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FINAL REPORT

**CONSTRUCTION MATERIALS INVENTORY/ GEOGRAPHIC
INFORMATION SYSTEM DEVELOPMENT PROJECT FOR
POTTAWATOMIE COUNTY, KANSAS**

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A COOPERATIVE TRANSPORTATION RESEARCH PROGRAM
BETWEEN:

KANSAS DEPARTMENT OF TRANSPORTATION
KANSAS STATE UNIVERSITY
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16 Abstract Construction Materials Inventories (CMI) created for the Kansas Department of Transportation (KDOT) for 36 Kansas counties are from 23 to 42 years old and in need of updating. New data, GIS technologies, and computer display tools offer new capabilities for the development of interactive web-based CMIs that can be continuously updated. This project developed a pilot CMI interactive website for Pottawatomie County. The county has been experiencing population growth, no state CMI had ever been produced, and the relevant USGS Material Construction Bulletin 1060-C was printed in 1959. Tasks involved gathering and evaluation of existing geologic and industrial mineral data, and collection of new data that was entered into the interactive website, which was designed and developed by Kansas Geological Survey staff. Information was collected on the location and type of approximately 120 commercial quarries, both active and abandoned. Over 100 individual sites were located where previous workers had measured and described sections of rock outcrops. Additional sections were measured and described for this project. Over 400 feet of core was collected and examined where outcrop data were sparse. KDOT project records, geological literature and KGS and US Army Corp of Engineer core holdings were compiled and examined. KDOT records contained geological plan and profile information on over 60 highway miles and 12 bridge construction sites. The website is hosted at the Kansas Geological Survey and will be maintained by Kansas Geological Survey staff. The CMI website can be accessed at: http://www.kgs.ku.edu/CMI/ . CMI website capabilities include: 1) Map navigation, layer control, ability to scale level of detail; 2) Hundreds of geographically fixed locations that can be "clicked" on to access geologic and laboratory analysis data; 3) Map overlays that include geology, topography, aerial photography, roads, rivers, streams, city and county boundaries, etc.; 4) All data and map products are available for download and printing from the web site.			
17 Key Words Geographic Information System, Geology, mapping, Interactive web-site, Construction Materials Inventory		18 Distribution Statement No restrictions. This document is available to the public through the National Technical Information Service, Springfield, Virginia 22161	
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Final Report

Prepared by

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A Report on Research Sponsored By

THE KANSAS DEPARTMENT OF TRANSPORTATION
TOPEKA, KANSAS

March 2008

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PREFACE

The Kansas Department of Transportation's (KDOT) Kansas Transportation Research and New-Developments (K-TRAN) Research Program funded this research project. It is an ongoing, cooperative and comprehensive research program addressing transportation needs of the state of Kansas utilizing academic and research resources from KDOT, Kansas State University and the University of Kansas. Transportation professionals in KDOT and the universities jointly develop the projects included in the research program.

NOTICE

The authors and the state of Kansas do not endorse products or manufacturers. Trade and manufacturers' names appear herein solely because they are considered essential to the object of this report.

This information is available in alternative accessible formats. To obtain an alternative format, contact the Office of Transportation Information, Kansas Department of Transportation, 700 SW Harrison, Topeka, Kansas 66603-3745 or phone (785) 296-3585 (Voice) (TDD).

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The contents of this report reflect the views of the authors who are responsible for the facts and accuracy of the data presented herein. The contents do not necessarily reflect the views or the policies of the state of Kansas. This report does not constitute a standard, specification or regulation.

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Construction Material Inventory

ABOUT

A prototype web system to help understand the construction resources of Kansas, starting with Pottawatomie County.

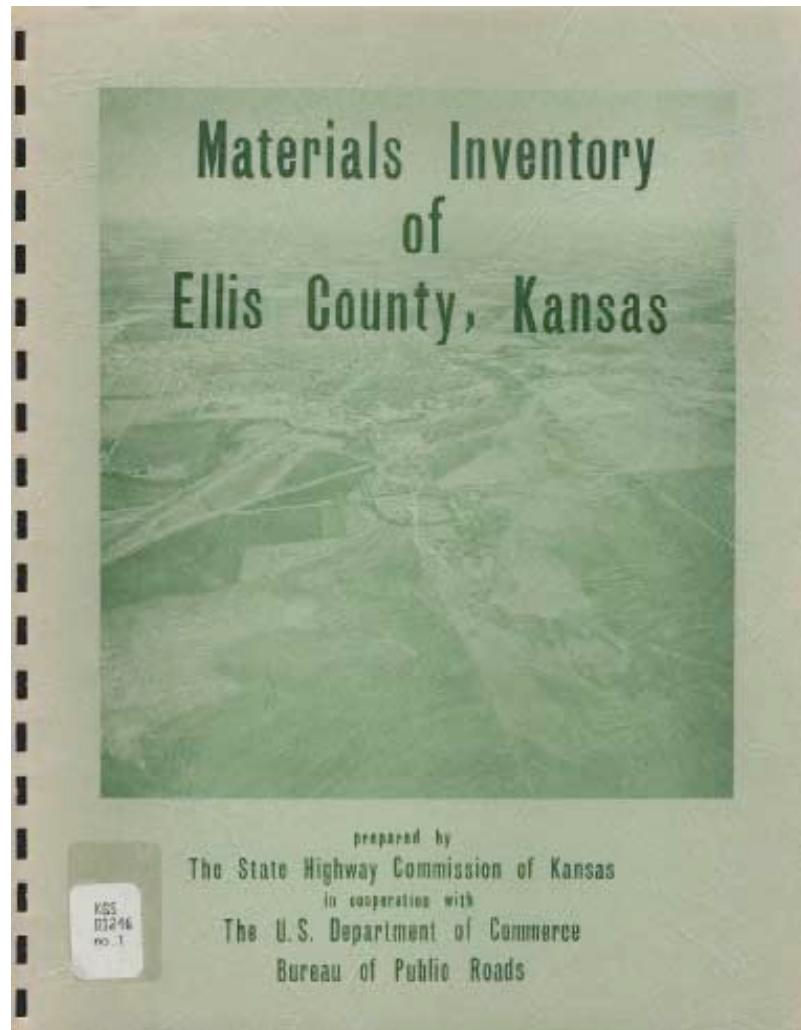
PARTICIPATING GROUPS

[Kansas Department of Transportation](#)

[Kansas Geological Survey](#)

Why a Construction Material Inventory Website?

In the past 50 years, both Federal and State agencies have produced printed county inventories that contained information regarding the quality, quantity, and location of various natural resources that could be useful in the construction of roads and buildings. The United States Geological Survey (USGS) has printed material inventories in 20 Kansas counties from 1947 to 1959. State of Kansas agencies, including the Kansas Department of Transportation (KDOT), produced 36 county construction material inventories from 1963 to 1982. Some USGS county inventories overlapped with KDOT publications. These inventories proved to be of great utility to state transportation employees, geologists, and private industry. Despite the age of some of the documents they remain a handy reference tool today.



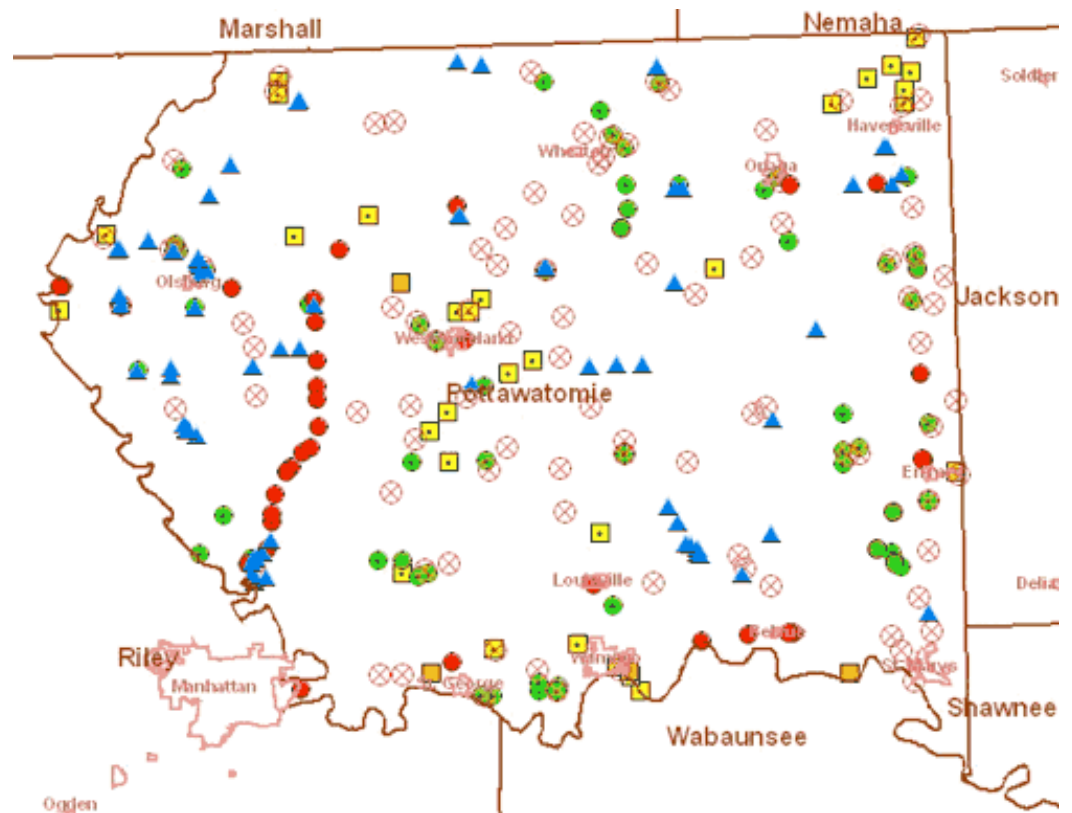
Inventories contained an overview of the geological history and stratigraphy germane to the area, photographs of outcrops from road cuts and quarries, and location maps depicting sites where specific materials could be found (sand, aggregate, clay). For some sites, material

laboratory analysis information (e.g., aggregate specific gravity, absorption, soundness) was available. Some USGS publications contained numerous measured sections of rock exposures.

