairie National Preserve in Chase County, Kansas (map by Cartographic Services, Kansas Geological Survey).



Figure 2. House built in 1881 by Stephen F. Jones at the entrance to the Tallgrass Prairie National Preserve on U.S. 177 north of Strong City (photograph by Robert Sawin).

Federal government, and the possible removal of the land from production and the tax roles, thwarted any action until 1989 when the Audubon Society bought an option on the Z Bar. In 1991, through the efforts of the Kansas Congressional delegation (led by Senator Nancy Kassebaum Baker), the National Park Service, the National Park Trust, and citizen leaders, the National Park Service formally identified the ranch as the best candidate for a “tallgrass prairie” national park. In 1994, the land was purchased by the National Park Trust, a private land conservancy organization dedicated to saving parklands and resources.

On November 12, 1996, Congress passed legislation creating the Tallgrass Prairie National Preserve. The preserve is the only unit in the national park system that is dedicated to the tallgrass prairie ecosystem. Because of concern about the level of Federal involvement, the legislation restricted National Park Service ownership of land to no more than 180 acres. The Park Service was to work cooperatively with the private National Park Trust in operating the preserve, an arrangement that Senator Nancy Kassebaum Baker described as “a model for the nation.” In 2002, the National Park Trust donated 32 acres to the Park Service; that area includes the

ranch headquarters, barn, schoolhouse, and other outbuildings.

In 2005, The Nature Conservancy purchased the National Park Trust’s interest in the preserve. Since then, The Nature Conservancy has been able to retire the land debt, retire a pre-paid 35-year grazing lease, and reacquire the mineral rights. Though the preserve is owned and operated jointly by the National Park Service and The Nature Conservancy, the land is still leased privately for cattle grazing and the preserve is still very much a working ranch (fig. 3).

Unique Partnership

The Nature Conservancy, the National Park Service, and the Kansas Park Trust have created a unique partnership (the only public-private partnership of its kind in the United States) to manage the preserve and educate the public about the Tallgrass Prairie National Preserve.

- The Nature Conservancy owns the land, pays the taxes, manages the grazing leases, and collaborates with the National Park Service on overall natural resource plans.



Figure 3. Cattle on the Tallgrass Prairie National Preserve (photograph by Robert Sawin).

- The National Park Service operates the preserve for visitors and offers tours, hiking, and a variety of other opportunities for public access to the land.
- The Kansas Park Trust promotes and develops tourism opportunities, assists in private fundraising efforts and special public events, and operates the on-site bookstore and gift shop.

Geology

The preserve is entirely in the Flint Hills physiographic region, and the bedrock geology (alternating layers of limestone and shale) is typical of the Flint Hills (fig. 4). These rocks are Permian in age and the sediments that formed them were deposited in fluctuating shallow seas that covered the region about 290 million years ago. Alternating beds of limestone and shale give the hillsides a steplike appearance. The limestones form the hillside benches; the shales form the steep slopes between the benches.

Flint is the region's name for chert, a hard, erosion-resistant silicious rock similar to quartz that occurs in some of the limestones. These layers and

nodules of chert differentiate the geology in the Flint Hills from the rest of Kansas. Because of the chert, shallow soils, rocky surfaces, and steep hillsides, much of this region has been left in native grass.

The highest hills on the preserve are capped by the Florence limestone, a rubbly rock layer composed of limestone and chert. The Threemile and Schroyer limestones also contain some fairly thick layers of chert. The Threemile forms the flat-topped hills that are common on the preserve, while the highest hills capped by the Florence are more rounded. Other limestones may contain minor amounts of chert, but the Florence, Schroyer, and Threemile are the major chert-bearing units.

Other interesting units include the Funston Limestone (named after a military camp at nearby Fort Riley), which was used in the construction of many of the property's rock fences and the walls of the barn. The Eiss limestone is a vuggy rock that is the source of water for some of the property's more persistent springs. Toward the bottom of the geologic section is the Cottonwood limestone, a rock unit named after Cottonwood Falls. The Cottonwood is a common building stone; the preserve's ranch house

and other buildings, the Chase County courthouse in Cottonwood Falls, and even the State Capitol in Topeka include Cottonwood limestone in their construction, and the rock is still quarried for building stone today.

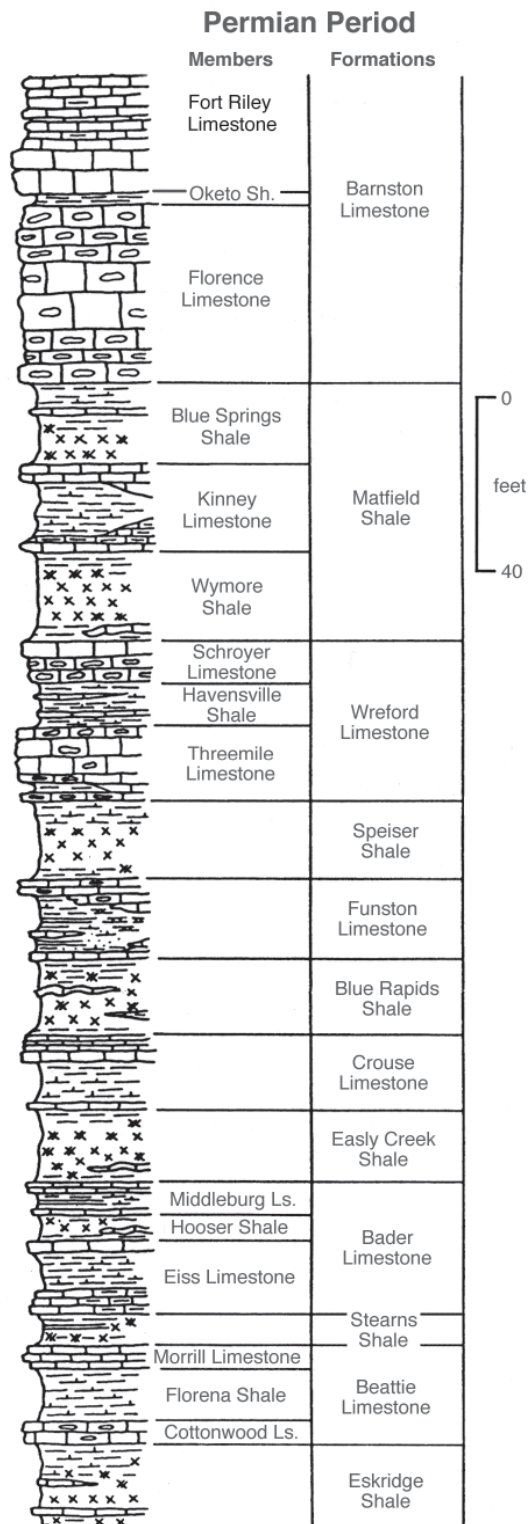


Figure 4. Idealized section of the rock units at Tallgrass Prairie National Preserve.

Many of these limestones contain invertebrate fossils typical of Permian rocks. The Cottonwood, for example, is typified by fusulinids—single-celled ocean-going animals shaped like a grain of wheat. Brachiopods (fig. 5), clams, snails, bryozoans, and crinoids (a distant relative of the starfish) are common in several of the other units, and even an occasional trilobite will turn up.

The Kansas Geological Survey conducted a survey of springs on the property, identifying 237 springs and seeps (fig. 6). Many of these are “wet-weather” springs that dry up during the summer. The Survey also developed a geologic map of the preserve and a companion map that shows the water-bearing rock formations and springs. An interactive electronic version of the geologic map has been developed through a partnership between the Kansas Geological Survey and National Park Service. It can be viewed at <http://geportal.kgs.ku.edu/tallgrass>.

Prairie Ecology

Less than 4% of North America’s presettlement tallgrass prairie survives today, and much of that is located in the Flint Hills of Kansas. Because so much of this area remains uncultivated, it is today one of the largest expanses of tallgrass prairie remaining in North America.



Figure 5. Brachiopod fossils are common in limestone at the Tallgrass Prairie National Preserve (photo by Robert Sawin).

These hills provide a home to a variety of animals. Twenty-three species of fish and 97 invertebrate species have been collected on the preserve. Several of the watersheds are home to a rare and endangered minnow, the Topeka shiner, as well as

more common fish and turtles. Twenty-eight species of amphibian and 53 species of reptiles have been found on the preserve. Eastern collared lizards (fig. 7), bright green and yellow and sometimes as long as 12 inches, are often seen on rocky outcrops. One-



Figure 6. Spring along Palmer Creek (photo by Robert Sawin).



Figure 7. Eastern collared lizard. (photo by Robert Sawin).

hundred-and-fifty bird species live here or migrate through, including Henslow's sparrow, eastern meadowlark, prairie plover, and various hawks and waterfowl. Great blue herons have a rookery on Fox Creek east of the ranch headquarters. Greater prairie chickens have booming grounds (or leks) on the preserve and are increasing in numbers. Thirty-one species of mammals are found on the preserve. Some large mammals are seen fairly regularly, including whitetail deer, coyotes, possums, raccoons, skunks, and bobcats. Bison, bears, antelope, and elk were common here once; they no longer roam the hills, though bison were recently reintroduced to one pasture on the preserve.

The plants of the preserve (over 400 species) are typical of the Flint Hills. This is tallgrass prairie, characterized by grasses such as big bluestem, little bluestem, Indian grass, switch grass, and others. However, other grasses typical of midgrass or shortgrass prairie, such as buffalo grass, are also present here, as is prickly pear cactus. The big bluestem is probably the most noticeable grass. If allowed to, it will grow to 8 feet in height.

A number of flowering plants also characterize this prairie. In the spring, blue false indigo, wild alfalfa (fig. 8), lead plant (fig. 9), and various coneflowers give the prairie a purple tint. In the



Figure 8. Wild alfalfa blossoms in the spring on the tallgrass prairie (photo by Robert Sawin).



Figure 9 (left). Lead plant also flowers in the spring (photo by Robert Sawin).

summer, butterfly milkweed, with its orange blossoms, is common. Around the springs and seeps of the preserve, watercress (fig. 10), cardinal flower (fig. 11), and bright yellow beggar ticks (fig. 12) are

found. In the fall, the yellow of broomweed covers many of the hills, particularly in places where soils are thin or pastures have been overgrazed.



Figure 10. Watercress grows in the water flowing from Red House Spring (upper), which is a developed spring in the Crouse Limestone (lower).



Figure 11. Cardinal flower and yellow beggar tick grow around springs and seeps (photo by Robert Sawin).



Figure 12. Beggar tick in September (photo by Robert Sawin).

The tallgrass prairie root systems reach down 15 to 25 feet into the soil, surviving fire, drought, and the changing environment. In dry periods prairie plants go dormant, conserving energy for regrowth when rain penetrates the soil. Nematodes and other animals help keep the prairie healthy by turning and aerating the

soil through their normal life functions of digestion and burrowing.

At the north end of the preserve near Palmer Creek, and in the Fox Creek valley, riparian vegetation, including oak, hackberry, sycamore, and cottonwood, is common.

Ranching

Cattle have now taken on the ecological role that bison historically fulfilled, though studies at the Konza Prairie show that prairies had a somewhat greater diversity of plant species when grazed by bison as compared to cattle. (However, species diversity is greater in areas grazed by cattle than in areas not grazed at all.) Historically, ranchers put cattle onto their pastures in early May and took them off in October.

Today, many ranchers use a method called early intensive grazing in which they double the typical stocking rate. They put the cattle on pastures in late April or early May, then begin taking them off in July so that their pastures are empty by August. By then the dry weather of summer has reduced the growth of the prairie grasses and they have far less nutritional value than they do in the spring. Because of the high quality of Flint Hills grass, the cattle generally make substantial weight gains, as much as two pounds per day. The cattle are usually taken to feedlots, where they are fattened (also known as finishing) on grain rations, before being shipped to slaughterhouses.

The pastures used for early intensive grazing are burned every spring, usually in mid-March to early April (fig. 13). Burning creates a black surface on the pastures that causes the ground to warm up more quickly, and thus encourages the growth of green grass for the cattle (fig. 14). It also helps control the brushy, less desirable vegetation. Annual burning of these grasses is a relatively recent practice, generally associated with settlement by ranchers; however, the prairie burned every few years even before Europeans arrived, either through lightning fires or those set by Natives.

Burn Management

North American prairies developed under the influence of fire and grazing. This history of fire and grazing provided disturbances that enabled grasses and herbaceous forbs to dominate the landscape. Native wildlife have adapted to these forces of nature, with some species preferring recently burned areas and others relying on relatively undisturbed habitat with dense vegetation and litter. Others have adapted to require both types of habitat to complete different activities within their lifecycles (the greater prairie chicken is a good example).



Figure 13. Pastures are burned in early spring (photo by Eva Horne).

Fire and grazing are used at the Tallgrass Prairie National Preserve as a key element of natural resource management. A fundamental management goal at the preserve is to create more natural patterns of burning and grazing, reflected in a shifting mosaic of burned and unburned, grazed and ungrazed areas. The result is a landscape more diverse in terms of plant composition and structure.

One grassland management practice gaining favor among biologists, ecologists, and range managers is patch-burn grazing. This fire-induced regime approximates the natural interaction between fire and native grazers. Typically, one-third of each patch-burn grazing pasture is burned every year on a three-year rotational basis.

Fire affects grazing patterns, and grazing patterns affect the extent and intensity of fire. Grazing animals preferentially feed in recently burned areas for foraging because the post-fire new plant growth is more palatable. When only a portion of a large pasture is burned, grazers prefer foraging in burned

patches and avoid grazing in the unburned patches. The accumulation of vegetation in these unburned areas creates fuel for fires in subsequent years. This burn regime also provides larger fuel loads, resulting in more intense burns that may help to control trees and shrubs from encroaching on the prairie. This technique may also prove effective in invasive plant control.

The interaction of these disturbances produces a shifting mosaic of plant communities within grazed grasslands. Experts believe that similar fire-grazing interactions helped shape the pre-settlement ecology of the Great Plains and other grasslands that had large grazers and a long history of fire.

On the Tallgrass Prairie National Preserve, The Nature Conservancy and the National Park Service work in close cooperation with its cattle-grazing lessee to implement patch-burn grazing on about 3,800 acres in the northwestern portion of the preserve. Long-term monitoring will help managers determine if management practices are having the desired results.



Figure 14. Blackened pasture before regrowth in spring (photo by Robert Sawin).

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Flint Hills National Wildlife Refuge

The Flint Hills National Wildlife Refuge lies in the upstream portion of John Redmond Reservoir. It is located in the broad, flat Neosho River valley, a native tallgrass prairie region with natural scenic beauty and noted for its diverse habitats: wetlands, croplands, forests, and tallgrass prairie.

The Refuge was established in 1966 as part of the U.S. Army Corps of Engineers John Redmond Reservoir flood control project. The U.S. Fish and Wildlife Service (USFWS) manages approximately 18,500 acres owned by the U.S. Army Corps of Engineers. Refuge habitats are managed to provide food and habitat for migratory birds and resident wildlife. The Refuge is one in a network of more than 500 refuges administered by the USFWS.

Wildlife Habitat

Managed primarily for migratory waterfowl and resident and other migratory bird species, the Refuge has been designated as an “Internationally Important Bird Area.” Located in the middle of the vast Central Flyway, John Redmond Reservoir is on an important flight path for migratory ducks and geese. The Refuge provides excellent habitat for a variety of birds. Its habitat is composed of uplands, grassland, agricultural lands, hardwood river bottoms, marshes, and flooded sloughs.

A secondary function of the Refuge is to provide a public opportunity to observe, study, harvest, and enjoy wildlife and plants in their natural environment. Two-hundred-and-ninety-four bird species use the Refuge. April and May are the best months for observing passerines, while November is an excellent time to observe the peak migration of waterfowl. More than 40,000 ducks and 200,000 geese pass through the Refuge during spring and fall migration. Up to 150 bald eagles and more than 100,000 snow geese may spend the winter here. Thousands of Mexico-bound monarch butterflies migrate through in September.

Osage Cuestas

Taking its name from the Flint Hills Region just to the west, the Refuge is actually in the western

portion of the Osage Cuestas physiographic region between the Flint Hills and the Ozarks. The Osage Cuestas region is characterized by a series of east-facing ridges between flat to gently rolling plains. Geologists use *cuesta*, Spanish for hill or cliff, to describe ridges with steep, cliff-like faces on one side and gentle slopes on the other. In this region, differential weathering between alternating limestone and shale units of the Pennsylvanian Subsystem (about 300 to 318 million years old) produced a band of rolling hills that look like a tilted staircase from a distance. The more resistant limestone units cap the hills and the more easily eroded shales form the gentle slopes between the ridges.

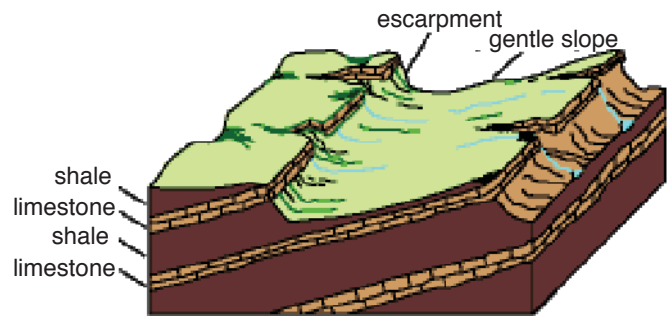


Figure 1. Cuesta topography developed in gently dipping, alternating layers of hard and soft rocks.

This region was predominantly tallgrass prairie for thousands of years prior to settlement, but with 30 to 40 inches of average annual precipitation, there is enough moisture to support forest growth. In the past, woody vegetation was held at bay by periodic droughts, fires started by lightning or Native Americans, and heavy grazing by bison and elk. Today, the bison and elk are gone and much of the former grassland has been turned to cropland or protected from fire. Trees and shrubs have invaded much of the remaining prairies, even surmounting the hilltops in places. Today, less than 4% of the once-vast tallgrass prairie remains. Some tallgrass prairie does remain in the Refuge, but most lies in the Flint Hills region west of the Refuge.

Conservation

The Refuge encompasses about 2,000 acres of wetlands and marshes. Closed portions of the Refuge are used for waterfowl and Bald Eagle management. Other parts are further protected during intensive waterfowl use.

A share agreement was made with farmers to provide food for migrating waterfowl on their

farmlands. Crops such as wheat, soybeans, corn, and sorghum are planted, and a percentage of the crops are left for wildlife. Some abandoned croplands are being restored to prairie flora.

In support of conserving the remaining tallgrass prairie landscape, the USFWS advocates protecting the Flint Hills tallgrass prairie. This involves landscape-scale conservation programs using conservation easements. Conservation easements are voluntary legal agreements between landowners and government agencies or qualified conservation organizations that limit the type and amount of development that may take place on a property in the future. Conservation easements typically prohibit subdivision and commercial development activities but allow for continued agricultural uses such as livestock grazing and haying.

The USFWS can purchase grassland conservation interests, from willing sellers only, in the form of perpetual conservation easements within portions of Butler, Chase, Chautauqua, Cowley, Geary, Greenwood, Elk, Lyon, Marshall, Morris, Pottawatomie, Riley, and Wabaunsee counties.

Unlike fee-title acquisition, the land ownership and property rights, including control of public access, remain with landowners who participate in conservation easement. In addition, participating properties remain on local tax rolls.

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Proposed Flint Hills Legacy Conservation Area

Conserving the Tallgrass Landscape

The U.S. Fish and Wildlife Service (Service) is proposing to protect a unique and highly diverse area of the United States known as the Flint Hills Tallgrass Region, in eastern Kansas. Today, less than 4 percent of the once-vast tallgrass prairie remains, most (80 percent) of which lies within the Flint Hills of eastern Kansas and northeastern Oklahoma. The purpose of the proposal is to help maintain the integrity of tallgrass prairie wildlife habitat, stream water quality, and the rich agricultural heritage of the Flint Hills.

Tallgrass prairie in eastern Kansas is rapidly being lost to residential and commercial development, or through conversion to other nonagricultural uses. Such development fragments habitat and erodes the agricultural land base that is so important for sustaining wildlife populations.

The Service recognizes the importance of protecting and fostering traditional cultural values, including ranching lifestyles and economies, in concert with habitat conservation interests. Ranching has historically played a major role in preserving the tallgrass ecoregion—and by extension conserving valuable fish and wildlife habitat—through

grazing and prescribed fire. The Service hopes to play a role in keeping working ranches on the landscape while continuing to conserve habitat for wildlife and provide unique tallgrass vistas for future generations of Americans to enjoy. Currently, the Service has tallgrass conservation areas totaling 4,092 acres in Minnesota and 51,750 acres in South Dakota.

How would the U.S. Fish and Wildlife Service conservation easement program work?

The Flint Hills Legacy Conservation Area proposal would involve a landscape-scale conservation program using conservation easements. Conservation easements are voluntary legal agreements between landowners and government agencies or qualified conservation organizations, which limit the type and amount of development that may take place on a property in the future. Service easements typically prohibit subdivision and commercial development activities, but allow for continued agricultural uses such as livestock grazing and haying.



The Service would purchase grassland conservation interests, in the form of perpetual conservation easements, from willing sellers only, who own property within the proposed project area. Portions of Butler, Chase, Chautauqua, Cowley, Geary, Greenwood, Elk, Lyon, Marshall, Morris, Pottawatomie, Riley, and Wabaunsee counties are in the proposed conservation area.

Unlike fee-title acquisition, under a conservation easement the land ownership and property rights including control of public access would remain with participating landowners. In addition, participating properties would remain on local tax rolls. Easement values are determined by appraisal and typically are approximately one-third of the property's full-market value.



Prairie Coneflowers

Mike Blair/Kansas Department of Wildlife and Parks

USFWS



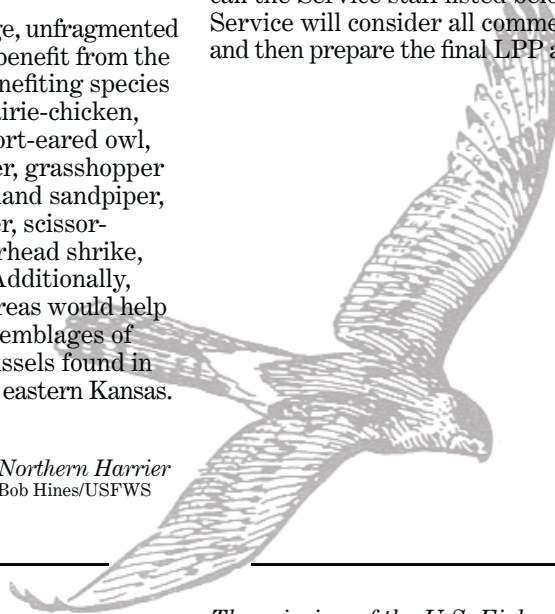
Greater Prairie-chicken

What resources would benefit from the conservation easement program?

About 90 native grass species are found in the Flint Hills, with big bluestem, little bluestem, Indiangrass, switchgrass, eastern gamagrass, and sideoats grama the species most often associated with the prairie landscape. The 500-plus native, broadleaf, prairie plant species found in the Flint Hills are also important, not only for maintaining the ecological health of the prairie but also for providing added forage value.

Birds dependent on large, unfragmented tracts of prairie would benefit from the easement program. Benefiting species include the greater prairie-chicken, Henslow's sparrow, short-eared owl, American golden-plover, grasshopper sparrow, dickcissel, upland sandpiper, buff-breasted sandpiper, scissor-tailed flycatcher, loggerhead shrike, and northern harrier. Additionally, conservation of these areas would help protect the diverse assemblages of freshwater fish and mussels found in many prairie streams in eastern Kansas.

Northern Harrier
Bob Hines/USFWS



What is the next step in the process?

We want to hear from you, and to do that we will hold three public scoping meetings to provide a public forum to share ideas and issues about the proposed conservation easement program. The dates, times, and locations for these meetings will be distributed in the local and regional area. We also encourage public comment through letters, emails, individual meetings, and phone calls to the local contact as well as the regional contact (see below).

The Service, using public input, will then develop a land protection plan (LPP) and environmental assessment (EA) to evaluate the proposal to purchase conservation easements within the Flint Hills Legacy Conservation Area.

The draft LPP and EA will highlight the resource values of tallgrass prairie; present alternatives that address issues and concerns that we, along with our conservation partners and the public, identified; and evaluate the effects that may occur if conservation easements are determined to be viable tools for conserving habitat in this area.

The draft LPP and EA document will be distributed to those who would like to review it, and three public meetings will be held to receive comments on the document. In addition, we want to encourage everyone to write a letter, send an email, meet individually, or call the Service staff listed below. The Service will consider all comments, and then prepare the final LPP and EA.



Upland Sandpiper

© Bob Gress

How do I get involved?

The Service welcomes your questions and comments!

Whether you are an interested individual or a group representative, please do not hesitate to call, write, or request information on upcoming meetings with Service staff to discuss this proposal and your perspective on the future of the Flint Hills Legacy Conservation Area project.

For more information, contact:

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The mission of the U.S. Fish and Wildlife Service is working with others to conserve, protect and enhance fish, wildlife, plants and their habitats for the continuing benefit of the American people.

We are both a leader and trusted partner in fish and wildlife conservation—known for our scientific excellence, stewardship of lands and natural resources, dedicated professionals, and commitment to public service. For more information on our work and the people who make it happen, visit www.fws.gov.



September 2009

An Overview of Reservoir Sedimentation

Reservoir sedimentation has been a recognized but historically disregarded problem. In simple terms, when sediment inflow exceeds outflow, reservoir capacity diminishes. A reservoir design life is approximately 150–200 years without sedimentation, but can be reduced to less than 50 years with sedimentation problems. With less capacity, a reservoir’s intended purposes—flood control, public and industrial water supply, irrigation, wildlife conservation, and public recreation—are significantly impaired.

Sediment Erosion and Stream Geomorphology

The cause of reservoir sedimentation is rooted upstream from the reservoir and is a consequence of watershed and stream corridor management practices. Rainfall runoff may erode sediment in a watershed and transport it through the processes of sheet, rill, and gully erosion. Once in suspension, sediment is transported by stream and eventually deposited in reservoirs, lakes, or oceans.

Most stream reaches are approximately balanced with respect to sediment inflow and outflow. However, changes in the watershed result in changes in streams and sediment transport. This involves the interplay of four basic factors—sediment discharge, sediment size, streamflow, and slope. Stream equilibrium and stable sediment transport occur when all four of these variables are in balance. If one variable changes, one or more of the other variables must increase or decrease proportionally if equilibrium is to be maintained (fig. 1). This relationship is known as Lane’s Balance.

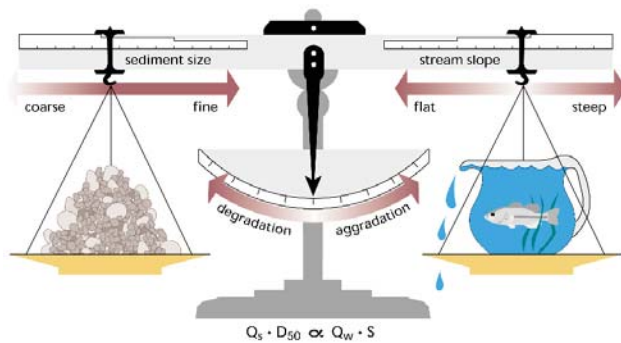


Figure 1. Factors affecting channel equilibrium. At equilibrium, slope and flow balance the size and quantity of sediment particles that the stream moves (Hagerty, 1998).

For example, sediment control structures and management practices such as CRP, terraces, and ponds in watershed uplands capture large amounts of sediment, dramatically changing drainage patterns and the movement of sediment that erodes off the land. In terms of Lane’s Balance, sediment is removed from the scale, leaving clear upland runoff with little sediment load transported to basin streams. The clear water runoff is “sediment starved” and has more erosive power, thus tipping the scale toward degradation or erosion. A stream seeking new equilibrium erodes more sediment volume and larger sediment sizes to reestablish its equilibrium, resulting in channel erosion and downstream sediment transport.

In many places, downcutting streams are simply remobilizing and transporting a legacy load left from the Dust Bowl era when drought and poor land-management practices led to upland soil erosion. The resulting sediment load was greater than sheet, rill, and stream channels could carry, so much of the 1930s sediment load was dropped and stored in stream valleys. Net stream erosion of this legacy load today is a major contributor to reservoir sedimentation.

Dam construction dramatically alters the balance as well, creating an impounded river reach characterized by extremely low flow velocities and efficient sediment trapping. When water velocity declines, transport power is lost and the sediment load is dropped. The impounded reach then accumulates sediment and loses storage capacity until a balance is again achieved, which would normally occur after the impoundment has become “filled up” with sediment and can no longer provide water storage and other benefits.

Declining storage reduces and eventually eliminates the capacity for flow regulation and, with it, all water-supply and flood-control benefits plus those navigation, recreation, and environmental benefits that depend on releases from storage.

Conclusions

To properly address reservoir sedimentation, policymakers must recognize sedimentation from a

regional perspective. The cause of the problems and solutions might be 100 miles away from a reservoir. Policy decisions should be based on science and far-reaching decision points that look 40 years out. To meet these goals, baseline sedimentation data in streams and reservoirs should be established and reservoir bathymetric (depth) surveys should be continued. Solutions will be made only through strategic alliances with stakeholders and State and Federal agencies.

During this conference, reservoir sedimentation will be examined in three ways. First, participants will be flown in helicopters over John Redmond Reservoir (fig. 2), Coffey County Lake, and sediment sources in the Neosho River to establish the scale and size of sedimentation processes in a watershed. The helicopters are being provided and flown by the 1st Battalion, 108th Aviation of the Kansas National Guard. Second, at Coffey County State Lake, the Kansas Biological Survey will demonstrate the need for baseline studies and bathymetric survey techniques. Finally, a tour of the Wolf Creek Nuclear Generating Station will provide insight into water use and consumption for cooling at the nuclear facility.

On the following pages are details about the 1st Battalion, 108th Aviation; stream corridor restoration and reservoir sedimentation projects from the Kansas Water Office; and bathymetric survey information and reservoir maps from the Kansas Biological Survey. Information about Wolf Creek water use and economics are included in the next section.



Figure 2. Cut bank and sediment erosion on the Neosho River upstream of John Redmond Reservoir near Neosho Rapids. (Photo by Bob Sawin, Kansas Geological Survey).

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1st Battalion, 108th Aviation

Headquarters in Topeka – 347 soldiers authorized



Lt. Col. David Leger



1st Sgt. Edward Monteith

Mission: Alert, mobilize and deploy to war-time theater of operations and conduct air assault and air movement operations as an integrated member of a combat aviation brigade. On order, conduct stability and support operations in support of both federal and state agencies. Retain our trained Soldiers and recruit new ones. The commander is Lt. Col. David A. Leger. 1st Sgt. Edward L. Monteith is the battalion command sergeant major.

Units:

- Headquarters and Headquarters Company, Topeka
- Company A, Topeka
- Company B, Salina
- Company D, Topeka
- Company E, Topeka
- Detachment 1, Company C, 1st Battalion, 171st General Support Aviation, Topeka

FY 2009 Highlights

- California Wildfire Support – Aircrews and aircraft assigned to Companies A and B, 1st Battalion, 108th Aviation and Detachment 1, Company C, 1st Battalion, 171st General Support Aviation Battalion conducted Bambi bucket operations in California, providing fire fighting capability for numerous wildfires throughout the state.
- Operation Pork Forward – Company A and Company B, 1-108th conducted air movement operations training with the Kansas Air Guard Joint Tactical Air Traffic Controllers at the Great Plains Joint Training Center. Both companies conducted multiple tactical insertions and extractions under daylight and night-vision goggles conditions.
- FORSCOM Aviation Resource Management Survey Inspection – 1-108th completed a six day FORSCOM ARMS inspection in March 2009. The battalion received an overall Green rating with a commendable in training and tactical operations.
- Annual Training 2009 – 1-108th conducted deployment and re-deployment operations to Camp Guernsey, Wyo. Upon arrival, the battalion conducted air movement operations, sling load operations, force protection operations, combat service support operations and sustainment operations. Detachment 1, Company C, 1-171st conducted aeromedevac operations. Company A and Company B, 1-108th also conducted an air movement exercise with the Marine Reserves, conducting multiple insertions and extractions along with



A UH-60 Black Hawk from the 1st Battalion, 108th Aviation lifts a slingload of equipment during a training exercise.

Detachment 1, Company C, 1-171st conducting aeromedevac scenario training during the exercise.

- Annual Safety Stand Down – 1-108th Soldiers conducted an eight hour Battalion Safety Stand Down on Aug. 15, 2009. Stations included drivers safety and drunk driving prevention, fratricide prevention, hazmat/hazcom, hearing conservation, fire safety, and hazardous spill containment training.
- Aerial Door Gunnery 2009 – Company A and Company B, 1-108th completed aerial door gunnery training on Sept. 12, 2009, at Smoky Hill Weapons Range. The battalion qualified a total of 21 door gunners.