As valuable as these inventories were and continue to be, similar information was not available in the majority of Kansas counties, and the inventories themselves were static, one-time only publications. Today, there are areas of Kansas experiencing population growth and economic development that are in need of updated information on the availability, quality, quantity, and location of aggregate and other construction materials that can be readily used by KDOT personnel, county and city public works departments, aggregate resource producers, and the general public.

The advent of new computer web-based technologies and Geographical Information Systems (GIS) software applications provided the opportunity to create a dynamic Construction Material Inventory (CMI) digital platform. In 2006, with funding provided by KDOT, the Kansas Geological Survey assigned personnel and resources to develop a CMI website pilot project starting in Pottawatomie County. The county has been experiencing population growth, no state CMI had ever been produced, and the relevant USGS Material Construction Bulletin 1060-C was printed in 1959.

During the winter and spring of 2006 a search was conducted for KDOT project records, geological literature and KGS and US Army Corp of Engineer core holdings. Information was collected on the location and type of some 120 commercial quarries, both active and abandoned. Over 100 individual sites were located where geological workers had measured and described sections of rock outcrops.



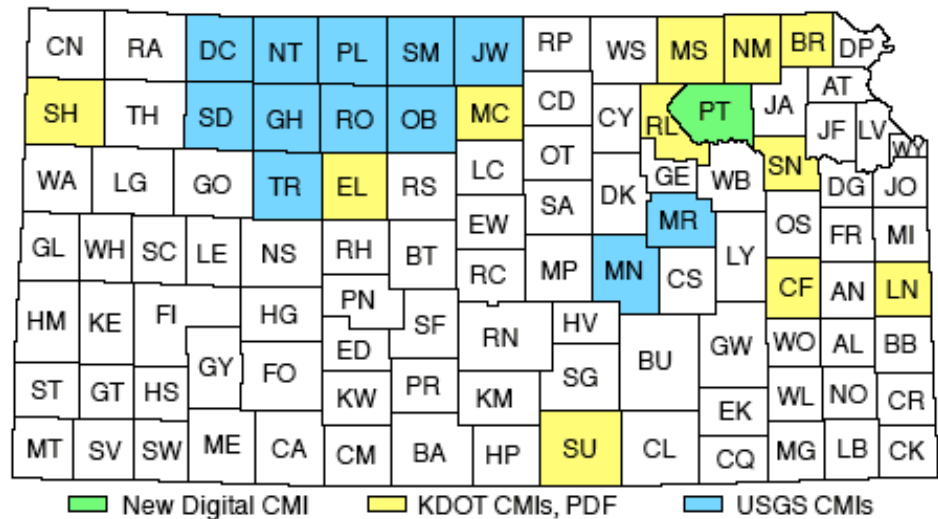
KDOT records contained geological plan and profile information on over 60 highway miles and 12 bridge construction sites. Field geologists visited many of these sites during the spring, summer, and fall of 2006 to confirm the original geological findings, pinpoint sites

more precisely with GPS technology, and to photograph key locations. In areas where geological research was more sparse, a limited rotary wire-line drilling program collected nearly 400 feet of core. At the KGS headquarters in Lawrence, Kansas, field geologists with student assistants worked with website development experts to digitize and place point data online. GIS specialists, cartographic experts, and Data Access/Support Center personnel (DASC) labored to place a variety of interactive mapping tools and geographical-based overlays alongside the current digital geology map for Pottawatomie County.

Key CMI Website Capabilities:

- Links to related databases, websites, and digital libraries (USGS, KDOT, KGS . . .).
- The ability to navigate swiftly to precise locations and return to a full-county view.
- Hundreds of geographically fixed locations than can be "clicked" on to access additional data.
- View a particular site that can be overlain with digital transparencies for geology, topography, aerial photography, roads, rivers, streams, city and county boundaries, etc.
- The ability to print out a map of the specific area you want with the GIS features of your choice.

The basic website architecture and GIS framework is now complete. A critical new advantage is that the web-based computer environment provides the opportunity to have CMI information maintained and updated on a continuing basis as new data becomes available. The long range goal is now to build upon this pilot study in future projects to create updated interactive computer-based material inventories for all Kansas counties, with the priority of developing CMIs for counties where the need for information is determined to be most critical.



This server is run by the [Kansas Geological Survey](http://www.kgs.ku.edu).
 This page updated March 20, 2007.
 The URL for this page is <http://www.kgs.ku.edu/CMI/about.html>
 Comments to webadmin@kgs.ku.edu



Construction Material Inventory

ABOUT

A prototype web system to help understand the construction resources of Kansas, starting with Pottawatomie County.

PARTICIPATING GROUPS

[Kansas Department of Transportation](#)

[Kansas Geological Survey](#)

How to Use This Inventory

Welcome to the Construction Material Inventory (CMI) website. This site combines the latest in Geographical Information System (GIS) features with geological and engineering information to create a modern, interactive tool for exploring the potential construction resources available in a particular area. You can expect to see changes in the website from time to time as it is a dynamic tool undergoing periodic additions and updates. Feedback is important; let us know if we can improve a feature or its explanation. This how-to-use document demonstrates the capabilities and types of information currently available. Clicking on an item in the Table of Contents below will take you to that subject.

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[Topological Map overlay](#)

[Land Cover overlay](#)

[2002 Black and White Aerial overlay](#)

[2005 Color overlay](#)

[Part III--Website Databases, Types of Information Available](#)

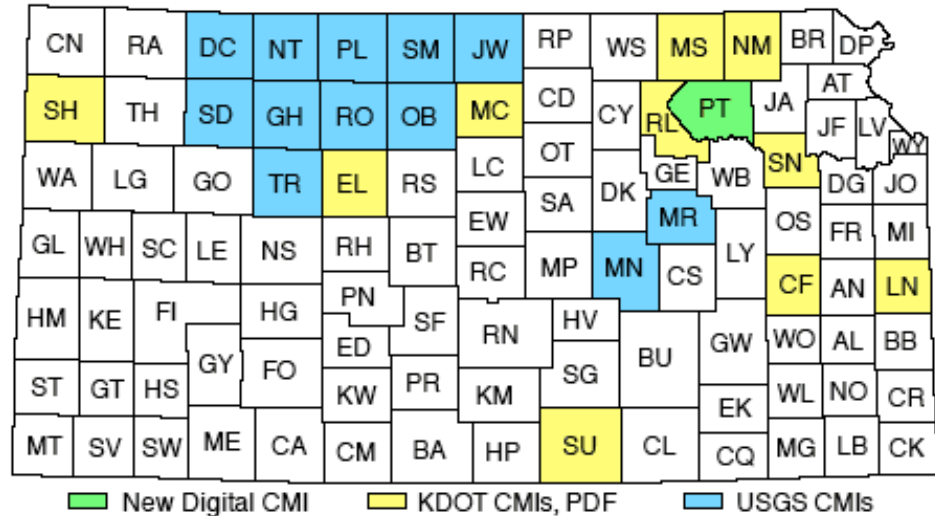
[CMI Points and WWC5 Wells](#)

[KDOT Highway and Bridge Projects](#)

[Material Analysis Sites](#)

Part I--Website Organization, Navigation, Print Features

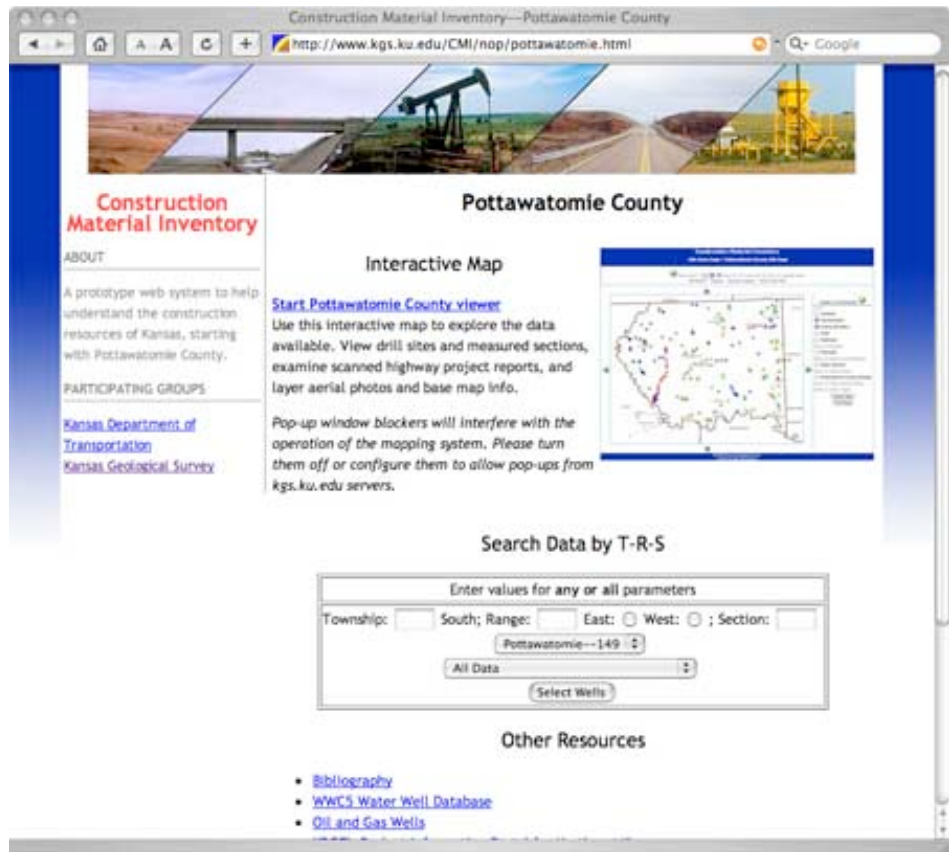
The CMI Homepage State map allows you to access available data by clicking on the county you wish to access.



- Interactive map features and data are currently available for Pottawatomie County (in green).
- In addition, KDOT Construction Material Inventories are available as PDF files (in yellow). Within some KDOT inventories are links to available USGS inventories for the same county.
- The USGS CMIs shown above (in blue) have no corresponding KDOT county inventory publication. Accessing the USGS documents may require the downloading and installation of a particular software plug-in (downloading links and instructions available at the USGS website).