STREAM AND RIPARIAN RESTORATION IN THE UPPER NEOSHO RIVER BASIN

The Kansas Water Office has received funding from the American Reinvestment and Recovery Act (ARRA) and the state’s Water Plan Fund to address sedimentation in the Neosho River basin. The ARRA funds were channeled through the state’s Clean Water Act State Revolving Funds. For non-traditional borrowers implementing “green infrastructure” projects, such as the KWO streambank project, the principal was forgiven on these low-interest loans.

An 8.3-mile reach of the Neosho River has been identified as a high priority area for streambank stabilization to reduce sedimentation. The project has the potential to reduce the annual sediment load downstream by 50,000 tons. Restoration of the riparian buffer adjacent to the stream is also a goal of this project. Riparian restoration will be funded through the Conservation Buffer Initiative, Continuous Conservation Reserve Program or other applicable programs.

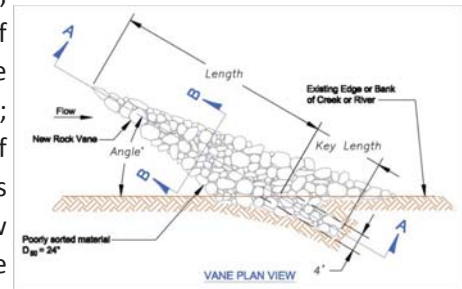


Project location on the Neosho River in Lyon County, KS.

Twelve individual streambank stabilization projects make up the full 8.3-mile project reach. Stabilization methods for these projects include reshaping of the

“This is the first project of its kind on the Neosho River,” says Tracy Streeter, Director of the Kansas Water Office. “It will give us a chance to demonstrate the effectiveness of restoring an unbroken corridor rather than scattered segments.”

bank to a more natural contour; willow plantings on flood benches; installation of longitudinal toe rock protection; construction of veins and weirs to redirect flow away from the bank; and restoration of a forested riparian buffer.



Rock veins divert the highest energy flows away from the bank, reducing future degradation.

Streambank Stabilization Supports State’s Reservoir Sustainability Initiative

Federal reservoirs in Kansas serve as the source of municipal and industrial water for more than two-thirds of the state’s population. They are a recreational destination and provide a reserve for stream flow for water quality, aquatic life and related activities. The reservoirs are an integral part of the infrastructure of water supply in Kansas. Like all infrastructure, reservoirs age. They fill with sediment, reducing their capacity to meet our needs.



Neosho River streambank to be reshaped and stabilized during project.

Reservoir sedimentation is a result of soil erosion from the land surface and from stream channels and banks. In most Kansas watersheds, this natural process has been accelerated due to changes in land cover and the modification of



STREAM AND RIPARIAN RESTORATION IN THE UPPER NEOSHO RIVER BASIN

stream channels to accommodate agricultural, urban, and other land uses.

Growing evidence shows that a significant source of sediment in streams is generated from stream channels and edge of field gullies. Streambank erosion can contribute nutrients, such as phosphorus, which can cause water quality impairments.



Ten landowners and operators volunteered to participate in the Neosho ARRA streambank project.

Leveraging ARRA Funds

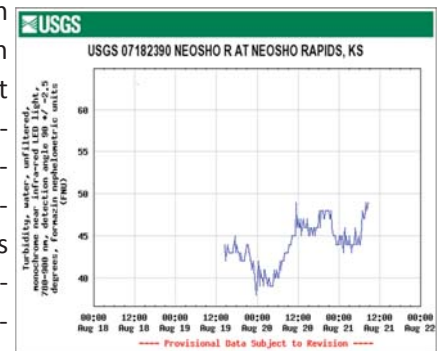
The receipt of the ARRA funds has provided Kansas the opportunity to leverage other sources of funding. These additional funds are targeted towards research

More “Green Infrastructure” projects in Kansas benefiting from the ARRA and principle forgiveness clause:

- Johnson County Community College—Stormwater infiltration through constructed wetlands, rain gardens, and bioswales.
- Lenexa—Stream improvements, constructed wetland, and water reuse irrigation system.
- Hays—Hybrid detention and infiltration basin with native plantings to manage stormwater.
- KSU, Center for Child Development—Porous pavement, bioretention cells, and water harvesting system to manage stormwater on-site.
- Bonner Springs—Streambank stabilization through bioengineering.
- Glacial Hills RC&D—Streambank stabilization to reduce sedimentation into Perry Reservoir.

and monitoring of the effectiveness and impact of the streambank stabilization project.

Funding from the U.S. Army Corps of Engineers supports U.S.G.S. real-time stream gages and turbidity monitors above and below the 8.3-mile project reach. State Water Plan Funds have been used to conduct habitat assessments for threatened and endangered species, as well as, ground-based LiDAR imagery to provide detailed mapping of the changes in streambank morphology as a result of the stabilization.



Stream gages and turbidity monitors assess the impacts of the project on sedimentation.

Long-term Funding Critical to Continue Green Infrastructure Projects

Funding is needed to continue the process of protecting our streams. Although costly, streambank stabilization and riparian restoration projects can be the most cost effective method of reducing sediment delivery to our water supply reservoirs.

Kansas supports future funding for Green Infrastructure projects through EPA to be targeted towards Kansas’ Clean Water State Revolving Fund in the form of low-interest, principally-forgiven loans.

“Were it not for the American Recovery and Reinvestment Act, it might have been many years before these necessary projects were created.” Roderick L. Bremby, Secretary of the Kansas Department of Health and Environment.

Additional project information and updates can be found at www.kwo.org/ARRA_Neosho.htm

Reservoir Sustainability Initiative

Reservoirs hold more than water ... they hold our future.

We've learned a lot. We've taken positive action. We need to do more.

Federal reservoirs in Kansas serve as the source of municipal and industrial water for more than two-thirds of the state's population. They are a recreational destination and provide a reserve for stream flow for water quality, aquatic life and related activities.

The reservoirs are an integral part of the infrastructure of water supply in Kansas. Like all infrastructure, reservoirs age. They fill with sediment, reducing their capacity to meet our needs. While erosion is a natural process, it is accelerated by our actions, such as urbanization, agriculture and alteration of riparian and wetland areas.

Kansas' landscape is changing. A viable economy depends on well-managed natural resources. Too often we take for granted that the foundation of our lives and livelihoods will be there forever.

The federal reservoirs were built from the 1940s through the 1980s by the U.S. Army Corps of Engineers and the Bureau of Reclamation primarily for flood control. State and local users saw value in adding water supply storage. Use of that storage space now is being compromised by sedimentation. Preliminary studies indicate that if a multi-year severe drought occurred in the foreseeable future, water supply shortages could occur due to the diminished storage in several basins. Models are being developed to optimize the use of reservoir water to meet current and future needs.

Many of the reservoirs have been measured to determine the amount of storage that has been lost to sedimentation. Methods are being developed to better de-

termine the sources of sediment, whether it be stream banks, construction sites or farm fields. This allows for targeting of appropriate management practices to reduce erosion to get the most value for the dollar spent.

Millions of private, state and federal dollars have been spent putting in watershed and land treatment structures.

Local stakeholder driven watershed groups, known as WRAPS (Watershed Restoration and Protection Strategy) are engaged in restoring and protecting their watersheds. WRAPS groups are active in the watersheds of 19 of the state's 20 federal reservoirs that provide public water supply benefits.

Mission Lake, a municipally-owned lake in Horton, Kansas is the object of a small reservoir pilot project underwritten by the State Water Plan Fund. The goal is to determine whether dredging or another method will be the best way to restore and extend a reservoir's life.

An unprecedented level of local, state and federal cooperation is needed to sustain and manage reservoirs. Our future may depend on our ability to recover lost storage, protect stream systems, build new reservoirs and decrease demand.

Developing the funding to assure reservoir sustainability is essential.

Your involvement is needed. Learn more at the Kansas Water Office web site www.kwo.org.

Secure. Protect. Restore.

Secure.

***Minimum Pool Agreement—Webster Reservoir
Reservoir Beneficial Use/Storage Purchases***

Protect.

***Riparian and Wetland Conservation Easements
Streambank Stabilization***

Restore.

***Streambank Planning
Neosho Logjam Removal
Dam Safety/Rehabilitation.***

Financial Needs for Reservoir Sustainability	10 Yr Total	20 Yr Total	40 Yr Total
Secure			
Reservoir Debt Service & Storage Purchase (P & I)	\$ 16,000,000	\$ 107,000,000	\$ 108,000,000
Reservoir Operation and Maintenance	\$ 21,000,000	\$ 67,000,000	\$ 447,000,000
Unfunded Liability	\$ -	\$ 19,000,000.00	\$ 68,000,000
Purchase of Additional Federal Storage	\$ 13,000,000	\$ 35,000,000	\$ 119,000,000
Development of New Large Reservoir	\$ -	\$ 300,000,000	\$ 1,293,000,000
Development of New Small Reservoirs	\$ 7,000,000	\$ 26,000,000	\$ 97,000,000
Minimum Pool Agreement	\$ 400,000	\$ 2,000,000	\$ 5,000,000
Planning and Design	\$ 3,000,000	\$ 7,000,000	\$ 12,000,000
Total Secure	\$ 60,400,000	\$ 63,000,000	\$ 2,149,000,000
Protect			
Implementation of Best Management Practices	\$ 19,000,000	\$ 57,000,000	\$ 189,000,000
Riparian and Wetland Protection and Development	\$ 13,000,000	\$ 33,000,000	\$ 121,000,000
Riparian and Wetland Easements	\$ 16,000,000	\$ 57,000,000	\$ 57,000,000
Streambank Stabilization	\$ 32,000,000	\$ 115,000,000	\$ 115,000,000
Planning and Design	\$ 36,000,000	\$ 41,000,000	\$ 51,000,000
Total Protect	\$ 116,000,000	\$ 303,000,000	\$ 533,000,000
Restore			
Sediment Removal Small Reservoirs	\$ 87,000,000	\$ 163,000,000	\$ 163,000,000
Sediment Removal Large Reservoirs	\$ 180,000,000	\$ 995,000,000	\$ 995,000,000
Dam Safety/ Rehabilitation	\$ 35,000,000	\$ 44,000,000	\$ 84,000,000
Planning and Design	\$ 5,000,000	\$ 6,000,000	\$ 6,000,000
Total Restore	\$ 307,000,000	\$ 1,208,000,000	\$ 1,248,000,000
Total Reservoir Sustainability	\$ 83,400,000	\$ 2,074,000,000	\$ 3,930,000,000

The Applied Science and Technology for Reservoir Assessment (ASTRA) Program of the Kansas Biological Survey

Addressing Research and Management Information Needs of Kansas Reservoirs

Water is fundamental to the economy of Kansas. The need for water infuses and permeates every aspect of life in our state, from the irrigation that supports our agriculture to the drinking water our citizens use every day at home and work. Indeed, nearly 60% of Kansans rely on surface-water supplies for their drinking water. Because Kansas has so few natural lakes, thousands of reservoirs have been constructed across the state. From small farm ponds to large Federal reservoirs, these bodies of water collectively provide multiple economic benefits in the form of drinking water, irrigation, flood control, and recreation. Reservoirs are critical infrastructure and, in Kansas, provide economic returns that far exceed the billions of dollars invested to build them (more than \$6 billion in 2010 dollars).

The state is now facing an enormous challenge as it attempts to respond to increasing needs for water, coupled with an increasing occurrence of water-quality problems affecting Kansas reservoirs. Most Kansas reservoirs were constructed an average of 40 years ago and are gradually filling with sediment washed down from their watersheds. As reservoirs silt in, less water is available for irrigation, industry, recreation, and drinking water. Furthermore, sediment accumulation continues to create water-quality problems and promote algae outbreaks that kill fish, pollute water, and lead to foul-tasting drinking water. Triggered by reservoir siltation, these environmental effects ripple outward as direct and indirect economic consequences for industry, agriculture, and municipalities.

Many Kansas reservoirs are silting in faster than originally anticipated; several are silting in two to three times faster than expected. Six of the 20 Federal reservoirs that are used as drinking-water supplies are more than 20% silted in; four of the 20 are more than 40% silted in. It is estimated that nearly half the capacity of John Redmond Reservoir has been lost since it was built a few decades ago (fig. 1), and we need John Redmond for water now more than ever. Under drought conditions, water demand could outstrip supplies in the Neosho River Basin by the

year 2012, according to projections by the Kansas Water Office.

Reservoir impairment already has cost local governments millions of dollars in increased water-treatment costs and lost economic opportunities. There is also a growing awareness of the issues related to the long-term viability of these reservoirs and the renovation actions that will become increasingly necessary. Reservoirs are being managed more intensively now than in the past as water-resource managers strive to balance multiple, and often conflicting, uses for the resource. At a time when there is increasing pressure on our state's reservoirs for drinking water, irrigation, flood control, and recreation, we fundamentally have only a fragmented picture of the current status of our lakes, how they are changing, and what drives those changes that threaten water supplies.

Recognizing this critical need for information on reservoir sedimentation and conditions, the Kansas Biological Survey created the Applied Science and Technology for Reservoir Assessment (ASTRA) Program with funding from the Kansas Water Office. ASTRA has acquired sophisticated acoustic echosounding technology for bathymetric mapping (fig. 2), sediment thickness estimation, and bottom-sediment type classification. Additionally, ASTRA has a dedicated sediment-coring pontoon boat with vibracorer for taking sediment cores in reservoirs for measuring sediment thickness and sampling sediment characteristics. Major investments in field equipment have been supported by additional investments in water-quality laboratory capabilities, high-speed data processing, and 3-D visualization technology.

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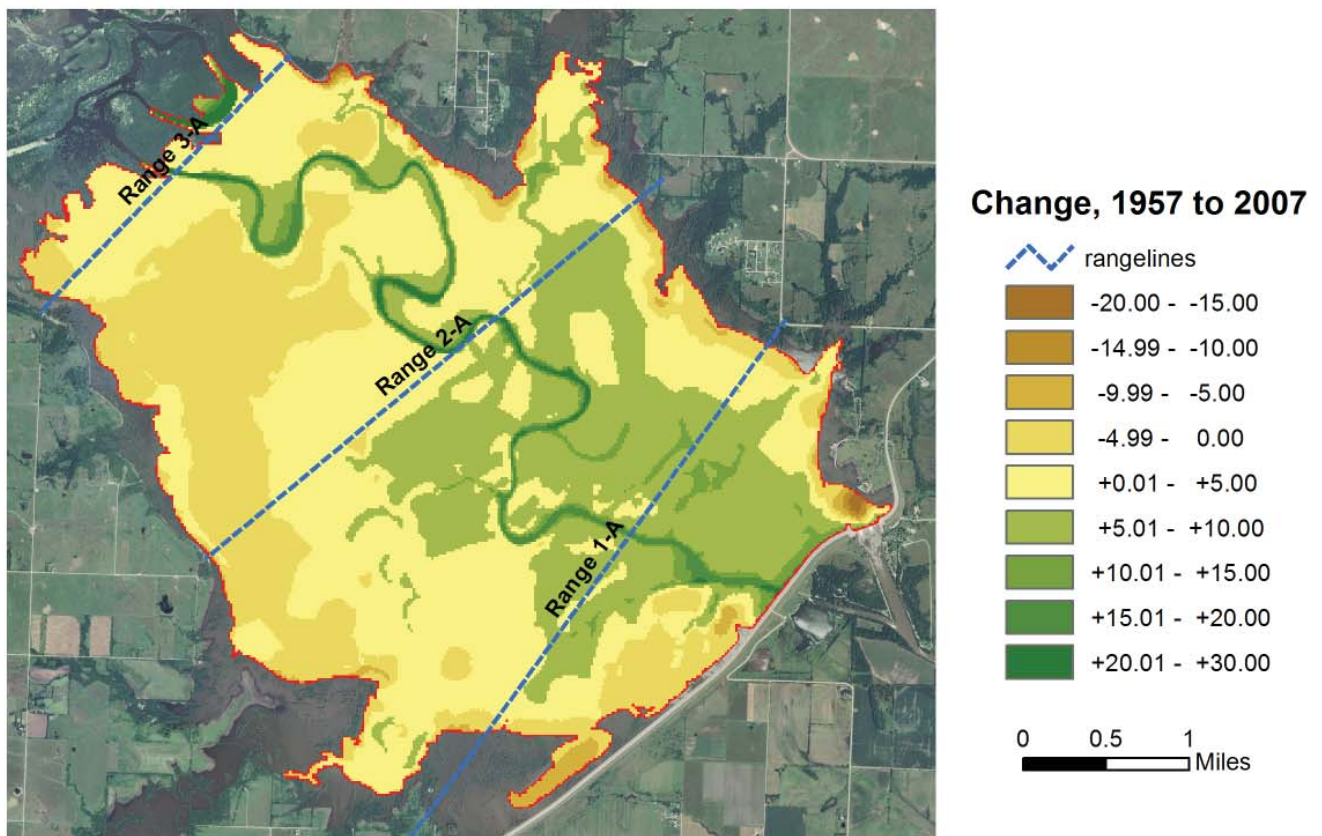
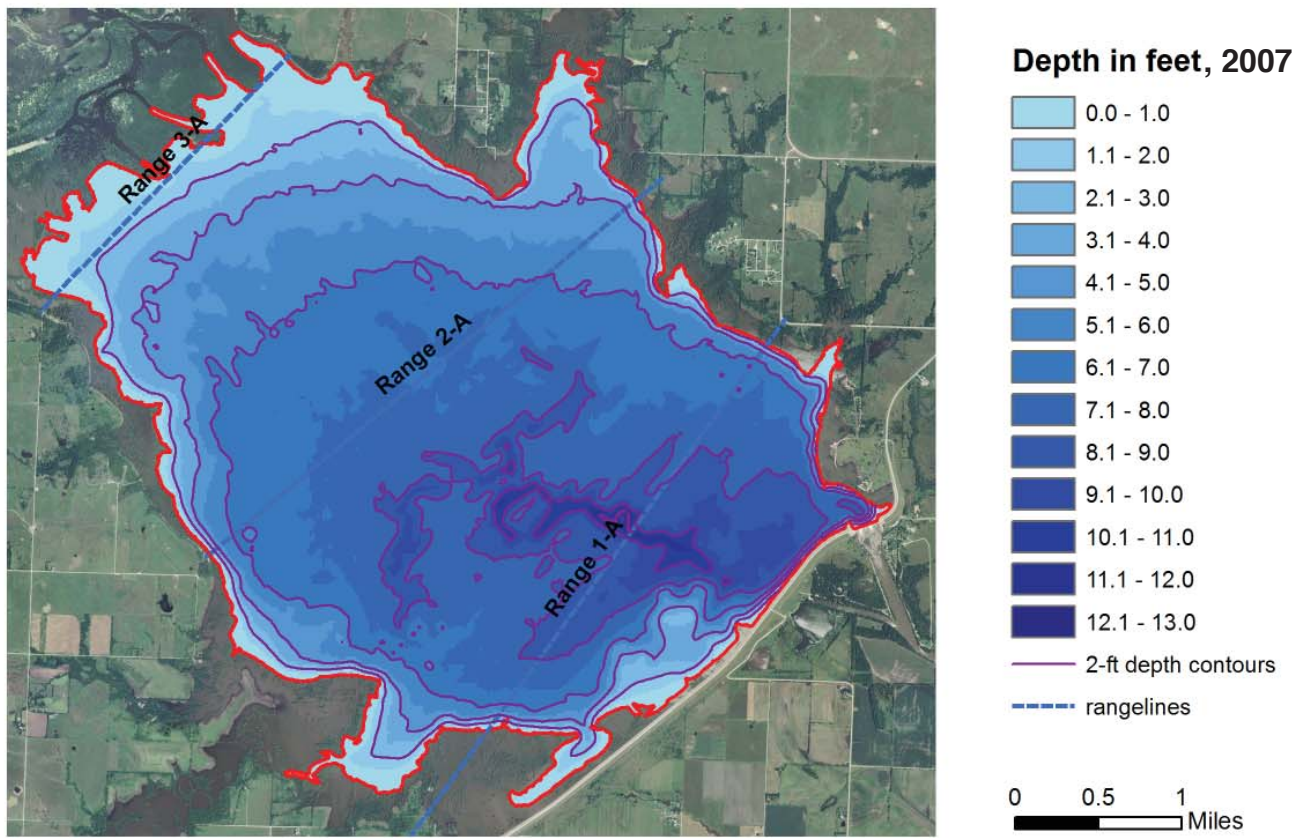


Figure 1. Water depth at John Redmond Reservoir in 2007 (top) and changes in water depth between 1957 and 2007 (bottom).

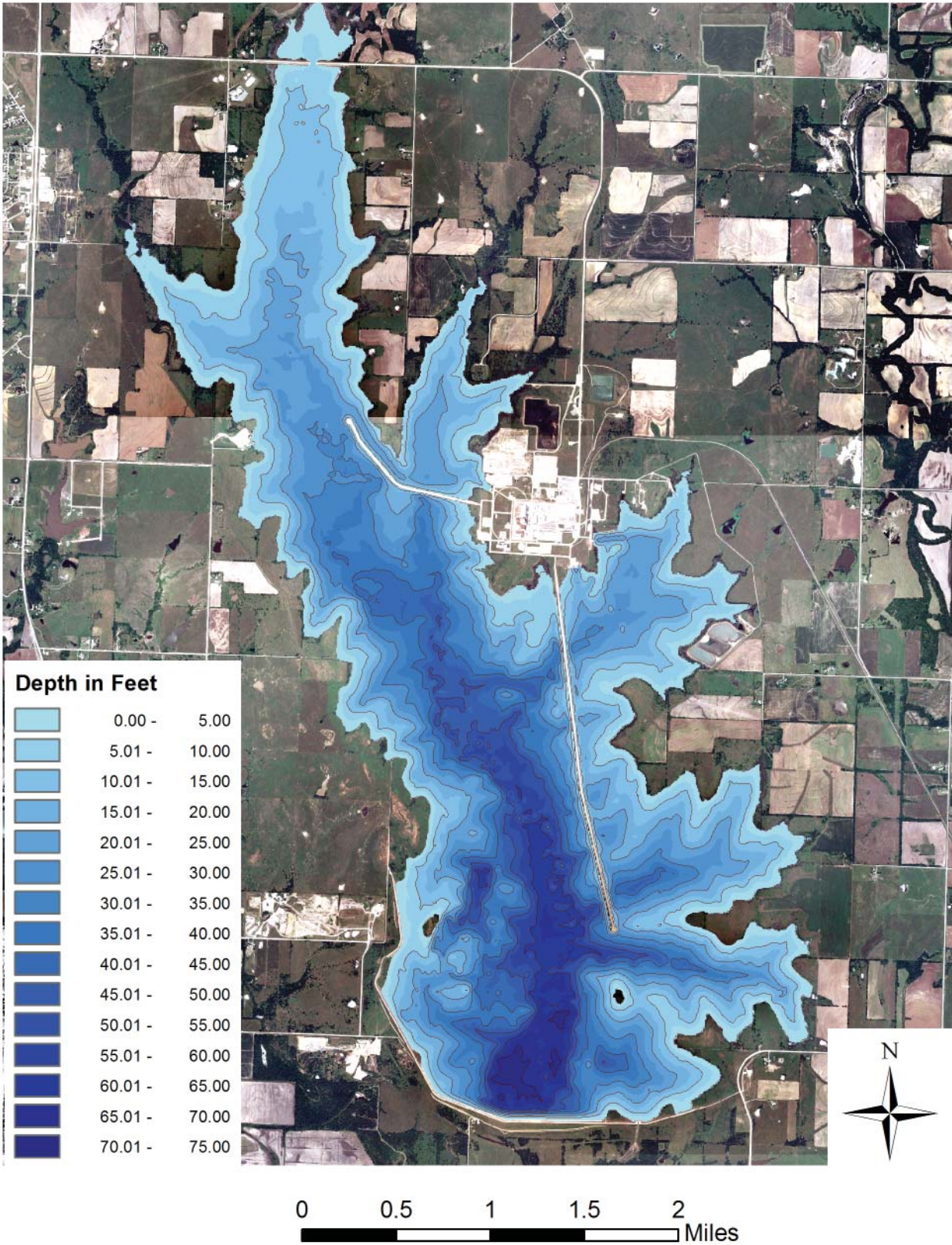


Figure 2. Water depth at Coffey County Lake based on an October–November 2009 bathymetric survey. Depths are based on a pool elevation of 1088.9 feet (NGVD29).

Wolf Creek Generating Station

Wolf Creek Generating Station, northeast of Burlington in Coffey County, is the only nuclear power plant in Kansas. Beginning electric production in 1985, Wolf Creek now generates about 1,200 megawatt electrical, enough energy for approximately 800,000 homes.

In addition to electricity production, Wolf Creek has an impact on the economy of both Coffey County and the State of Kansas. A study by the Nuclear Energy Institute (NEI) estimates that Wolf Creek Generating Station contributes \$165 million annually to the local and State economy in the form of payroll, purchases, and taxes.

Wolf Creek Nuclear Operating Corporation (WCNOC) is a subsidiary of three owners:

- Kansas City Power & Light, a Great Plains Energy Company (47%)
- Kansas Gas and Electric, a Westar Energy Company (47%)
- Kansas Electric Power Cooperative (6%)

WCNOC manages the plant for its owners, who share its energy in proportion to their ownership interest.

Water Cooling Technology

Whether fueled by coal, natural gas, or nuclear power, all power plants that generate electricity from steam to move a turbine rely on water for cooling. The cooling water supply at Wolf Creek includes the Coffey County Lake. Water from below the John Redmond Reservoir outlet is diverted into Coffey County Lake.

Wolf Creek utilizes a once-through cooling system to help cool the steam used to spin a turbine and generator. Although the consumptive water use is minimal, the amount of water withdrawn from the lakes is significant.

Lake water is passed through a heat exchanger to condense the steam (fig. 1). This water never encounters the reactor or radioactive material. The water is used only a short time and the exiting condenser water is pumped back into the lake. The condensate is recycled and flashed to steam again to turn the turbine.

Although thermoelectric power plants in the United States withdraw large amounts of water, only

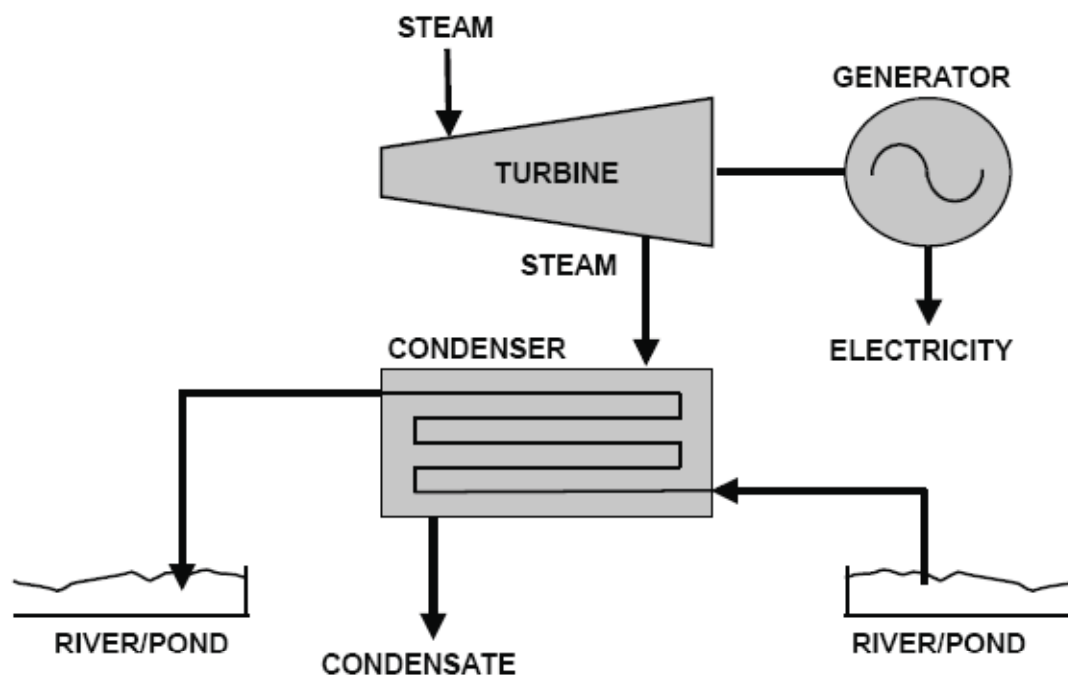


Figure 1. Generalized diagram of a once-through cooling system (modified from Torcellini et al., 2003).

a small percentage is evaporated, approximately 2.5% or 3,310 MGD (12,530 x 10⁶ L/d). This constitutes 3.3% of all consumptive use in the United States. Much of the water is returned to its source. The water consumption in a once-through cooling system is minimal because the water does not directly contact the air. However, the temperature increase of the effluent returned to Coffey County Lake can increase the evaporation rate, thus indirectly increasing water consumption.

A nuclear power plant that returns cooling water directly to the source consumes the equivalent of 6–16 gallons of water per day per household. The same plant would consume the equivalent of 20–26 gallons of water per day per household if it used cooling tower systems. By comparison, the average U.S. household of three people consumes about 300 gallons of water per day for indoor and outdoor uses, according to the U.S. Geological Survey.

Nuclear Economics

After a 30-year hiatus, the United States may soon return to building nuclear plants. Projects are propelled by \$8 billion in Federal loan guarantees that may increase over the next few years. In response, some states are beginning to explore or encourage utilities to develop nuclear power.

Project finance is a critical component of the nuclear industry's growth and success. In spite of Federal funding, private financing remains an essential component in plant expansions and new reactor construction. Construction still requires massive capital expenditure with significant risk, so obtaining these funds may yet be out of reach.

Sources

- NEI, 2008, Water consumption at nuclear power plants fact sheet, 3 p.
- Torcellini, P., Long, N., and Judkoff, R., 2003, Consumptive use for U.S. power production: National Renewable Energy Laboratory, NREL/TP-550-33905.
- Wolf Creek Nuclear Operating Corporation, 2010, <http://www.wcnoc.com/index.html>.

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Schedule and Itinerary

Thursday, June 3, 2010

- 6:00 a.m. Breakfast at Tioga Suites Hotel
- 7:00 a.m. Bus from Super 8 to Tioga Suites Hotel
- 8:00 a.m. **Bus leaves Tioga Suites Hotel for Site 5**
- Bus Session – Interstate Water Relations
Burke Griggs, Counsel, Kansas Dept. of Agriculture, Division of Water Resources
- 8:45 a.m. **SITE 5** – Kansas Army Ammunition Plant, Parsons
Don Dailey, Commander’s Representative, Kansas Army Ammunition Plant
Dan Goddard, CEO, Great Plains Development
Lance Hedges, Region 5 Public Lands Supervisor, Kansas Department of Wildlife and Parks
Mike Hayden, Secretary, Kansas Department of Wildlife and Parks
- 10:15 a.m. Bus to Site 6
- Bus Session – Kanas Forestry Economics and Invasive Species
Larry Biles, State Forester, Kansas Forest Service
- 11:00 a.m. **SITE 6** – KDOT Project U.S. 169 North of Coffeyville
Highway Design and Floodplain Management
Deb Miller, Secretary, Kansas Department of Transportation
- 11:30 a.m. Bus to Lunch at Brown Mansion, Coffeyville
- 12:30 p.m. Bus to Site 7
- 12:45 p.m. **SITE 7** – CVR Energy, Coffeyville
Water Use in Petroleum and Nitrogen Fertilizer Production
Mike Swanson, Coffeyville Resources Refining and Marketing
Marc Gilbertson, Coffeyville Resources Nitrogen Fertilizers
- 2:15 p.m. Bus to Site 8
- Bus Session – Verdigris River Basin and Floodplain Management
Tracy Streeter, Director, Kansas Water Office
Earl Lewis, Assistant Director, Kansas Water Office
- 2:45 p.m. **SITE 8** – Verdigris River Stream Corridor Stabilization Project
Jodi L. Cushenbery, Supervisory District Conservationist, NRCS, U.S. Department of Agriculture
Dr. Phillip Eastep, Project Site Landowner

- 3:30 p.m. Bus to Flint Oak Resort
- 3:45 p.m. Break – Neodesha City Hall, Neodesha, KS
J. D. Cox, Neodesha City Administrator
- 4:15 p.m. Bus to Flint Oak Resort
- Bus Session – Wind Farm Site Selection
Brad Loveless, Director, Biology and Conservation Programs, Westar Energy
- 5:00 p.m. Arrive Flint Oak Resort
- 6:00 p.m. Social Gathering
- 6:30 p.m. Supper in Mallard Room at Flint Oak Resort
- 7:30 p.m. Conclude Supper

Redevelopment of the Kansas Army Ammunition Plant Property

In 2005, Congress passed a Base Realignment and Closure (BRAC) Act authorizing restructuring of the U.S. defense establishment to increase efficiency and operational readiness. As part of the reorganization, the BRAC Commission recommended the closure of four munition facilities in Kansas, Texas, Mississippi, and California, including the Kansas Army Ammunition Plant (AAP) in Labette County near Parsons. First to close, the Kansas AAP stopped production in December 2008 and was officially deactivated in March 2009.