By clicking on the Pottawatomie County highlighted in green, we enter the Pottawatomie County Construction Material Inventory Homepage. There are three main elements:

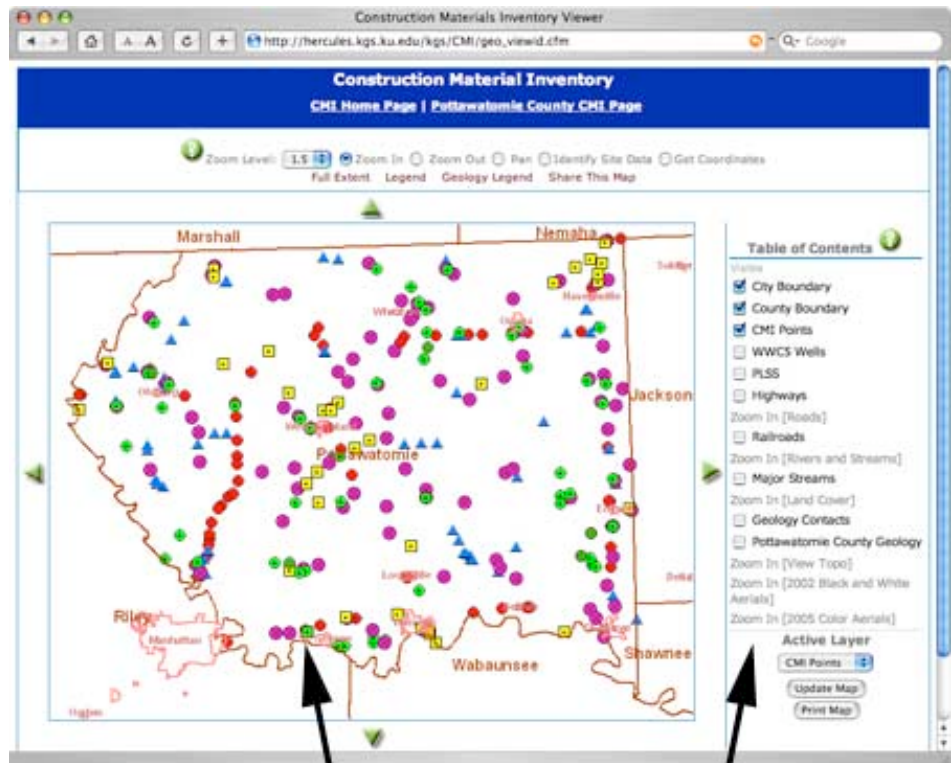
1. An interactive map with GIS capabilities;
2. A search engine that pulls all data within a Township, Range, and Section into a table format, rather than a graphical format as with the interactive map;
3. An "Other Resources" listing internet links to relevant organizations and databases. "Bibliography," for example, lists all publications and research thesis papers pertaining to Pottawatomie County.



Interactive Map

Clicking on the **Pottawatomie County Viewer** brings you to the interactive map viewer for Pottawatomie County (see image below). **Warning!** If your pop-up blocker is turned on, it may interfere with using interactive map features or in being able to access point data. At the Menu feature at the top of your webpage, go to "Tools" and then to "Popup Manager" and then click on "Allow Popups."

The **Table of Contents** on the right-hand side of the screen (black arrow) lists map overlays that can be turned on and off. Some overlay features will only activate once a certain level of resolution, or zooming in, is achieved. Please note that the **City Boundary**, **County Boundary**, and **CMI Points** features are defaulted to be checked on when the interactive map is first accessed. The Table of Contents and its overlays will be explained in greater detail in Part II.




Interactive Map

Table of Contents

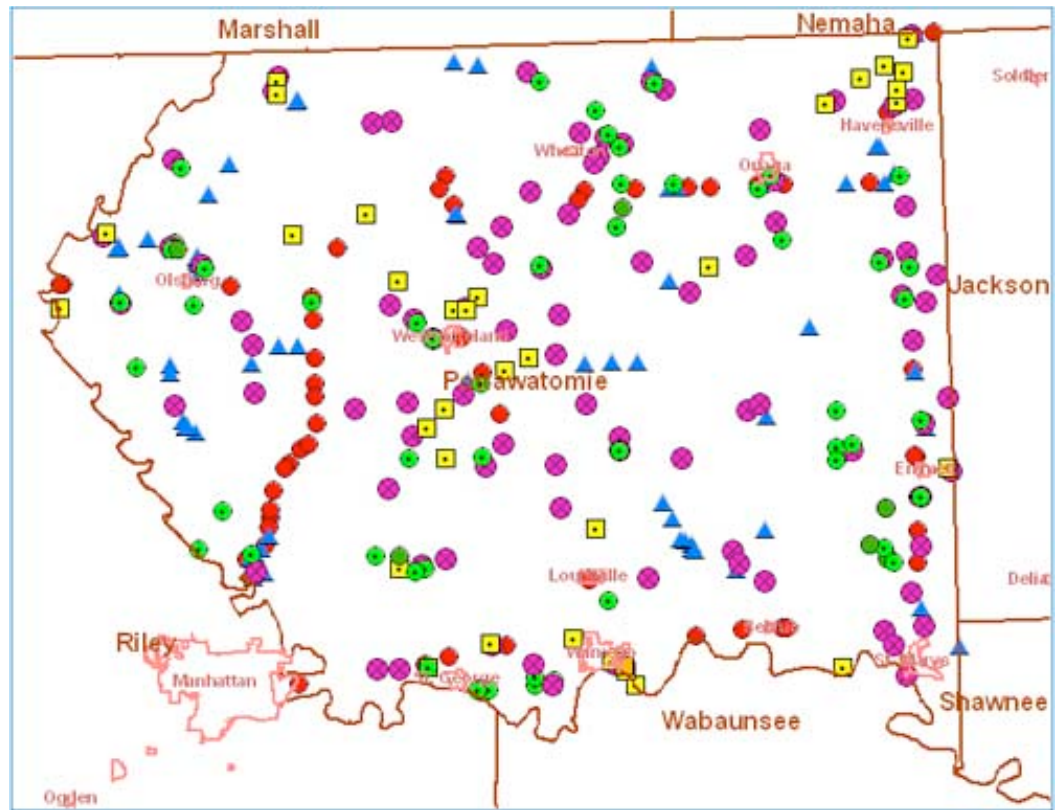
Within the interactive map viewer, the **Navigation Tool Bar** at the top of the page allows movement within the interactive map.



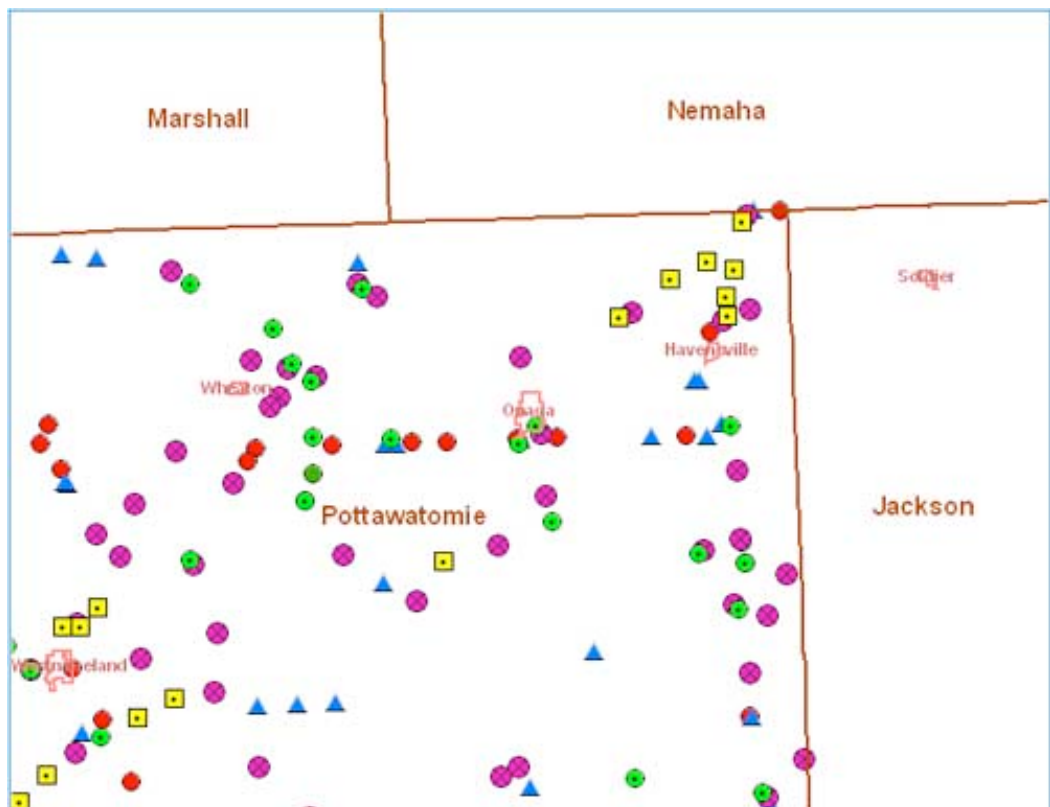
Clicking on the question mark  will activate a panel that explains the tool bar functions. You may wish to switch back and forth between this document and the Pottawatomie County Interactive map to experiment with the illustrated changes yourself.

Zoom Level: The default zoom level is 1.5x, with additional levels of 2x, 3x, 5x, and 10x. The best way to discover what zoom level works best for your search is to take a few minutes to experiment and get a feel for zooming in and out. For example, starting at full extent (the entire county), choosing 10x, choosing "zoom in" and clicking once in the interactive map will allow you to zoom in from the full county view to a twelve square mile area or about one-third of a township.

The image below is the Pottawatomie County Interactive map at "Full Extent."