To plan for the transfer of the property from the Federal government and the future management of the plant, the Labette County Commission formalized a Local Redevelopment Planning Authority (LRPA) in October 2005. To implement the plan, the commission established the Great Plains Development Authority (GPDA). Both are discussed in the following Base Realignment and Closure Community Profile, which also outlines the Master Redevelopment Plan, implementation strategies, the involvement of the State (including Kansas Department of Wildlife and Park), and demographics of the area. The pages from the Great Plains Development Authority Newsletters include information on the development and cost of the property as well as a map of the planned Great Plains Industrial Park.

History of the Kansas Army Ammunition Plant

Production at the Kansas Army Ammunition Plant began in 1942 with the manufacture of basic artillery and mortar shells for World War II. Over the next seven decades, production at the plant evolved, and by December 2008, output included sophisticated air-dropped weapons with infrared and laser technology for target detection and guidance.

Placed on stand-by status after World War II, the plant was declared surplus and offered for sale. In 1950 it was reactivated to produce bombs, artillery shells, and cartridge cases for the Korean War. At the end of the war, it went back on stand-by status until December 1966 during the Vietnam War. In the early 1970s, Day & Zimmermann, Inc., became the operating contractor. Starting in the 1980s, the

plant was modernized to produce such munitions as the 155mm Improved Conventional Munition (ICM), Combined Effects Munition (CEM), and the technically advanced Sensor Fuzed Weapon System (SFW).

Sources

- Great Plains Industrial Park, 2007, <http://www.greatplainsindustrialpark.com> (verified May 2010).
- Howlett, D., 2009, Kansas Army Ammunition Plan Ends Mission: United States Army, <http://www.army.mil/-newsreleases/2009/03/04/17756-kansas-army-ammunition-plant-ends-mission/> (verified May 2010).
- U.S. Department of Defense, 2010, Base Realignment and Closure 2005: U.S. Department of Defense, http://www.defense.gov/brac/definitions_brac2005.html (verified May 2010).
- U.S. Department of Defense, 2009, Base Realignment and Closure Community Profile—Kansas Army Ammunition Plant, Kansas: U.S. Department of Defense, Office of Economic Adjustments, <http://www.oea.gov> (verified May 2010).
- U.S. Department of Defense, 2006, Base Redevelopment and Realignment Manual, 2006, U.S. Department of Defense, http://www.defense.gov/brac/pdf/4165-66-M_BRRM.pdf (verified May 2010).

BASE REALIGNMENT AND CLOSURE

Community Profile

November 2009

Kansas Army Ammunition Plant, Kansas

Community

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Closure at a Glance

Local Redevelopment Authority (LRA):

Planning LRA: Great Plains Development Authority (GDPA)
Implementation LRA: Kansas Army Ammunition Plant Local Redevelopment Planning
Authority

Geographic area affected by closing:

Southeast Kansas and neighboring counties of Missouri and Oklahoma.

Population of affected area (before closure): 220,000

Total Acres to be Disposed: 13,727 acres

Estimated Job Loss Impact:

Jobs Lost	
Military Personnel	0
Civilian Personnel	8
Contractors	328

Source: Base Realignment and Closure (BRAC)
Commission Report and Plant Operator

Economic Adjustment Challenges

- Create job growth in one of the three poorest counties in Kansas
- Create tax base for the community with the largest population in the county – Labette County has the highest property tax rate in Kansas for populations over 10,000
- Attract good-paying jobs that help compensate for the lost jobs, which paid an average of more than 50 percent above the county average
- Modernize an aging infrastructure system that dates back to 1941

Key Reuse Planning & Property Disposal Milestones

5/09/06	Federal Surplus Determination
9/15/06	LRA Homeless Outreach Completed
10/30/07	Reuse Plan Received by Department of Housing and Urban Development (HUD)/Military Service
12/19/09	HUD Determination on Submission
11/04/08	National Environmental Protection Act Record of Decision
12/31/09	Base Closure

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Organization

The Local Redevelopment Planning Authority (LRPA) was formalized by the Labette County Commission in October 2005 following five months of a volunteer group working with the Army. The LRPA was comprised of city and county officials, as well as community leaders. This body hired an executive director, who then hired an office manager and deputy director.

The GPDA, the implementation LRA, was established by the County Commission as directed by state statute. According to a county resolution, the GPDA's Board of Directors was populated, by appointment, with leaders within the community. Recommendations for these appointments were made by the GPDA executive director with the goal of creating a well-rounded professional and balanced board. Member professions range from the banking and insurance arenas to the transportation and agriculture industries. It was determined that elected officials are not eligible for appointment. However three ex-officio members are appointed to the board, representing county government, the Kansas Department of Commerce, and the Kansas Department of Wildlife and Parks (KDWP).

Reuse Plan/Other Studies

The Kansas Army Ammunition Plant is a 13,727-acre facility located in rural Kansas and has always been utilized for "pack and load" production rather than manufacturing of explosives. Because of the usage, it required Quantity Distance Arcs far larger than the actual production areas. The majority of the acreage (88 percent) is free of contamination. Nearly 100 percent of the plant grounds are under agricultural leases for haying, pasture, and cropland.

The Master Redevelopment Plan was completed and submitted to the Army in August 2007. The recommended key land uses are Conservation and Agriculture, Commercial Energetics and Munitions Storage, Industrial/Manufacturing, Transportation and Warehousing, Energy Parks, Public Education and Training, Office/Business Parks, Housing, and Hazardous Materials Treatment. In addition, a comprehensive infrastructure study was recommended to modernize the infrastructure systems.

The Master Redevelopment Plan provides for 4,000 acres to be acquired by the current munitions manufacturer. In this downsized footprint, the company will continue to seek contracts at competitive bid and through third-party companies. It also plans to diversify its operations.

The plant has long provided a protective habitat for white-tail deer – it is ranked the seventh best location in the country for hunting opportunities. The protective habitat, and the many riparian corridors and wetlands unique to Kansas, has resulted in strong interest from the KDWP. To capitalize on the hunting/tourism opportunities, 3,000 acres will be sold to KDWP through an Army Compatible Use Buffer (ACUB) transfer directly from the Army as well as an indirect sale through the GPDA. The 6,737 acres of remaining land will be developed into heavy and light industrial parcels, agribusiness and agritourism sites, office space, and residential property.

Although the Kansas Army Ammunition Plant is located in rural Kansas, it is also located in the center of the United States. The GPDA has already acquired commitment from the Union Pacific Railroad to continue service for the new industrial park and its 33 miles of rail. Inland barge is available from the Port of Catoosa, just 60 miles south by rail, with access to all eastern waterways. The nearest interstate highway system is 58 miles to the southeast; however, 28 miles of that will be a 4-lane road within the next 10 years. The remaining distance is a portion of the No. 3 route listed on the U.S. Congressional High Priority Corridor Study.

Most beneficial for the community, with its decision to acquire significant acreage in this rural area, was the completion of an "Existing Conditions Assessments" and "Infrastructure Master Plan." The ammunition plant and most of its infrastructure was built in 1941. Like many closed bases, the plant now suffers from an aging water and wastewater system. The geographical location of utility lines does not necessarily fit in corridors that would be expected; and the 106 miles of roads, bridges, and culverts are not all in the best condition. The above-referenced reports helped staff and

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the Board of Directors better understand the magnitude of the problems, and determine the best approach to developing the property to with access to limited capital improvement dollars. Other in-depth studies included:

- Existing Explosives Safety Conditions
- Existing Land Management Conditions

Request for Proposals (RFPs) were recently sent out for other studies that will help align this 22 square-mile site with the surrounding countryside and Labette County. An RFP was created to address a federal enclave, which existed at the time of state-mandated 911 addressing. The RFP will address grounds that weren't included in the studies as well as provide recommendations for incorporating the area into the county's firefighting and law enforcement systems. Another RFP addresses utility easements and zoning recommendations.

Homeless Submission

The Kansas Army Ammunition Plant has been a production facility since its establishment and has no housing opportunities nor personnel support system, base exchange, gym, or hospital. Because this rural property is remote from any metropolitan area, the HUD-required documentation of need and potential were not a significant portion of the transfer process. There were no Notices of Interest from homeless providers.

Implementation and Partnering Strategies

The Kansas Army Ammunition Plant is located in the poorest region of the state. The nearest and largest community in the county (Parsons, population 12,000) has the highest property taxes in the state (for populations more than 10,000). The focus of the GPDA board is to rebuild jobs, return nearly 14,000 acres to the tax rolls of the county, and improve the valuation of the property through development. The GPDA has worked hard to retain the private munitions contractor as the first tenant of the new industrial park so that it can rebuild its talented work force. As the property transfers, there is considerable opportunity to use the company's as-yet unemployed skilled workers to attract other industry.

Environmental remediation is expected to provide several dozen jobs for up to a decade. In addition to the economic benefit of those jobs, remediation is planned to take place in the most promising areas for development first, leaving the more remote locations for later in the process.

The local community college will be a significant partner in the environmental process, which anticipates providing certification course work for local residents so that they can perform hazardous and explosive material decontamination. The community college is also establishing a nationally-certified Heavy Equipment Operators (HEO) school on the plant grounds. The extensive road network, terracing needs, and building opportunities will provide direct hands-on experience for students, and provide the GPDA with low-cost graders, dozers, and other necessary equipment. The community college will also investigate partnering the HEO School with a diesel mechanics school. This would allow the community college to provide service to its own equipment and potentially provide diesel engine service for other park tenants.

The City of Parsons is a probable partner in the near future. The aging water system at the base has many needs and operators constantly struggle to meet state standards – primarily because of the limited flow through over-sized water mains. Parsons already has a water main within two miles of the base. By extending the main to the base, with a meter on the border, the GPDA would be able to sell potable water to park tenants. The GPDA could convert the existing water system into a non-potable system for industrial purposes, which would eliminate the need to maintain an expensive potable water system and provide tenants with a dual water system to help contain their costs. This plan would also provide non-potable water through the fire hydrant system.

The State of Kansas has already been a strong partner on many levels. The acquisition of 3,000 acres for public lands will provide a tourism attraction for hunters and nature-lovers. KDWP will also provide land management recommendations and agricultural lease management in exchange for use of undeveloped property. The Kansas

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Legislature has provided \$750,000 for new entrance roads to the industrial park, as well as attractive signage to welcome visitors and occupants. Necessary legislation was also passed to allow the GPDA to dispose of property in the same manner as industrial parks in municipal areas. Finally, the Kansas Department of Commerce (KDOC) has taken a personal interest in the transfer by providing GPDA staff with an audience of its national and international representatives. The secretaries of both the KDWP and KDOC were appointed ex-officio board members to the GPDA board of directors.

Successes/Lessons Learned

Lessons Learned

Getting off to the correct start with the Army was a critical first step for the community. Local volunteers were the first of all the 2005 Base Realignment and Closure (BRAC) communities to arrive at the Pentagon. They asked officials what they needed to do to move forward, rather than objecting to the inevitable. Hiring an experienced executive director very early in the process was critical approach to prevent volunteer burnout and frustration.

Creating the LRA board as a non-political, business-oriented entity was a success on multiple levels. Appointing professional business people, who have a financial investment in the community, provided a strong determination to succeed. The LRA board:

- Provided the business acumen needed to both transition and rebuild
- Did what was necessary, even when unpopular, rather than dwelling on re-election concerns
- Provided an extremely balanced professional base with which staff could interact

The community also learned it is important to mitigate issues between the regulators (state and federal) immediately. Successfully seeking political intervention will move the project forward in a timely manner. Lastly, it is important to know and understand both state and congressional politics to avoid delays and better ensure progress.

Successes

2/12/06	LSPA recognized by the Department of Defense
5/02/06	Army Site Assessment Report complete
8/31/07	Comprehensive Master Redevelopment Plan submitted to the Army and HUD
6/12/08	Public officials briefing hosted nearly 100 people from throughout southeast Kansas and attracted area media
6/30/08	Footprint was successfully negotiated with munitions manufacturer which remain as first tenant
9/19/08	Business Plan and Implementation Strategy completed
11/03/08	Implementation LRA was created by Resolution
12/03/08	Office of Economic Adjustment (OEA) formally recognized Implementation LRA
5/08/09	Economic Development Conveyance submitted
5/27/09	Senate Bill 60 signed by Governor, allowing GPDA the ability to sell property without public bid
9/30/09	First 3,600 acres transferred
12/31/09	Final 6,100 acres expected to transfer

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FIRST ACRES TRANSFERRED!

After nearly five years, the first parcel of the Kansas Army Ammunition Plant finally transferred. As drawn out as those five years may have seemed, this transfer actually marked the first acreage to move through the process for the Army.

On February 9, 2,600 acres was acquired by the Great Plains Development Authority. It included 2,000 acres along the west and south borders, which will later be transferred to the Kansas Department of Wildlife and Parks, and 600 acres, which have been determined free of environmental contamination and ready for industrial development. The 600 acres lies roughly along both sides of the intersection of Road D and Road 1, which will become county roads Scott and 23,000.

There are no buildings on any of the property that was acquired.

Members of the GPDA's board of directors, and the board of the authority's predecessor, the Local Redevelopment Planning Authority, were in attendance and each kicked



Chairman Bob Wood signs the \$1.00 check to purchase 2,600 acres from the Army, while past-chairman James McCarty waits to add his signature.

in a nickel to help raise the necessary dollar for the purchase price. Other nickels came from staff and legal counsel, Fred Johnson.

Unfortunately chief executive officer Dan Goddard had to join the meeting by phone. Goddard had been pulling together last minute details for the signing package at the Pentagon when the historic D.C. blizzard hit, delaying his return home.

Goddard said that difficulties in being first in line for transfer slowed the process because the Army will use the

KSAAP transfer as precedence for later transfers.

A second parcel of 6,100 acres is expected to be acquired by the GPDA in mid-to late-summer. The organization will pay a cash amount of \$49,999 for that parcel, plus enter into a 10-year revenue sharing agreement.

Additional revenue sharing payments will not exceed \$3,450,000. The GPDA has the ability to cap out on those payments at the end of seven years if a total of \$3 million has been paid.

CEO Dan Goddard said he

was extremely pleased with the deal that was struck with the Army, saying, "The real benefit of this payment structure is that it's not a financial burden for the residents of Labette County.

"If we're successful, the Army wins, but if development is slower than anticipated, the people of the county aren't saddled with a financial obligation."

Details of the transaction can be found on page 2.



NEGOTIATED SALE DETAILS

PURCHASE PRICE

The purchase price for the first 2,600 acres is \$1.00. The purchase price for the next 6,100 acres will be \$49,999. Additional payments will be made from gross revenues for a 10-year period, with the total additional payments not to exceed \$3,450,000.

This financial obligation terminates:

- When the 10-year period ends, whether or not the \$3,450,000 has been paid, or
- When the total of \$3,450,000 has been paid, or
- At the end of seven years, if payment of \$3,000,000 has already been paid.

ALLOWED EXPENDITURES

The GPDA's portion of proceeds realized from the property must be reinvested in the property to further enhance its value for future operations. The GPDA is required to submit annual financial statements, audited by an independent CPA, that account for the reinvestment of those proceeds during the 10-year reporting period. All expenditures must fall into one of the following 12 categories.

- | | |
|--|---|
| 1. Road Construction | 8. Pollution prevention equipment or facilities |
| 2. Transportation management facilities | 9. Demolition |
| 3. Storm and sanitary sewer construction | 10. Disposal of hazardous materials generated by demolition |
| 4. Police and fire protection facilities and other public facilities | 11. Landscaping, grading, and other site or public improvements |
| 5. Utility construction | 12. Planning for, or the marketing of, the development and reuse of the installation. |
| 6. Building rehabilitation | |
| 7. Historic property preservation | |

REVENUE TO BE SHARED WITH ARMY

Revenues received by the GPDA, from the property itself and excluding grants, will be shared with the Army in three categories.

Land Sales

- (any property sold other than the original 2,600 acres)
- Years 1 through 6: 25%
 - Years 7 and 8: 30%
 - Years 9 and 10: 50%

Operational, Industrial and Commercial activities

- (lease of ag land, storage units, etc.)
- Years 1-4: none
 - Years 5 and 6: 5%
 - Years 7 and 8: 30%
 - Years 9 and 10: 50%

Rail Operations (rail car storage and movement)

- Years 1-5: none
- Years 6 and 7: 5%
- Years 8 and 9: 30%
- Years 10: 50%



FROM THE PAST...

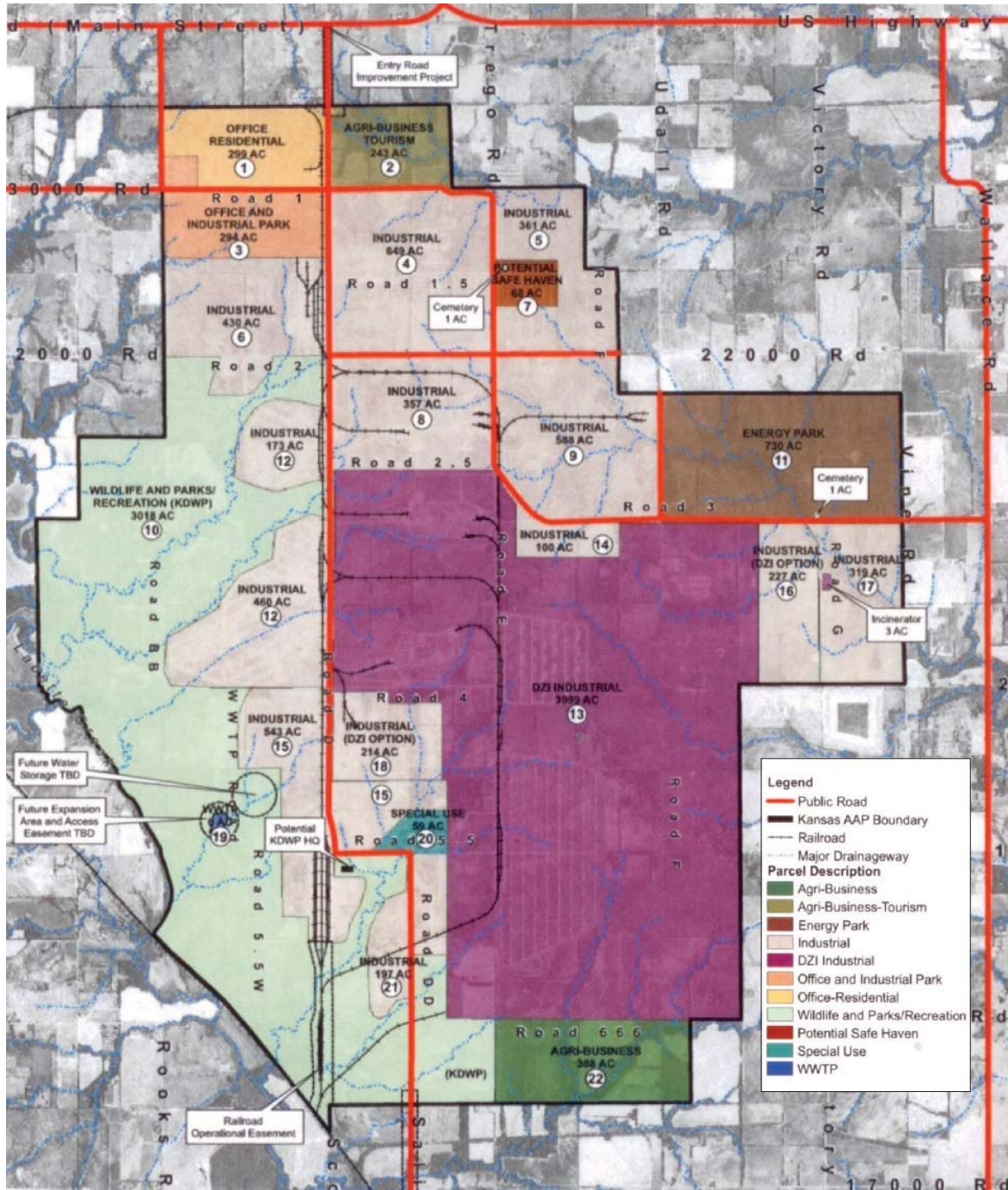


This 1986 aerial view of the Kansas Army Ammunition Plant shows two administration buildings during the move from one to the other.

DZI's manager of quality assurance, Bill Gorman, said he began work in the old building in May 1986, but was moved into the new one about three months later. It is believed that the old one was demolished early in 1987. The circle drive and flag pole can still be seen today.

The "new" administration building contains 67,000 sq. ft. of space and cost \$4,989,400. The building and a surrounding 10 acres will be put up for public bid sometime this summer by the Army.

20-YEAR BUILD-OUT PLAN FOR INDUSTRIAL PARK



Redevelopment proposal by Matrix Design Group

KDOT Project U.S. 169 North of Coffeyville

The U.S. 169 North of Coffeyville project is approximately 6 miles long, beginning just north of the Verdigris River Bridge and extending north to Potato Creek. This section of U.S. 169 will be constructed as a four-lane upgradeable expressway. An expressway is a multilane highway with a median. Connecting roads cross the highway at the same elevation as the expressway to maintain cross-traffic flow. The project scope includes grading, surfacing, seeding, fencing, three intersections, one interchange, and six bridges (fig. 1).

System Enhancement Program

The City of Coffeyville applied for this project through the Kansas Department of Transportation's (KDOT) System Enhancement Program (SEP). SEP is one aspect of the Comprehensive Transportation Program (CTP) passed by the Kansas Legislature and signed into law by Governor Bill Graves on May 10, 1999. The CTP provides \$1 billion for System Enhancements over the 10-year life of the program.

System Enhancement projects must be in the State Highway System or a logical addition to the State Highway System. They must also substantially improve safety, relieve congestion, improve access, or enhance economic development. Projects are divided into three categories: Corridor Improvements, Bypass Construction, and Interchange/Separation Improvements.

Coffeyville requested this project to address increased traffic into its industrial park area, to enhance U.S. 169 traffic safety, to increase economic development, to provide a high-capacity roadway for heavy truck and passenger traffic, and to improve traffic flow at the U.S. 169/U.S. 166 junction.

Environmental Impact

The project had environmental aspects, including cultural and historical, wetlands, wildlife, and hazardous-waste issues that had to be addressed.

Eight sites were considered and reviewed for cultural and historical significance. Several wetlands

were present along the project alignment. Because many were impacted by construction, a new wetland mitigation area is being constructed near the Walmart site.

Certain areas on this project were identified and designated critical habitat for Federal endangered species, including the American burying beetle, and a State threatened species, the spotted skunk. In addition, potential Bald Eagle perching trees are located within 100 feet of the Verdigris River.

The potential for contaminated ground water in several areas affected the design and required soil compaction before construction. The original slope stability and settlement design specified numerous vertical drains to relieve subsurface pore-water pressure. The overlying soil weight would push ground water up through the vertical drains to the ground surface and allows the soil to settle and compact faster. However, because of the contaminated ground water, the original construction sequencing had to be revised to allow more time for slower soil settlement without the drains.

Project Design

This project has been dynamic in terms of project limits, scope, and partners. The original project design specified a four-lane freeway design. A freeway is a multi-lane highway with a median, with access only at interchanges. Right-of-way was purchased with that scope in mind.

The project limits were extended to include the Potato Creek bridge after local inspection found the bridge in need of extensive repair. When the project design was approximately 60% complete, Coffeyville advised KDOT that Walmart planned to construct a new super center at the south end of the project. The design was altered to accommodate the proposed Walmart.

Due to funding issues with the CTP, the project scope required reevaluation. To address funding, the design criteria were changed from a freeway design to an upgradeable expressway. The project has three intersections that were changed from interchanges to

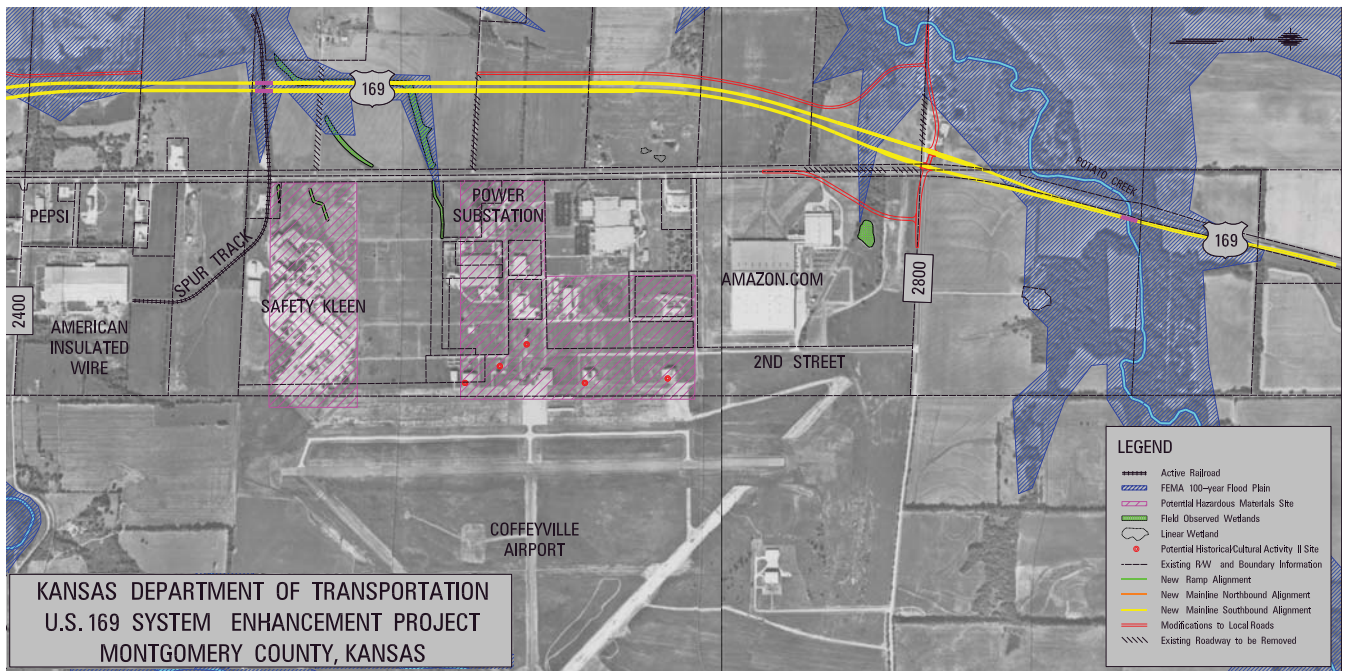
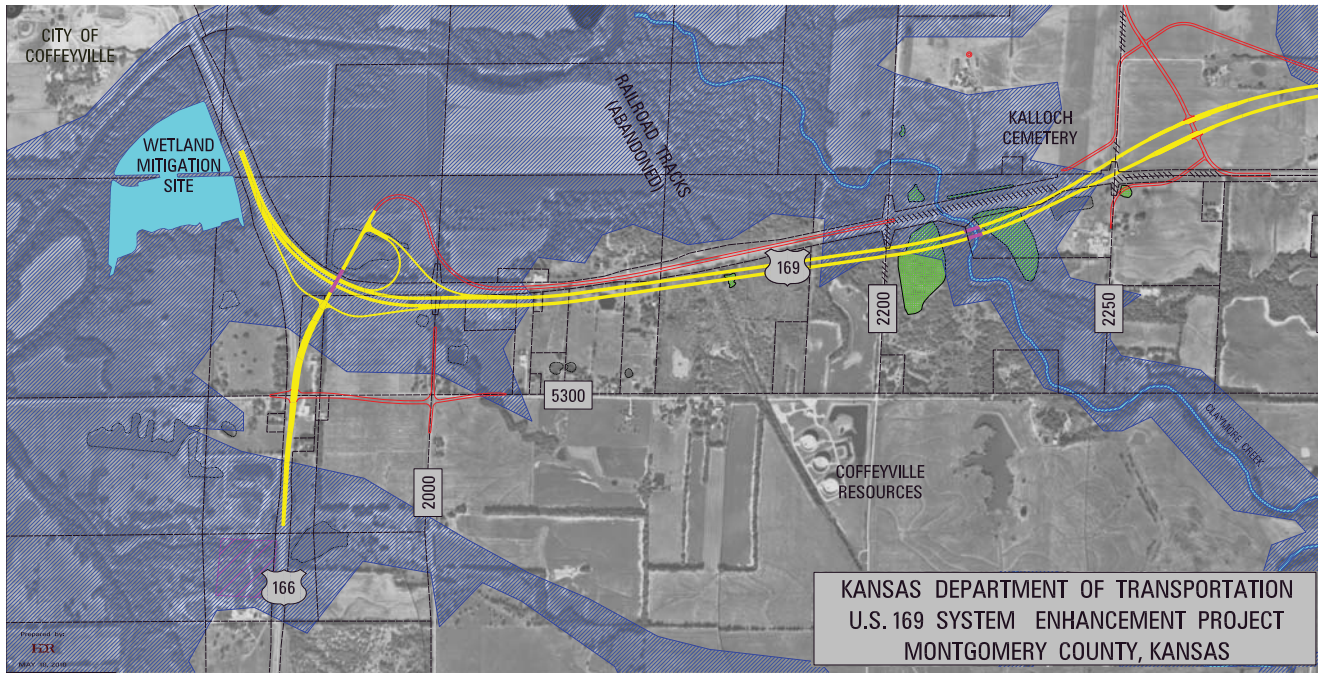


Figure 1. Map showing Project U.S. 169 North of Coffeyville; south half (upper), north half (lower).

at-grade crossings. Because of the funding dilemma, even the fourth interchange at U.S. 169/U.S. 166 junction near the proposed Walmart was changed to an at-grade intersection. To address the traffic impact of the proposed super center, Walmart’s design consultant completed a Traffic Impact Study. The study discovered a significant impact on the traffic volume used for the road design. Because of

the increased traffic from the Walmart and the fact that U.S. 169 is a major trucking corridor, KDOT once again reviewed the design and determined that a partial cloverleaf interchange at U.S. 169/U.S. 166 was more appropriate than an at-grade intersection. The addition of the partial cloverleaf added approximately \$17 million dollars to the project cost.

The Walmart was scheduled to open approximately one year before this project was scheduled for letting. To avoid construction interference, KDOT asked the design consultant to split out the work near the Walmart, which was let and completed prior to Walmart's opening. Additional coordination was needed to address the Amazon.com facility at the industrial park, which required an entrance much larger than KDOT would normally install. KDOT coordinated with Montgomery County and Amazon.com to reach a design acceptable to all project partners.

Construction

The project was let for construction at a special letting on February 04, 2009, and awarded to Sherwood Construction for \$42,495,108.56 on February 11, 2009. The contract was approved on February 22, 2009, and Sherwood Construction started work on March 30, 2009. The project is to be complete on or before November 4, 2011. At this time, Sherwood Construction's schedule shows project completion about three months ahead of the contract date. As of April 30, 2010, Sherwood Construction has been paid \$18,120,035.00. The project, as of April 30, 2010, is 42% complete.

This project is a testament to a successful partnership between local, county, State, and Federal governments and private enterprise. Not only did KDOT partner with Coffeyville and new business entities, but also with existing businesses in the industrial park. All entities have gone the extra mile to take this project from design to construction while addressing the concerns and needs of the many stakeholders.

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CVR Energy's Petroleum and Nitrogen Fertilizer Production

CVR Energy is an independent petroleum supply company and refiner of transportation fuels as well as a producer of ammonia and urea ammonium nitrate fertilizers. The company's petroleum business is composed of four subsidiaries that operate a refinery, fuel terminal, a crude-oil transportation service, and a pipeline network. A fifth subsidiary operates the nitrogen fertilizer facility next to the Coffeyville refinery.

Headquartered in Sugar Land, Texas, with main operations in Coffeyville, Kansas, CVR Energy is one of the largest employers in southeastern Kansas. The refinery employs more than 650 employees, and CVR Energy generated more than \$3.1 billion net sales revenue in 2009.

CVR Energy Petroleum Refining and Supply Operations

CVR Energy's petroleum business consists of a refinery, a system of crude oil transportation pipelines, and a fuel terminal facility.

The Coffeyville refinery is operated by Coffeyville Resources Refining & Marketing. It is a catalytic cracking/delayed coking refinery that processes moderately heavy medium-sulfur crude oil from domestic and international sources. It mostly refines fuel products such as gasoline, diesel, and propane.

The refinery is situated approximately 100 miles from Cushing, Oklahoma, one of the largest crude-oil storage hubs in the United States. Numerous pipelines, including ones from the U.S. Gulf Coast and Canada, provide access to virtually any crude variety in the world.

About 75% of the refinery's 115,000 barrel-per-day crude oil is purchased from international and domestic crude oil suppliers. The remainder is supplied by CVR Energy's crude-oil transportation system operated by Coffeyville Resources Crude Transportation, LLC. Approximately 30,000 barrels-per-day of crude oil are delivered to the refinery through its gathering system, which serves much of the central Midwest.

The fuel terminal is located in Phillipsburg, Kansas, and is operated by Coffeyville Resources Terminal, LLC. The terminal supplies the region with up to 4,500 barrels-per-day of asphalt and refined transportation products.