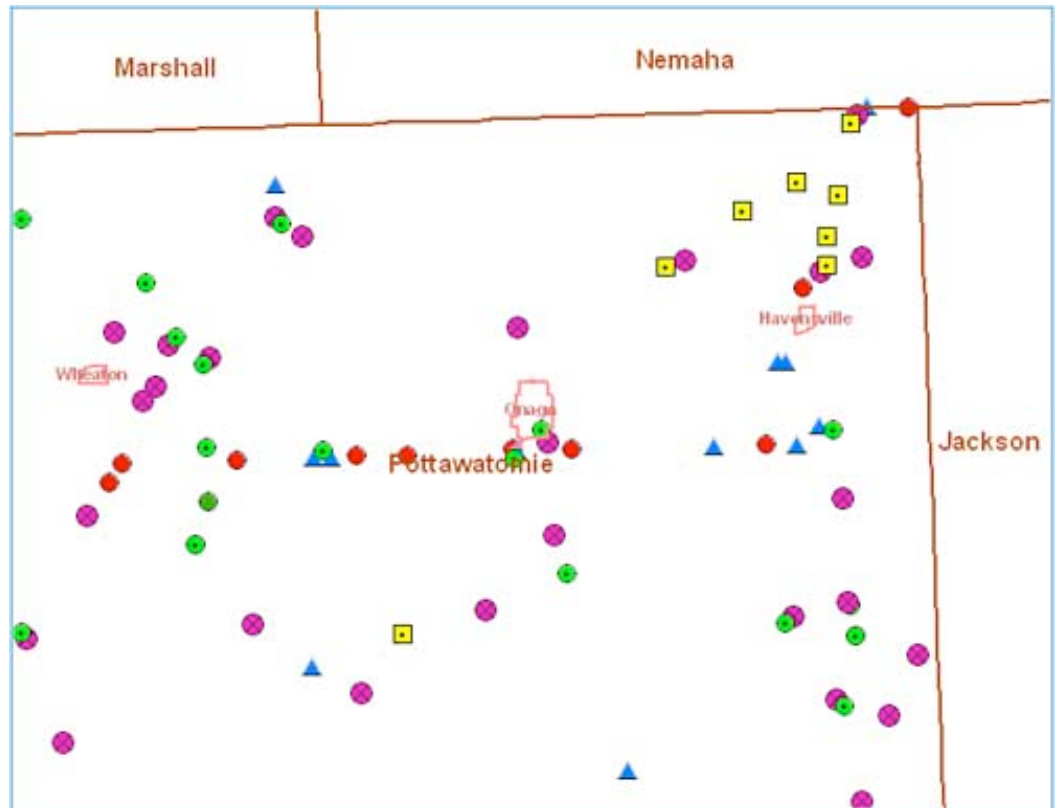


With the zoom level set at 1.5x, click on the city/town area labeled "Onaga" in the upper right-hand corner. The image below is of the interactive map after clicking 1.5x once. Also take note of the changes that automatically occur in the Table of Contents. The Topo and Aerial overlays are now active.

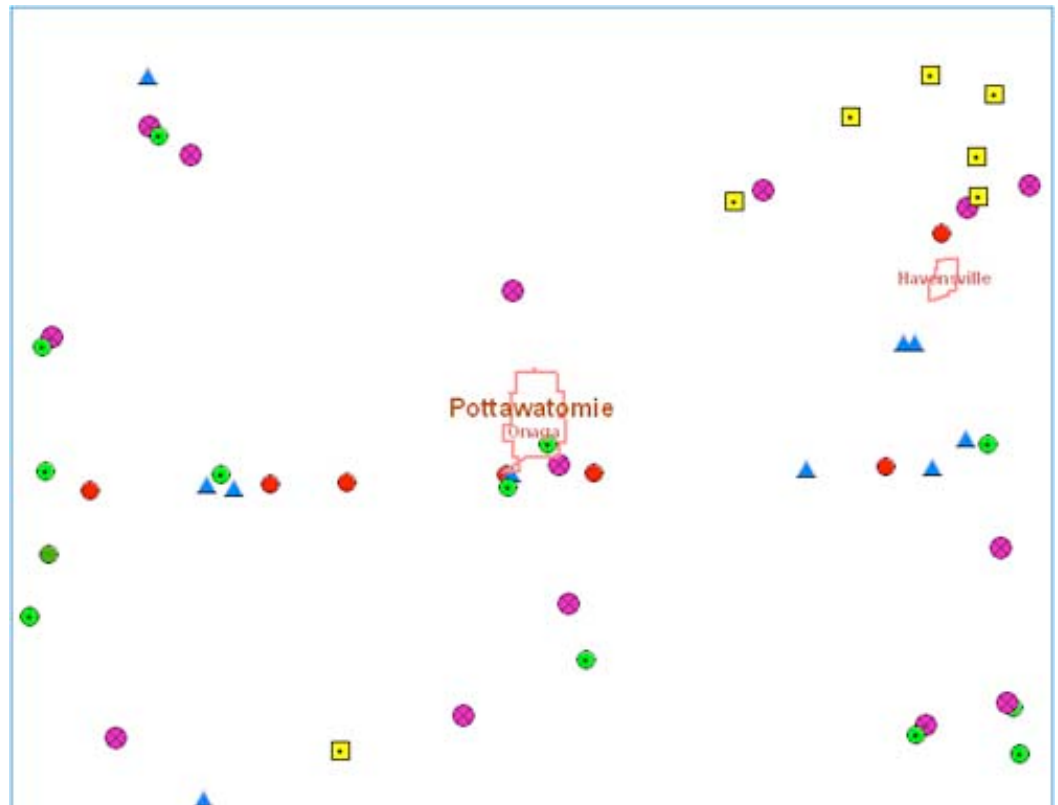


The image below is Onaga after clicking twice with zoom 1.5x. Please note that the Table of

Contents has not changed.

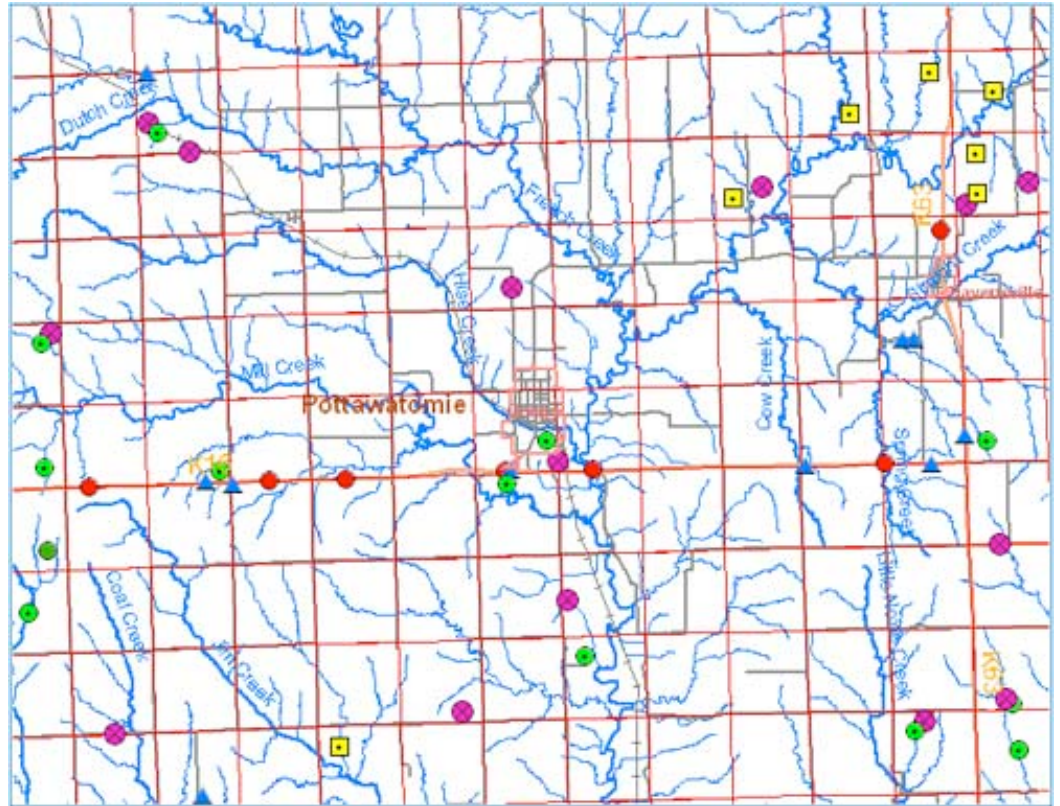


Click on Onaga for the 3rd time with zoom 1.5x and you get the image below. Please note that in the Table of Contents, all features will be active now.

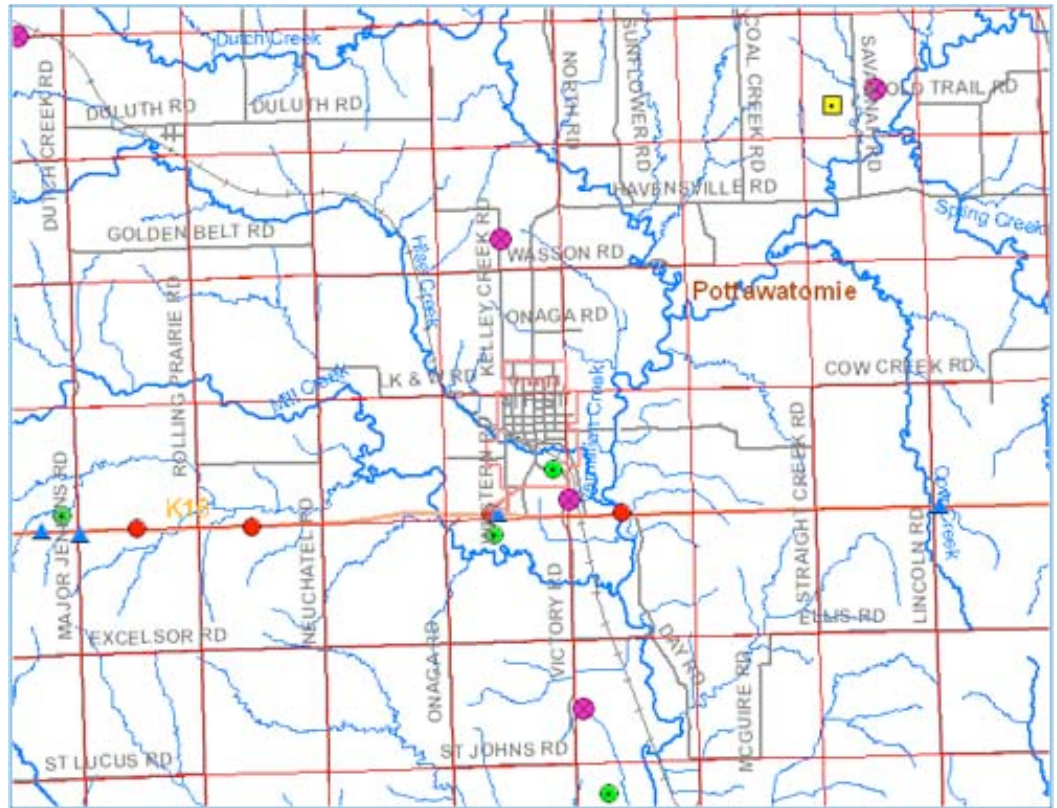


In the Table of Contents, if we check on **PLSS**, **Highways**, **Roads**, **Railroads**, **Rivers and Streams**, and **Major Streams**, and then click on "Update Map" box at the bottom of the

Table of Contents, we should see an image similar to the one below. Note that clicking on the Update Map by itself doesn't increase or decrease the level of resolution. Each red square represents a township and range section and is usually about one square mile. Blue lines are waterways.

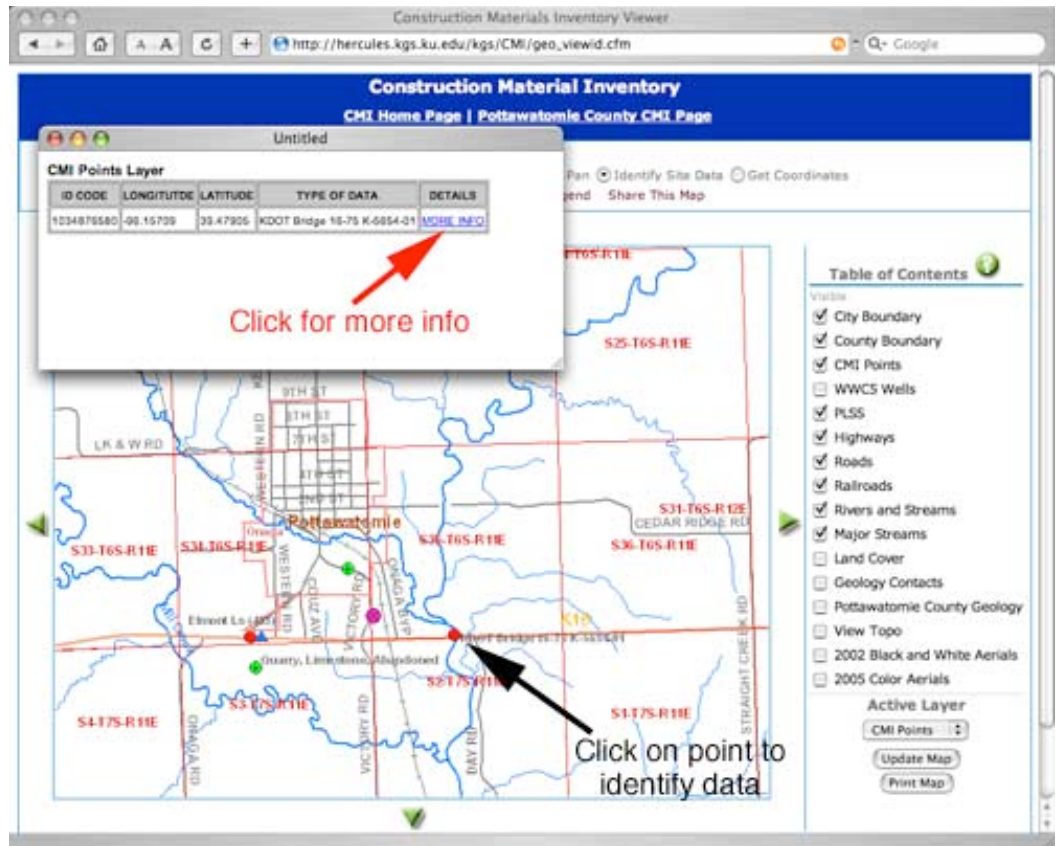


Clicking on the Onaga City area a fourth time (with zoom set at 1.5x) produces the image below. Note that the roads now are labeled with names. A fifth zoom (1.5x) will produce some street names within the Onaga town area itself.

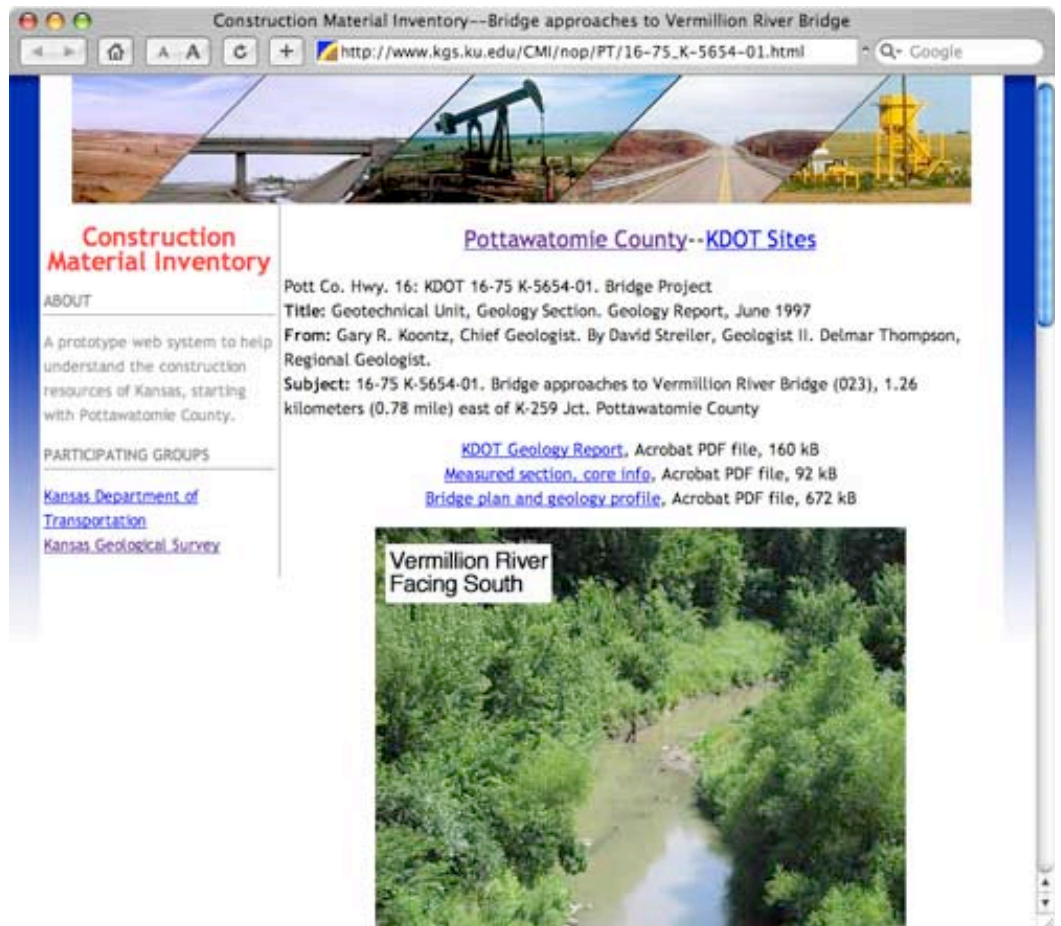


Identify Site Data: Most points in the interactive map represent sites that have additional data that can be accessed by choosing "Identify Site Data" and then clicking on the desired point. For example, in the image below, "KDOT Bridge 16-75-K5654-01" (black arrow) is clicked on. In a moment a dialogue box appears on the screen with basic site information. In addition, there is a link to "More Info" (red arrow) that takes a user to a web page pertinent to that site (2nd image).

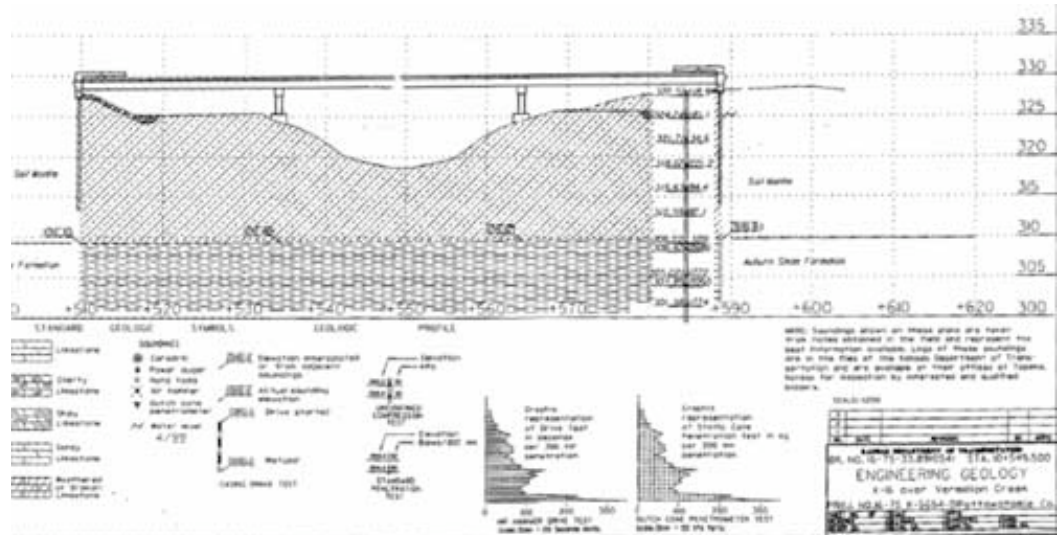




In this case, photos of the bridge, the original KDOT geology report, core data, and a bridge profile sheet are available.



Example of a KDOT bridge project plan and profile sheet. These scans are available as Acrobat PDF files, and thus you can zoom in or out, pan, and print high-quality versions.



Example of a KDOT Core Sounding datasheet.