Petroleum products are sold to other petroleum refiners, convenience-store operators, petroleum jobbers, railroads, and truck stops. Fuel and natural gas liquids produced at the refinery are distributed through Magellan's Central and Mountain pipelines as well as MAPCO, Enterprise Product Partners LP, and NuStar LP pipelines. Gasoline and diesel fuel are also sold from truck-loading racks at the Coffeyville refinery and the Phillipsburg terminal.

CVR Energy Nitrogen Fertilizer Operations

CVR Energy's 20-acre nitrogen production facility adjacent to the Coffeyville refinery is the only commercial facility in North America that uses low-cost petroleum coke—as opposed to natural gas—to produce nitrogen fertilizers. The majority of the petroleum coke is supplied by the Coffeyville refinery. The refinery also produces high-purity hydrogen for export to the nitrogen fertilizer plant. The hydrogen, which would otherwise be consumed as fuel, is converted into value-added ammonia using excess capacity in the ammonia plant.

The technology used to produce ammonia and urea ammonium nitrate fertilizers (UAN) is complex. The gasifier converts low-cost petroleum coke, a refinery byproduct, into a hydrogen-rich synthesis gas. The syngas is then converted into anhydrous ammonia in an ultra-high-efficiency ammonia plant. Approximately two-thirds of the ammonia is further upgraded into UAN in a fully integrated plant licensed from Weatherly, the largest single train UAN plant in North America.

A petroleum-coke fuel supply provides the nitrogen fertilizer business with a competitive business advantage. The plant uses less than 1% of the natural gas required by other nitrogen-based fertilizer facilities. As a result, the facility is not subject to market fluctuation and the economic-forced plant closures that often occur at other domestic fertilizer plants that use natural gas as a fuel source.

In 2009, Coffeyville Resources Nitrogen Fertilizers Operations produced 156,600 tons of ammonia for sale and 677,700 tons of urea ammonium nitrate.

Petroleum Refining Water Use

The production of petroleum gasoline can consume substantial quantities of water from steam-heat sources and cooling in the different refining processes (fig. 1). Of the various refining processes—crude desalting, distillation, alkylation, fluid catalytic cracking (FCC), hydrocracking, and reforming, among others—crude distillation and FCC require the majority of the steam and cooling water use.

Approximately half of a refinery’s water losses are from the boiling and cooling system. Cooling water routed through process coolers and condensers absorbs heat from hot process steams. Warm water is returned to the top of a cooling tower(s) and trickles down over baffles that bring the water into contact with rising ambient air, transferring heat into the air by evaporating water. Water loss occurs through evaporation and by drift from the wind. Evaporation

concentrates minerals in the circulating water and a portion of the concentrated water, called blowdown water, is removed and recycled, or treated and discharged. Makeup water is added to prevent mineral concentration and to account for evaporation, drift, and blowdown losses.

Refining processes consume an average of 1.5 gallons of water for each gallon of crude oil refined. Although it varies by oil source, in general U.S. onshore oil production (i.e., not refining) consumes about 2.1 to 5.4 gallons of water for each gallon of crude oil produced for a total of 3.6 to 6.9 gallons of water. Canadian oil-sands consume 2.8 to 6.5 gallons of water. Saudi Arabian crude production consumes slightly less, using 2.9 to 6.1 gallons of water to produce and process a gallon of oil.

Sources

CVR Energy, 2010, <http://www.cvrenergy.com/index.html>.
 Wu, M., Mintz, M., Wang, M., and Arora, S., 2009, Consumptive water use in the production of ethanol and petroleum gasoline: Center for Transportation Research Energy Systems Division, Argonne National Laboratory, ANL/ESD/09-1, p. 76.

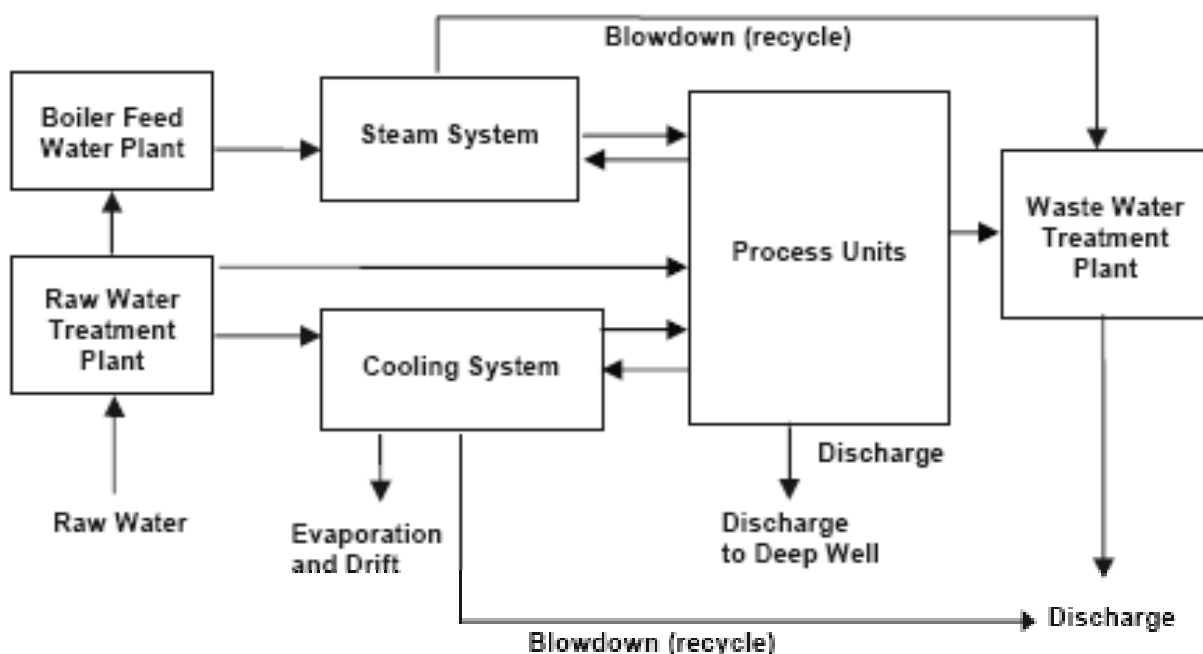


Figure 1. Generalized water usage in a petroleum refinery (modified from Wu, M., et al, 2009).

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Verdigris River Basin Flooding, Summer 2007

During the weekend of June 30–July 1, 2007, heavy rains caused the Verdigris and Fall rivers to overflow their banks, top protective levees, and flood the cities of Fredonia, Neodesha, Independence, Coffeyville, numerous smaller communities, and the CVR Energy refinery in Coffeyville. Heavy rain and flooding persisted in the area for two weeks, forcing up to 3,000 people from their homes. At the end of this section is an aerial map of the Verdigris basin, overlain with GIS coverage showing the extent of the 2007 flooding from just below Fredonia to the Kansas–Oklahoma state line.

On July 1, the Verdigris River at Independence rose to a record 52.4 feet—more than 20 feet above flood stage—and exceeded the previous high water mark of 47.6 feet in 1943. The river crested in Coffeyville at 30.4 feet, 12 feet above flood stage and 4.2 feet above the protective levee. The Caney River crested at 21.8 ft on July 2.

Roads were covered for several days, cutting off parts of the basin from access by emergency vehicles, and the National Guard was mobilized to assist in relief efforts. Water and wastewater treatment plants and industrial facilities were shut down for weeks (fig. 1).

The Federal Emergency Management Agency (FEMA) and the U.S. Small Business Administration (SBA) approved nearly \$40 million dollars for



Figure 1. Independence water-treatment plant during 2007 flood (photo courtesy of the KWO).

disaster relief in 20 southeast Kansas counties to assist in the recovery from the severe storms and flooding. Fifty-six Verdigris watershed district flood-control structures conservatively sustained \$2,107,500 in flood damage. In Montgomery County a reach of streambank was destabilized, threatening a county road that was estimated to cost \$135,100 to repair.

Flood Control Structures

Four Federal reservoirs were constructed in the basin between 1949 and 1981 to manage flooding and provide reliable water supply; from oldest to youngest, they are Fall River, Toronto, Elk City, and Big Hill. The 13 watershed districts in the basin have constructed 222 water-retention structures on tributaries within the basin, and several levees have been constructed in Montgomery County.

Although the upstream Federal flood-control reservoirs functioned properly and numerous smaller watershed dams retained water, this catastrophic event served as a reminder that even with extensive structural flood-control efforts, excessive rainfall over successive days will overcome the ability of the flood-control system to prevent damage.

Floodplain Management

Rivers and streams in the Verdigris basin have historically been prone to flooding during high rainfall events. Most of the basin is native prairie with fairly steep slopes and shallow soils, making it mostly unsuitable for crop production. As a result, row-crop agriculture occurs mainly in the more fertile floodplains. Most communities and cities are sited near stream channels and several, including Neodesha, Independence, Coffeyville, and Altoona (fig. 2), are located at the confluence of major rivers and creeks in the basin, making them further vulnerable to flood damage.

Expansion of urban development in floodplains increases the potential for flood damage. Flood damage may be reduced by preventing development in flood-prone areas and by converting existing land-use types to those more compatible with flood-prone



Figure 2. 2007 flood, looking west toward Altoona (photo courtesy of the KWO).

areas. Local governments can implement floodplain management through planning and zoning and, in some cases, through county sanitary codes. By minimizing structural development in floodplains, floodwaters can spread out onto the floodplain. This reduces the water's erosive potential by slowing it down and allowing sediment to settle out.

The Kansas Department of Agriculture–Division of Water Resources (DWR) provides technical assistance to local governments and has developed a Floodplain Management Guide fact sheet, but there is no State requirement for local governments to implement floodplain management.

Kansas Water Plan Recommendations

In January 2009, the Kansas Water Authority adopted a basin priority issue in the Kansas Water Plan for the Verdigris basin in response to the flooding issue.

Verdigris Basin Priority Issue:

Persistent flood damages in the Verdigris basin indicate a need for a comprehensive evaluation of existing flood-control infrastructure and storage to determine current status, mapping funding needs, and opportunities for flood-management actions and flood-damage reduction in the future.

Recommendations for the basin priority issue in the Kansas Water Plan:

- Assess the effectiveness of existing flood-control infrastructure and develop plans to reduce flood damage to this infrastructure. Ensure that stream obstructions are maintained and free of debris accumulation.
- Complete repairs of damaged flood-control structures and deferred maintenance needs.
- Determine the current floodplain status and promote National Flood Insurance Program participation, model ordinances, and best-management practices to local units of government. Limit development in the 100-year floodplain using Flood Insurance Rate Maps to delineate prohibited areas.
- Engage in Watershed Restoration and Protection Strategies to integrate comprehensive watershed-based flood management with exiting floodplain, wetland, and riparian programs. Assess and inventory watersheds to identify potential locations for non-structural flood-control measures.
- Develop emergency plans for high-hazard dams still needing them.
- Complete breach-zone mapping.
- Coordinate with the DWR Water Structures Program to determine if increased hydrologic and hydraulic evaluation of stream obstructions should be considered in the Verdigris basin or in parts of the basin particularly prone to flooding. Identify and evaluate flood-prone areas that may be attributed to permitted stream obstructions. Consider costs to repair damages against costs to implement the program.

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Verdigris River Stream Corridor Stabilization Project

In response to Verdigris River flooding, approximately 94 acres of river-bottom land in Montgomery County, Kansas, has been planted to trees as a component of a streambank stabilization project (fig. 1). In partnership with the site landowner, Dr. Phil Eastep, three agencies—the Natural Resources Conservation Service (NRCS), Kansas Forest Service, and Farm Service Agency (FSA)—assisted in planting approximately 30,000 trees for erosion control between April 2006 and March 2009. Project plans include installation of streambank stabilization measures to prevent channel erosion during out-of-bank flow periods. Projects such as these fulfill the recommendations outlined in the Kansas Water Plan for the Verdigris Basin Priority issue, which in part recommends comprehensive watershed restoration and protection strategies within the basin.

Project Scope

NRCS and the Kansas Forest Service selected tree species and optimal tree spacing based on the different soil types at the site. The river bottom includes four different soil types. The Verdigris silt loam soil makes up the majority of the river bottom. The remainder of the bottom is Lanton silty clay loam, Osage silty clay, and Dennis silt loam.

The tree species mixture includes black walnut, pecan, bur oak, shumard oak, sawtooth oak, chinkapin oak, northern red oak, hackberry, and green ash. Three-hundred-and-three trees were planted per acre on a 12 ft x 12 ft grid. Bare-root seedlings were planted with a tractor-mounted tree planter followed by two people who ensured proper soil compaction and depth to ensure optimum survival rates.

Interagency Funding and Partnership

FSA provided the initial financial assistance to Dr. Eastep in April 2006. Nine acres received financial assistance through the Bottom Land Timber Establishment on Wetlands Initiative, a Conservation Reserve Program (CRP) program administered by the FSA with technical assistance from the NRCS. The initiative works to improve air and water quality as

well as increase wildlife habitat along wetland areas. It allows landowners to enroll in a CRP practice on lands suitable for growing bottom-land hardwood trees or shrubs to establish a multipurpose forest. In April 2008, another 63 acres received financial assistance through the program. In April 2009, 7.5 acres were replanted through CRP to replace trees lost in the 2007 flood.

In April 2009, another 21 acres at the site received financial assistance through the Environmental Quality Incentives Program (EQIP) administered through NRCS. EQIP is a voluntary program that provides assistance to farmers and ranchers who face threats to soil, water, air, and related natural resources on their land. Both technical and financial assistance is provided by NRCS to carry out EQIP contracts.

In January 2008, a Wildlife Habitat Incentives Program (WHIP) application from the landowner was approved by NRCS. WHIP is a voluntary program for conservation-minded landowners who want to develop and improve wildlife habitat on agricultural land, nonindustrial private forestland, and Native American land. The NRCS provides financial and technical assistance to landowners to carry out this contract. The WHIP funding will be used to complete a future streambank stabilization project on the Verdigris River. In the conservation plan developed by NRCS, approximately 800 feet of the Verdigris River will be protected. Rock armor or rock vanes will be installed along the toe of the river cutbank along with weirs or small overflow dams to raise the level of the streambed and control its grade.

The streambank stabilization project was contracted to the State Conservation Commission (SCC), and the Watershed Institute will complete the site survey and design for SCC. The exact project reach and construction materials will be determined once the site is surveyed and then designed. After design, the NRCS will work with the U.S. Corps of Engineers (USCOE) and Kansas Division of Water Resources (DWR) to obtain permits for the streambank stabilization project.

Conservation Map Plan

Customer(s): PHILLIP B EASTEP
District: MONTGOMERY COUNTY CONSERVATION DISTRICT
Approximate Acres: 221.4
Legal Description: Sec 17 T31S R16E

Field Office: INDEPENDENCE SERVICE CENTER
Agency: NRCS
Assisted By: David Stephen




Legend

Practices (lines)

— <all other values>

Practice name

 Streambank and Shoreline Protection

 Consplan

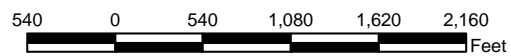


Figure 1. Conservation map plan of Eastep streambank stabilization site (courtesy of NRCS).

Environmental Features

Cultural deposits were found at the Eastep site about 85–360 cm below ground surface along the cutbank of the Verdigris River. Radiocarbon ages on charcoal indicate a time period of about 2300 to 340±15 yrs ¹⁴C yrs B.P. Faunal remains recovered at the site include bison, deer, turtle, beaver, fish, bird, and rodents. Lithics recovered at the site include projectile points, bifaces, biface fragments, and plano-convex scrapers (fig. 2).

Federal law requires an archeological survey to determine if the proposed streambank stabilization project would adversely impact the site. The NRCS has been working with the Kansas Historical Society (KSHS) and Kansas Geological Survey since 2008, when a visual inspection of the area was conducted. A Memorandum of Agreement between NRCS, the Kansas State Historic Preservation Officer, and the landowner was signed in May 2009 to investigate the cultural features. To help meet these goals, the Kansas Anthropological Association will conduct further investigations as part of its 2010 Kansas Archeology Training Program. The June 5–20, 2010,

field school will give public volunteers an opportunity to participate in salvage excavation and investigation of the Eastep site. Professional and avocational archeologists will work together to recover as much data as possible from the site before a major portion is destroyed by further flooding and the streambank stabilization project.

This site is also a State Designated Mussel Refuge. There are 24 different species of mussels in the Verdigris River below Fall River to the Kansas–Oklahoma state line. Although none of the mussel species is listed for statutory protection under the Federal Endangered Species Act (ESA), several are identified as threatened and endangered and one is a Federal candidate species. Candidate species are plants and animals for which the U.S. Fish and Wildlife Service has sufficient information indicating a serious enough species decline to propose listing under the ESA, but are precluded by other higher priority species or activities.