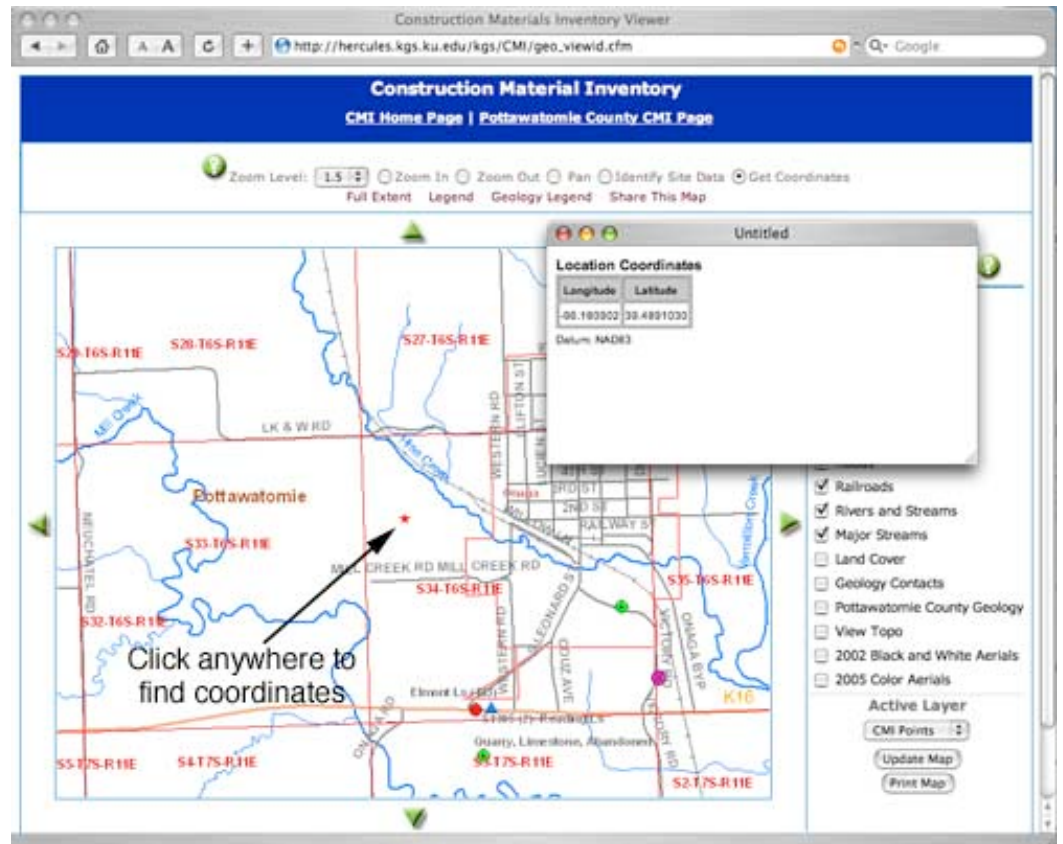
KANSAS DEPARTMENT OF TRANSPORTATION

RTE./CO. 16-75	SOUNDING NO. CD#1	SHEET OF 2
BRIDGE STA. 10+548.500	PROJECT. K-5659-01	BRIDGE NO. 16-75-3652(002)
SITE NAME K-16 over Vermillion Creek	SCALE: 1:1000 (1 Inch = 1 Meter)	HOLE STA. 10+548.618
GEOLOGIST D. Stricker		DATE 4-99
DRILLER G. Bergman	RIG TYPE D-61	TOP HOLE ELEV. 328.171
GROUNDWATER ELEV. 325.18	TOTAL DEPTH 28.76	W/B ELEV. 309.83

BIT TYPE	GEOLOGIC NAME STRATIGRAPHIC COLUMN	DEPTH	ELEVATION	CLASSIFICATION OF MATERIALS DESCRIPTION AND REMARKS	UNCONFINED COMPRESSION (K.G.)	STANDARD PENETRATOR OR CASING DRIVE	
						STROKS Per ft. #	ELEV.
		0.00	328.171	THE			
		0.60	327.57	Dark brown silty clay	118.5	Sh-1	327.57
				Grey-brown silty clay			
		2.83	325.34	Light brown silty clay with silt	181.1	Sh-2	325.34
		6.46	321.71	Grey silty clay - Wet	346.6	Sh-3	321.71
					271.2	Sh-4	309.83

Get Coordinates: Want to know the longitude and latitude for a certain point? Choose "Get Coordinates" and click on any point in the interactive map and a red star (see arrow in image

below) will appear on your chosen spot along with a dialogue box on your screen with the UTM coordinates.



Full Extent: Lost in the interactive map? Want to return to the default setting? Just click once on "Full Extent" and the interactive map will return to viewing the entire county, with all overlays reset to their original starting point.

Legend: Contains an explanation of the interactive map symbols, and is also somewhat interactive; its contents will vary with which "Active Layer" is chosen, CMI Points or WWC5. You may need to click and drag on the legend borders to see all of the legend contents.

Legend

City Boundary

County Boundary

CMI Points

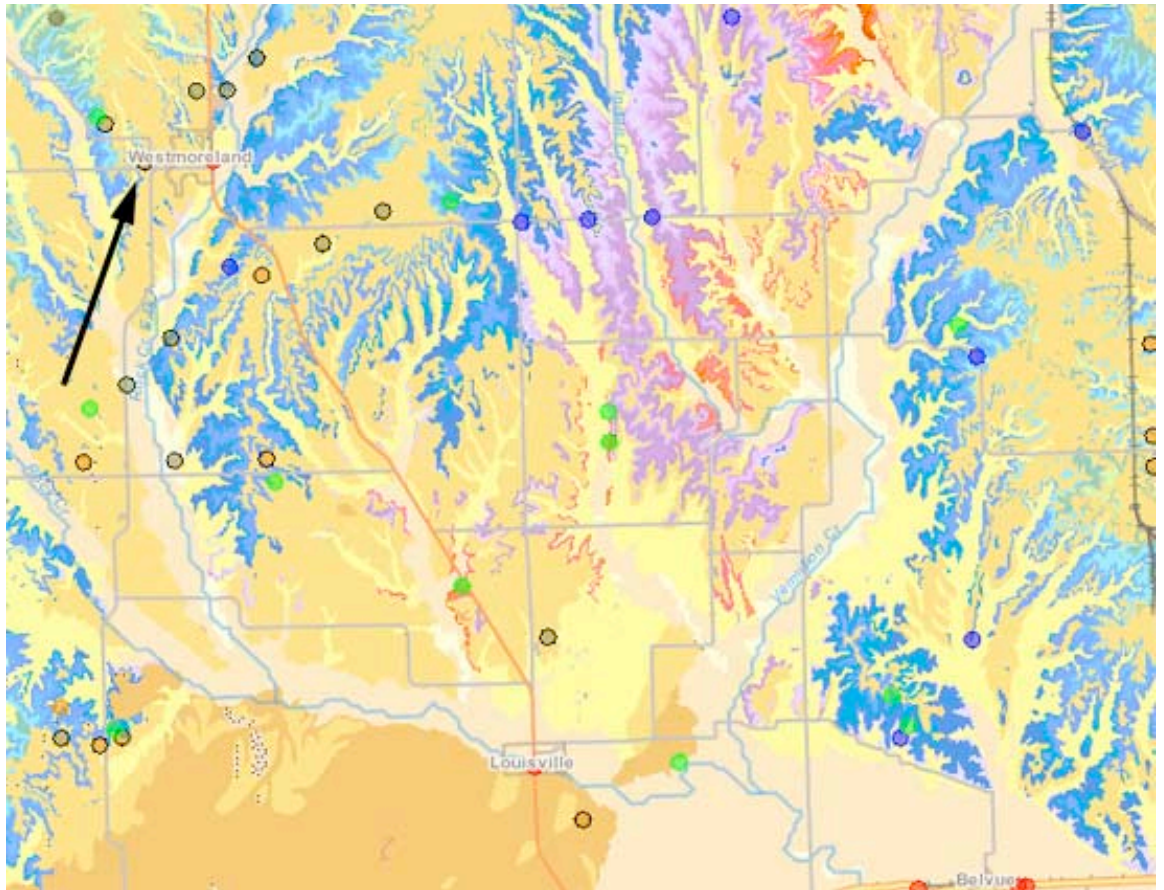
Type

- KDOT Highways and Bridges
- ⊗ Material Analysis / Data (1060-C)
- ▲ Measured Sections, Rock Exposures, Cores
- Quarry, Limestone, Abandoned
- Quarry, Limestone, Active
- Quarry, Sand and Gravel, Abandoned
- Quarry, Sand and Gravel, Active
- PLSS