In this river stretch, the Butterfly Mussel and Ouachita Kidneyshell Mussel are identified as



Figure 2. Projectile points recovered at the Eastep site (modified from Tomasic, 2010).

threatened. The Neosho Mucket Mussel and the Western Fanshell Mussel are identified as endangered. Additionally, the Neosho Mucket is a Federal candidate species. The Butterfly, Neosho Mucket, Ouachita Kidneyshell, and Western Fanshell are all State-listed species.

To address the threatened and endangered species at the site, the NRCS collaborated with Kansas Department Wildlife and Parks (KDWP) in obtaining a permit for this project. A KDWP assessment indicates that construction will not adversely impact the mussel population, and the project will likely result in a net benefit to the mussel population and river habitat downstream.

This project is an example of successful partnership between local, county, State, and Federal governments, and the private landowner Dr. Eastep. With technical and financial services provided by NRCS, a series of conservation strategies were designed, and continue to be implemented, to help flood control and protect the state's natural resources in the Verdigris River basin.

Sources

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Mandel, Rolfe D., 2010, Geomorphology and stratigraphy of the Eastep Site (14MY388): Kansas Historical Society, Contract Archeology Program.
Tomasic, John, 2010, Phase IV excavations of 14MY388 at the Eastep Streambank Stabilization Project, an NRCS undertaking in Montgomery County, Kansas—A preliminary report: Kansas Historical Society, Contract Archeology Program.

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SCHEDULE AND ITINERARY

Friday, June 4, 2010

- 6:00 a.m. Breakfast in the main dining room at Flint Oak Resort
- 8:00 a.m. **SITE 9** – Flint Oak Resort
Carbon Capture and Sequestration Panel Discussion
Rex Buchanan, Interim Director, Kansas Geological Survey
Michael Moore, North American Carbon Capture and Storage Association
Saibal Bhattacharya, Assistant Scientist, Energy Research, Kansas Geological Survey
Doug Louis, Kansas Corporation Commission
- 8:45 a.m. Break
- 9:00 a.m. Ecotourism
Mike Hayden, Secretary, Kansas Department of Wildlife and Parks
- 9:30 a.m. Break
- 9:45 a.m. **Bus leaves Flint Oak Resort to Site 10**
- 10:30 a.m. **SITE 10** – Cross Timbers State Park, Toronto Lake
Cross Timbers Geology and Forestry
Bob Sawin, Kansas Geological Survey
Larry Biles, State Forester, Kansas Forest Service
- 11:15 a.m. Bus to Emporia
- 12:30 p.m. Arrive at Holiday Inn Express and Fairfield Inn, Emporia

Carbon Dioxide Sequestration

With concern about climate change have come various proposals for dealing with greenhouse gases such as carbon dioxide. Among those proposals is the geologic sequestration of CO₂; that is, capturing CO₂ and putting it in underground formations. In Kansas, the primary focus of geologic sequestration has been on its use in enhanced oil recovery, and in deep subsurface storage in rock formations already saturated with saline water. Kansas is a strong candidate for CO₂ sequestration because

- the state has a number of older oil fields that would be candidates for CO₂ flooding;
- much of the Kansas subsurface consists of sedimentary rocks that have significant pore space that could hold CO₂; and
- more than 100 years of oil and gas production have generated considerable data about the Kansas subsurface.

CO₂ Sequestration Projects in Kansas

Various projects have begun to study and prepare for the possibility of geologic sequestration in Kansas. In the early 2000s, the Kansas Geological Survey and the Tertiary Oil Recovery Project at KU began a joint project, working with industry partners, to study the use of CO₂ from an ethanol plant to produce oil in the Hall–Gurney field in Russell County. During last year’s Field Conference, we drove through an ethanol plant outside of Liberal, where CO₂ was going to be captured and piped into an Oklahoma oil field for additional production.

In 2009, the KGS received a multi-million dollar grant from the U.S. Department of Energy to characterize the ability of reservoirs in south-central Kansas to store CO₂. A collaborative effort between government and industry, the three-year project includes scientists from the KGS, the University of Kansas and Kansas State University Departments of Geology, and two Wichita-based firms—BEREXCO, Inc., and Bittersweet Energy, Inc.

Research is being done in the nearly depleted Wellington oil and gas field in Sumner County south

of Wichita, which has produced 20 million barrels of oil since 1927. Subsurface rock units in the Wellington field that once held large quantities of oil and gas will be evaluated through drilling and geophysical methods to determine their capacity to securely contain CO₂ in the future. The project is a subsurface-characterization investigation and will not include any sequestration of CO₂.

In addition, the researchers will model the use of industry-emitted CO₂ to squeeze out still-trapped oil and gas unreachable by traditional methods. They will also study the suitability of the Ozark Plateau Aquifer System for sequestration in a 17-county area. The highly saline water in the aquifer, which is about 4,000 feet beneath the surface in south-central Kansas, is not usable for other purposes and is isolated from shallower freshwater aquifers by impermeable rock units.

Another CO₂ sequestration project, initiated by Wichita-based company CAP CO2 LLC, received a \$2.7 million DOE award for a Phase I project. Phase I awards funded feasibility studies and preliminary design for capture, compression, pipeline transportation, and injection of CO₂ into depleted oil fields for enhanced oil recovery and sequestration. Phase II awards will fund final design, construction and reworking of oil fields, and operations for a 5-year period beginning October 2010. To complete Phase II, the company has applied for a portion of \$1.3 billion in funding to be announced in June. DOE funds are a part of the American Recovery and Reinvestment Act and are matched by industry dollars.

The KGS is one of the project partners, along with the University of Utah and Southwest Regional Partnership, Schlumberger Carbon Services, Blue Source LLC, and others. CAP CO2 LLC’s mission is to identify and implement commercially profitable carbon-mitigation plans.

Regulating the Injection of CO₂

Increasing investigation into sequestration has led to the need to develop regulations to ensure that the injection of CO₂ is both safe and effective.

On the national level, the U.S. Environmental Protection Agency is developing regulations for CO₂ sequestration, including the designation of a new class of wells, class VI, that would be used for sequestration of CO₂. On the State level, the Kansas Corporation Commission was charged with developing rules and regulations governing CO₂ emplacement. The KCC approved those rules in February 2010, and they are now in effect. In addition, a number of organizations have been involved in the development of regulations, including the Interstate Oil and Gas Compact Commission, which developed a legal and regulatory guide for the states.

Sources

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The Cross Timbers and Chautauqua Hills

The Chautauqua Hills physiographic region of southeast Kansas, a sliver of rolling upland capped with thick sandstone, coincides with the Cross Timbers ecosystem, a patchwork of ancient hardwood forests interspersed with prairie grasses. That these geologic and ecological regions overlap is no coincidence. Black jack oaks, post oaks, and other hardwoods of the Cross Timber thrive in the sandstone environment.

While the Chautauqua Hills designation is recognized only in Kansas (fig. 1), the Cross Timbers region extends from north-central Texas into Oklahoma, where it is most prevalent, before crossing a short distance into Kansas (fig. 2). (A small area of western Arkansas is also sometimes included in the region.) Although the age and depositional characteristics of the geologic units underlying the Cross Timbers vary from state to state, sandstones and sandy/clayey soils predominate. Just as the Cross Timbers is not one solid forest but a conglomeration of woodlands, the underlying sandstone is not a unified deposit. Geologic environments supporting Cross Timbers vegetation range in age from 300-million-year-old Pennsylvanian to much younger Cretaceous.

Chautauqua Hills Geology

Approximately 10 miles wide, the Chautauqua Hills formed primarily in thick Pennsylvanian-age sandstones. Sand, silt, and mud were deposited in an ancient river valley on the northern edge of a Pennsylvanian sea. These sediments were later buried and compacted—the sands became sandstone and the muds became shale. Over millions of years, uplift and erosion exposed the sandstone and shale at the earth’s surface. Further erosion dissected the area into a series of low hills, capped by more resistant sandstone. The Verdigris, Fall, and Elk rivers cross the area in narrow valleys walled by sandstone bluffs. Topographic relief in the region is never more than 250 feet.

Sandstones capping the Chautauqua Hills are the Tonganoxie Sandstone Member of the Stranger Formation and Ireland Sandstone Member of the Lawrence Formation (fig. 3). Both members are remains of deposits that filled a large, ancient river valley during the Pennsylvanian Subperiod. Some of the sandstone is marked by ridges and troughs called ripple marks (fig 4.). Fossil ripple marks provide information about the direction of the current, the environment, and, to a degree, the depth of the water.

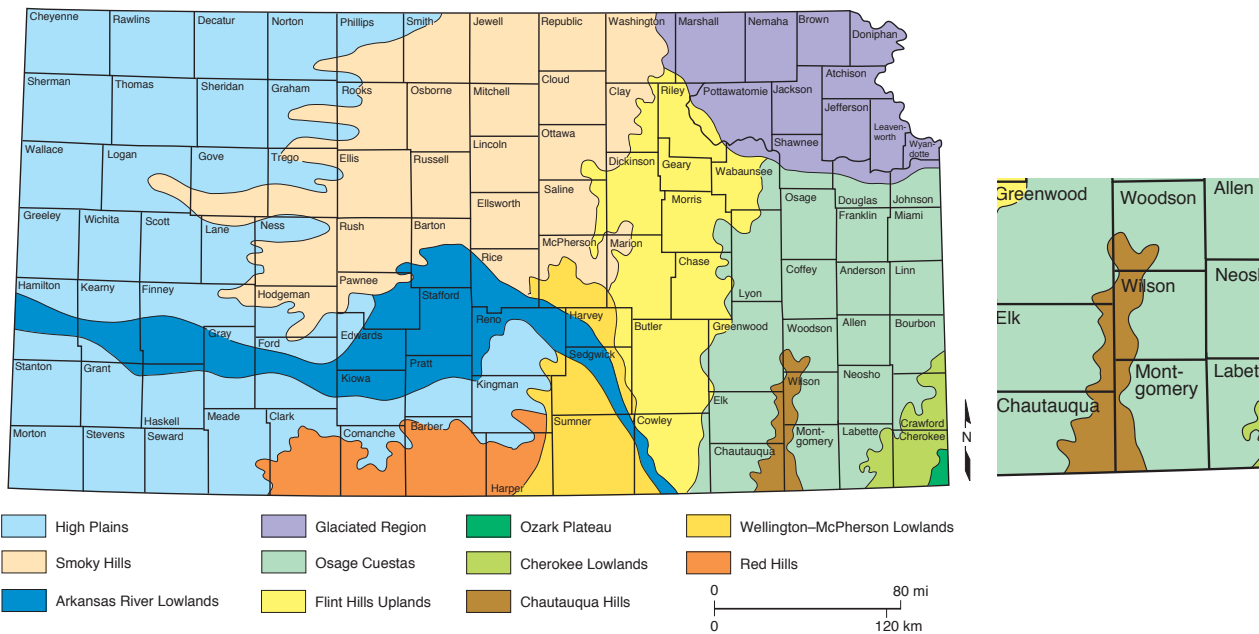


Figure 1. Physiographic map of Kansas showing the Chautauqua Hills physiographic region.

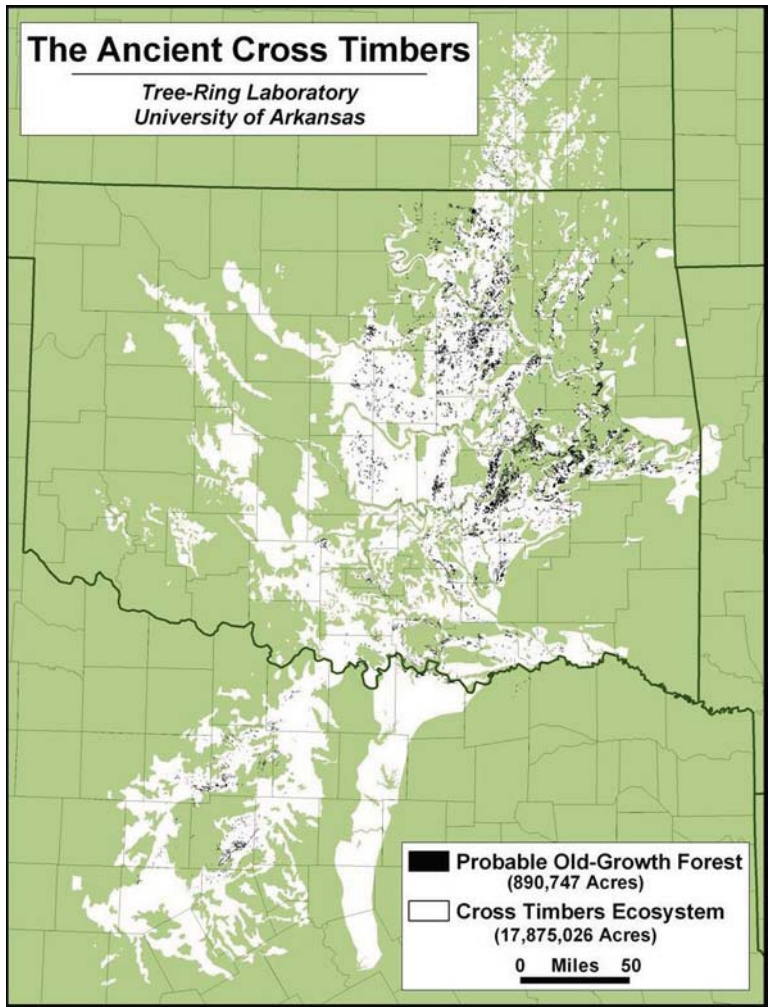


Figure 2. The potential natural distribution of the Cross Timbers ecosystem, based on the 1964 A. W. Kuchler map (courtesy of The Ancient Cross Timbers Consortium).

Oil and natural gas produced from small fields in the region was used to smelt zinc and manufacture bricks, glass, and ceramics in southeast Kansas during the late 19th and early 20th centuries. Although small quantities of oil and gas are still produced in the region, the industries dried up as other natural resources used in the manufacturing processes became scarce.

Cross Timbers Ecoregion

Ecoregions, such as the Cross Timbers, denote areas of general similarity in ecosystems and in the type, quality, and quantity of environmental

Figure 3 (right). Ireland Sandstone near Toronto Lake Dam (photo by Grace Muilenburg).

resources. Although the climate varies significantly from north to south in the Cross Timbers, especially in the winter, the vegetation is consistent throughout. In Kansas, a combination of dense hardwood growth, savanna (grassy woodlands), and glade (open areas within a woodland) distinguishes the Cross Timbers from the neighboring oak-hickory forest and tallgrass prairie of the surrounding Osage Cuestas and tallgrass prairie of the Flint Hills farther west.

Besides post oaks and black jack oaks, common trees and shrubs found in the region include black hickory, bitternut hickory, black oak, shumard oak, and red cedar. Little bluestem, big bluestem, and Indiangrass grasses are also common in the Cross Timbers and in the surrounding grassland regions. Black bear, bison, Carolina parakeet, and passenger pigeons once lived in the region.

Trees in the Cross Timbers are stunted compared to those in other forested areas, rarely growing more than 8 inches in diameter and 30 feet in height. In the past they were often recognized as little





Figure 4. Ripple marks in sandstone, Chautauqua County (photo by John Charlton).

more than a nuisance to farmers and travelers. (“It was like struggling through forests of cast iron,” wrote Washington Irving, who crossed present-day Oklahoma in 1832.) Uneconomical for mass lumbering, thousands of the ancient post oaks, up to 400 years old, have survived, particularly in steeper terrain unsuitable for farming. Five-hundred-year-old red cedars have been found along fire-protected bluffs. Level areas within the Cross Timbers region, however, have largely been cleared for cultivation and grazing.

Cross Timbers State Park and Other Parks

Cross Timbers State Park in Woodson County is adjacent to Toronto Lake. Vegetation in the park includes post oak, blackjack oak, northern red oak, sumac, rusty blackhaw, serviceberry, dogwood, and green ash. In November 1982 increment core samples were collected from 26 of the park’s mature post oaks.

Eighteen were found to be at least 200 years old, and the five oldest had inner ring dating from 1724, 1727, 1736, and 1740 (The Ancient Cross Timbers Consortium).

Other parks in the area are Woodson State Fishing Lake in Woodson County (fig. 5) and Berentz–Dick (Buffalo Ranch) Wildlife Area and Copan Wildlife Area, both in Montgomery County.



Figure 5. Dense oak forest on eastern side of Woodson State Fishing Lake (photograph from Kansas Physiographic Regions: Bird's-eye View, used with permission of the authors).

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