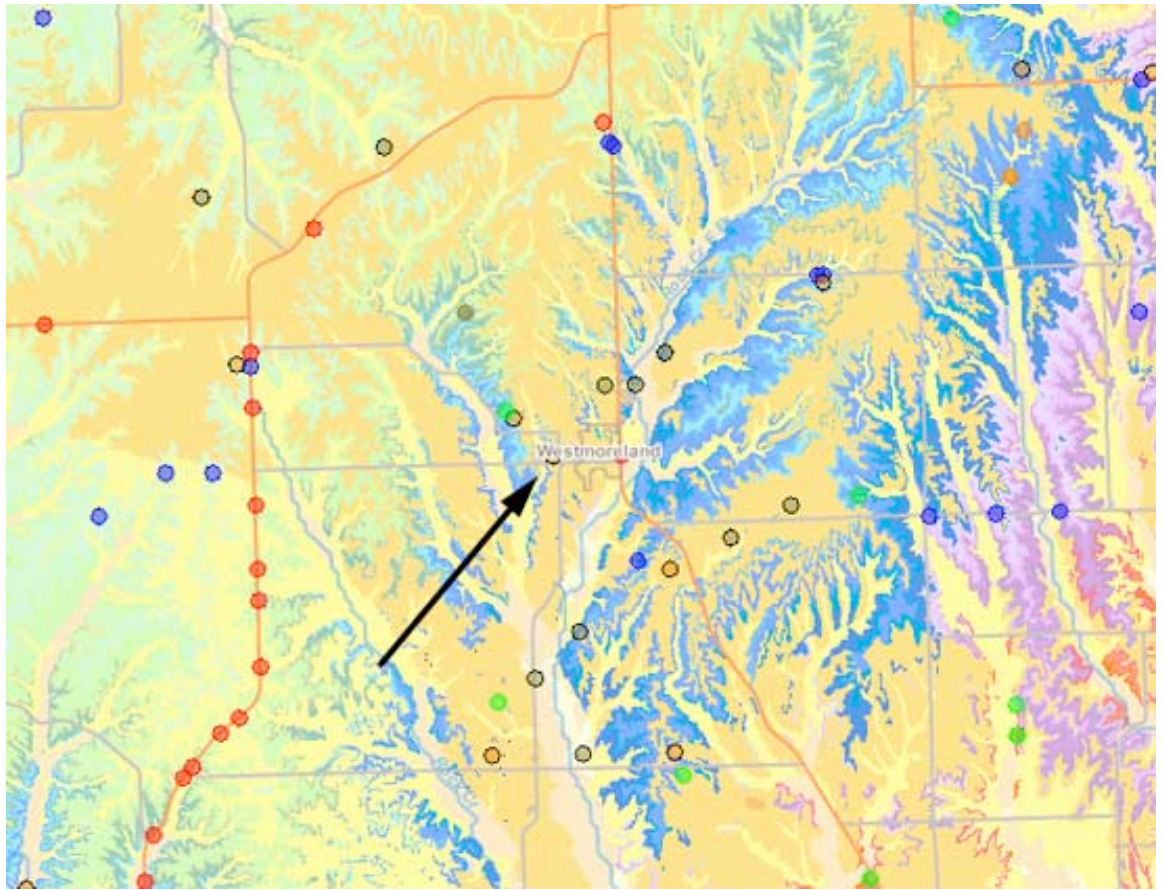
Geology Legend: Contains the current KGS geological map symbology, color identification, and stratigraphic nomenclature.

Quaternary	Permian	Pennsylvanian
Qal Alluvium	Pt Towanda Ls Mbr	Pjf Johnson Sh Foraker Ls
Qtn Terrace Alluvium	Phfr Holmsville Sh Mbr Fort Riley Ls Mbr	Admire Group
Qs Loess and Colluvium	Pof Oketo Sh Florence Ls	Phfp Hamlin Sh Mbr Five Point Ls Mbr
Qds Dune Sand	Pmw Matfield Sh Wreford Ls	Pwf West Branch Sh Mbr Falls City Ls
Qgl Glaciolacustrine Deposits	Council Grove Group	Pha Hawxby Sh Mbr Aspinwall Ls Mbr
Qgo Glacial Outwash	Psf Speiser Sh Funston Ls	Pftb Towle Sh Mbr Brownville Ls Mbr
Qgt Till	Pbc Blue Rapids Sh Crouse Ls	Wabausee Group
Qog Old Gravel	Peb Easley Creek Sh Bader Ls	Ppn Wood Siding Fm
	Psb Sterns Sh Beattie Ls	Pfd Root Sh Stotler Ls
	Peg Eskridge Sh Grenola Ls	Ppm Pillsbury Sh Maple Hill Ls Mbr
	Prr Roca Sh Red Eagle Ls	Pwt Wamego Sh Mbr Tarkio Ls Mbr
		Pwe Willard Sh Elmont Ls Mbr
Boulder Dump Boulder Dump		Pfr Harveyville Sh Mbr Reading Ls Mbr
Stratigraphy follows original mapping. Penn-Perm boundary now moved to base of Bennett Shale Member of the Red Eagle Limestone (see map).		
		Paw Auburn Sh Wakarusa Ls Mbr
		Psb Soldier Creek Sh Mbr Burlingame Ls Mbr
		Psr Silver Lake Sh Mbr Rulo Ls Mbr
		Pov Cedar Vale Sh Mbr

Pan Feature. In the image below, if you wanted to go to the Westmoreland area visible in the upper left hand corner (black arrow), chose the "Pan" button, and then click once on or near Westmoreland.



The interactive map will now realign and show Westmoreland in the center of the interactive map feature (see below). The level of resolution will remain constant while pan is selected (no zooming).



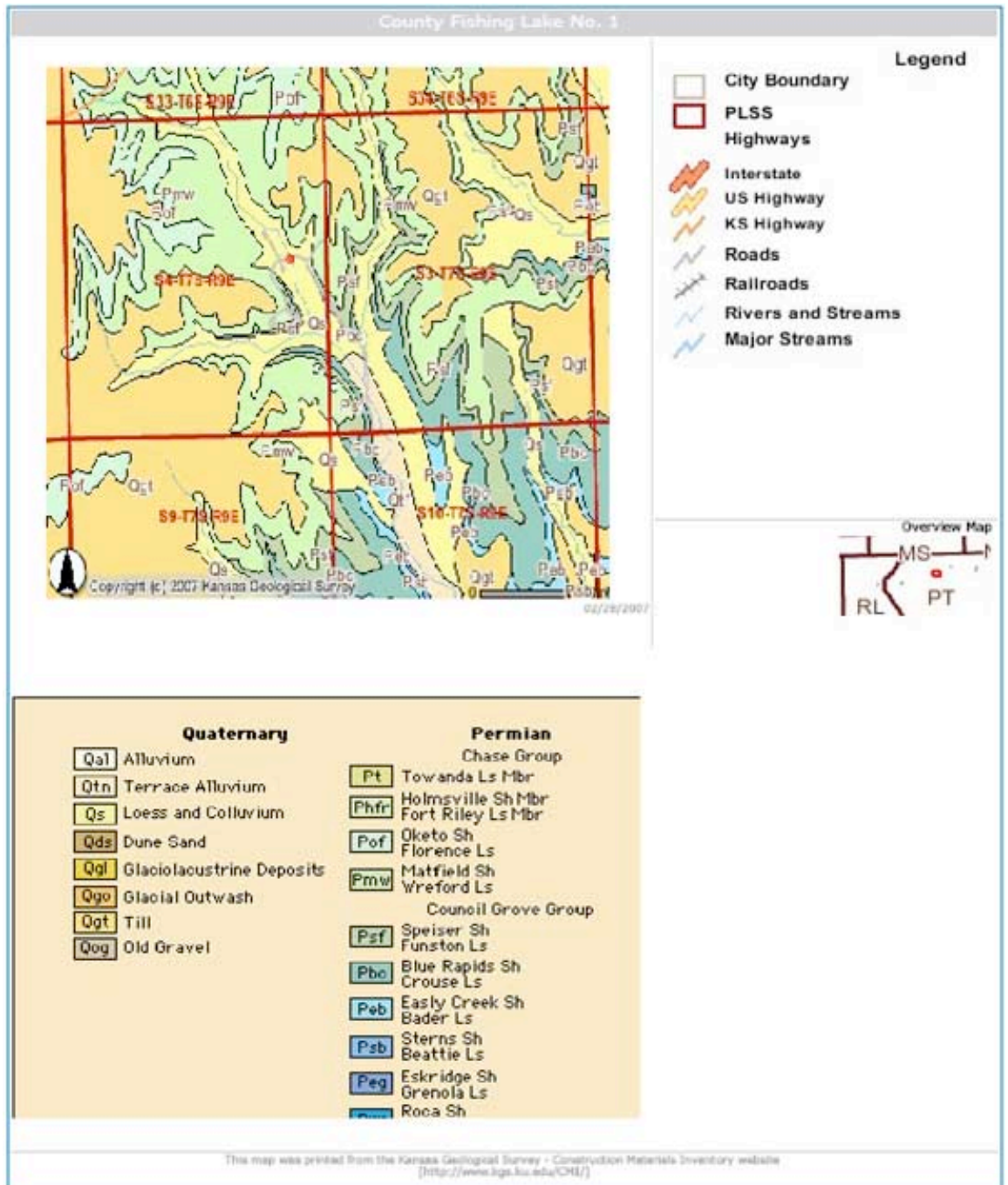
The up, down, left, right green directional arrows along the sides of the interactive map feature will also move the map in the indicated direction, without zooming.



Share This Map: Allows a person to turn what is currently being viewed on the interactive map into a website link that can be sent via an email. A website link/address to the image can be accessed by the email recipient.

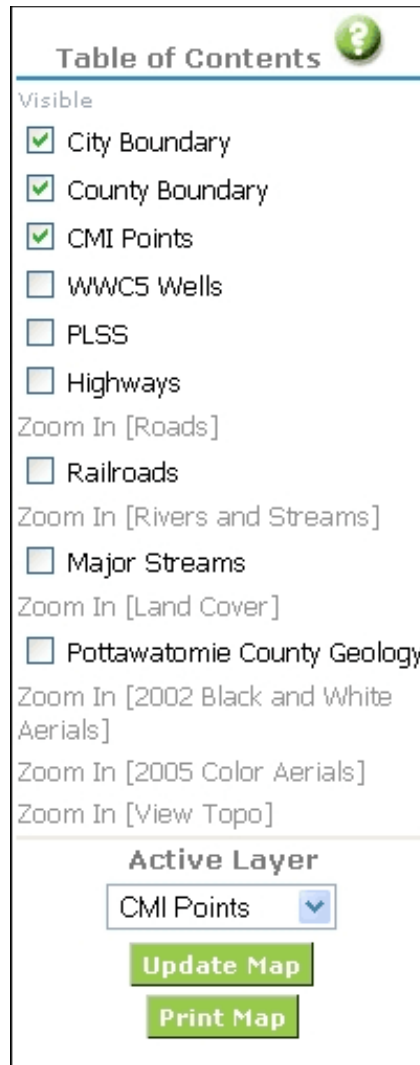


Underneath the Update Map button is the **Print Map** feature that will allow you to capture the current image on the screen and create a document where options for titles, north arrows, legends, overview maps, and the original image can be displayed on a single page for printing or electronic transmission. An example is shown below at reduced size.




Part II--GIS Overlays

The **Table of Contents** on the right-hand side of the interactive map lists GIS overlays that can be turned on and off. Simply click in the box beside the overlay to add or remove the green checkmarks and press "Update Map" at the bottom to refresh. **Note: some overlay features will only be active once a certain level of resolution, or zooming in, is achieved.** For example, in the Table of Contents image below, features like city boundaries and county geology can be activated while at "Full Extent," while roads, rivers and streams, land cover, aerial photos, and topographical overlays require some zooming in first. Please note that the **City Boundary, County Boundary, and CMI Points** features are defaulted to be checked on when the interactive map is first accessed.



In addition, while both **Geology Contacts** and **Pottawatomie County Geology** can be checked on while at "Full Extent," activating Geology Contacts at this level of resolution will tend to produce a distorted black and brown image of little use. **To effectively see the geological relationships at the County level, use Pottawatomie County Geology overlay only.** Generally, to see a relatively coherent image, you must zoom in at least 3 times (with zoom set at 1.5x) before activating both Geology Contacts and Pottawatomie County Geology overlays, although this rule of thumb depends on the user's purpose.


The Table of Contents image below shows all overlays and features activated. Generally, aerial photos and topological features will activate after only one click of "Zoom In" set at 1.5x. Roads, rivers and streams, and land cover will activate after 3 clicks of "Zoom In" set at 1.5x. This aspect is demonstrated in more detail later on.

Table of Contents 

Visible

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- County Boundary
- CMI Points
- WWCS Wells
- PLSS
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- Major Streams
- Land Cover
- Pottawatomie County Geology
- 2002 Black and White Aerials
- 2005 Color Aerials
- View Topo

Active Layer

CMI Points 

Update Map

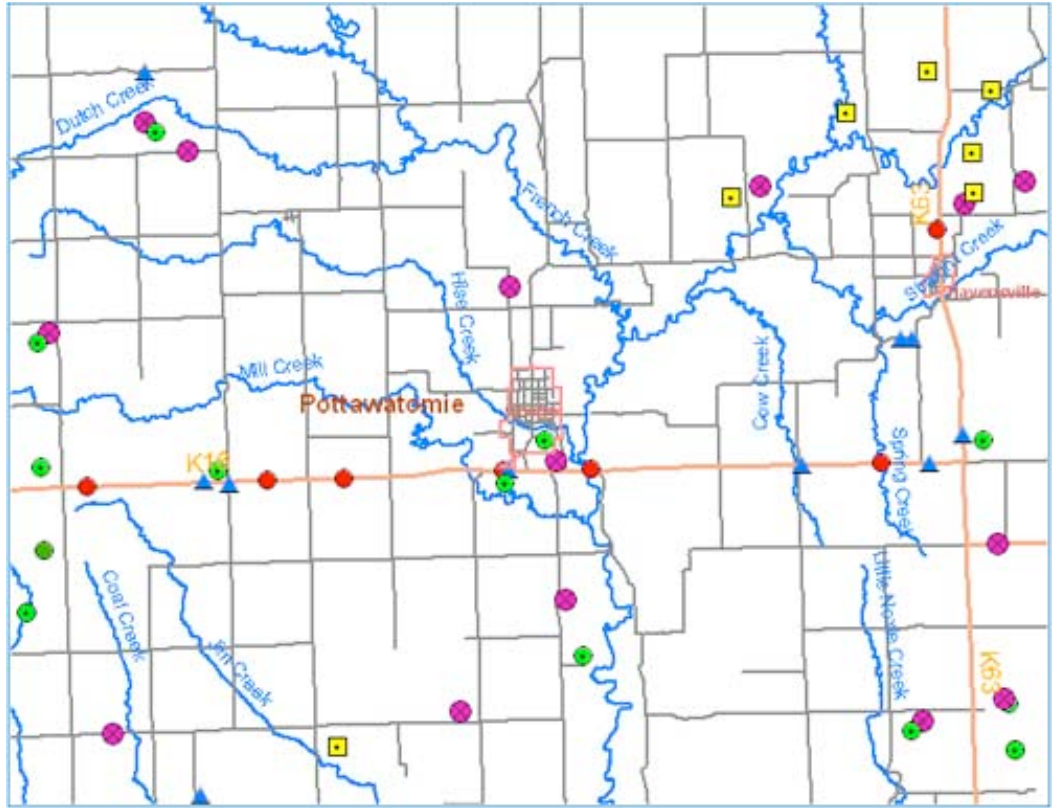
Print Map

Highways, Roads, Railroads are self-explanatory as overlays.

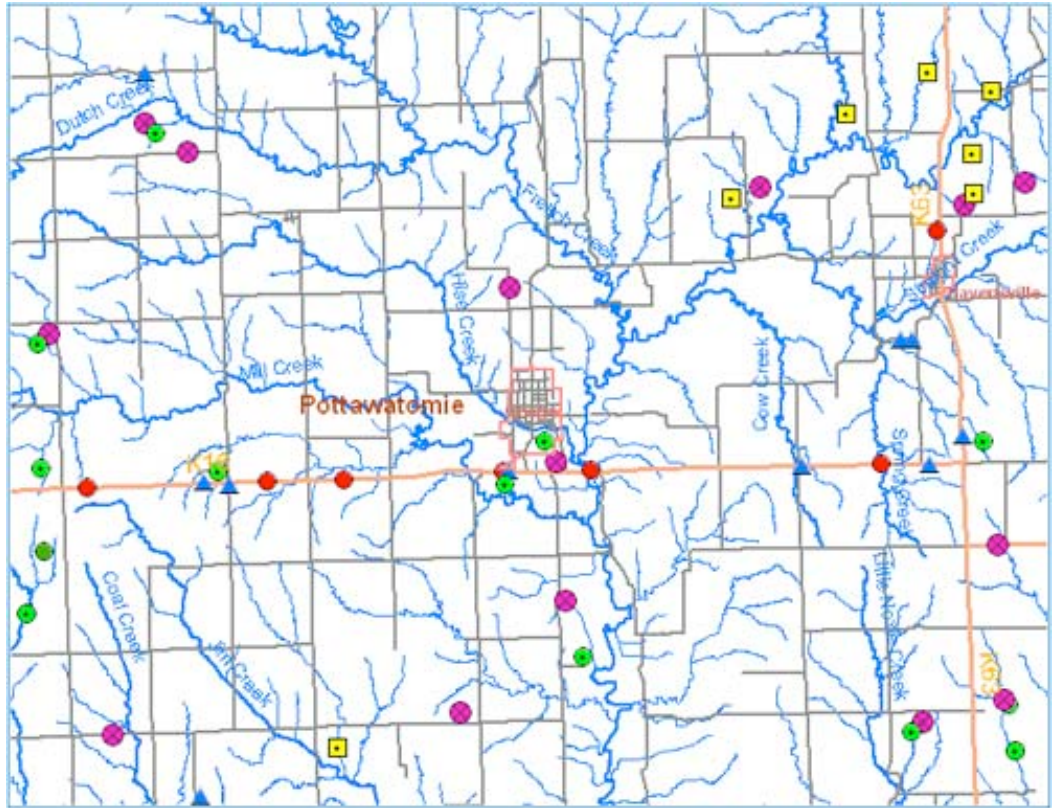
PLSS stands for **Public Land Survey System**, and uses the Township, Range, and Section organization. See the example in Zoom Level, Part I.

The **Major Streams** overlay can be turned on while the interactive map is at full-extent and so a county-wide view of the largest rivers and streams can be seen. However, the names of the streams will not activate until the map is zoomed in twice at 1.5x zoom level. The **Rivers and Streams** overlay is intended for higher resolution viewing and will not be available until the interactive map is zoomed in about 3 times at 1.5x zoom level. One disadvantage of the current Rivers and Streams overlay is that the streams are unnamed. When both water overlays are active, the Major Streams data will be seen as a blue line that is thicker than the Rivers and Streams data.

"Major Streams" Overlay

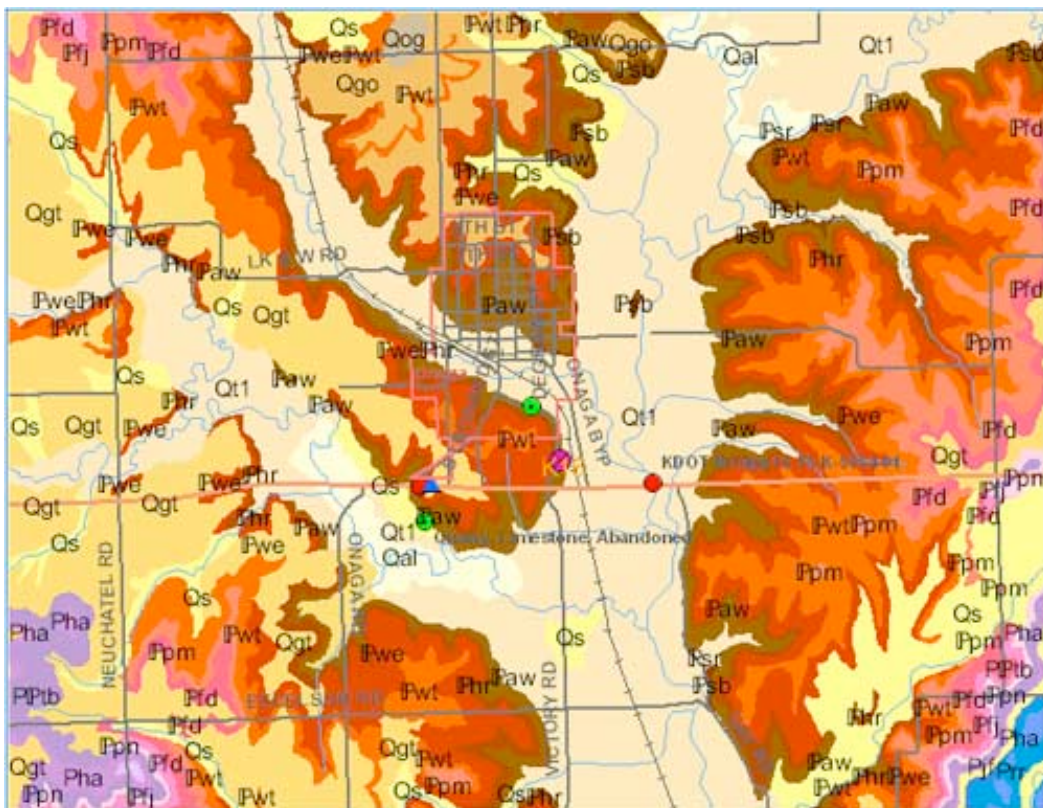


"Major Streams" and "River and Streams" Overlays

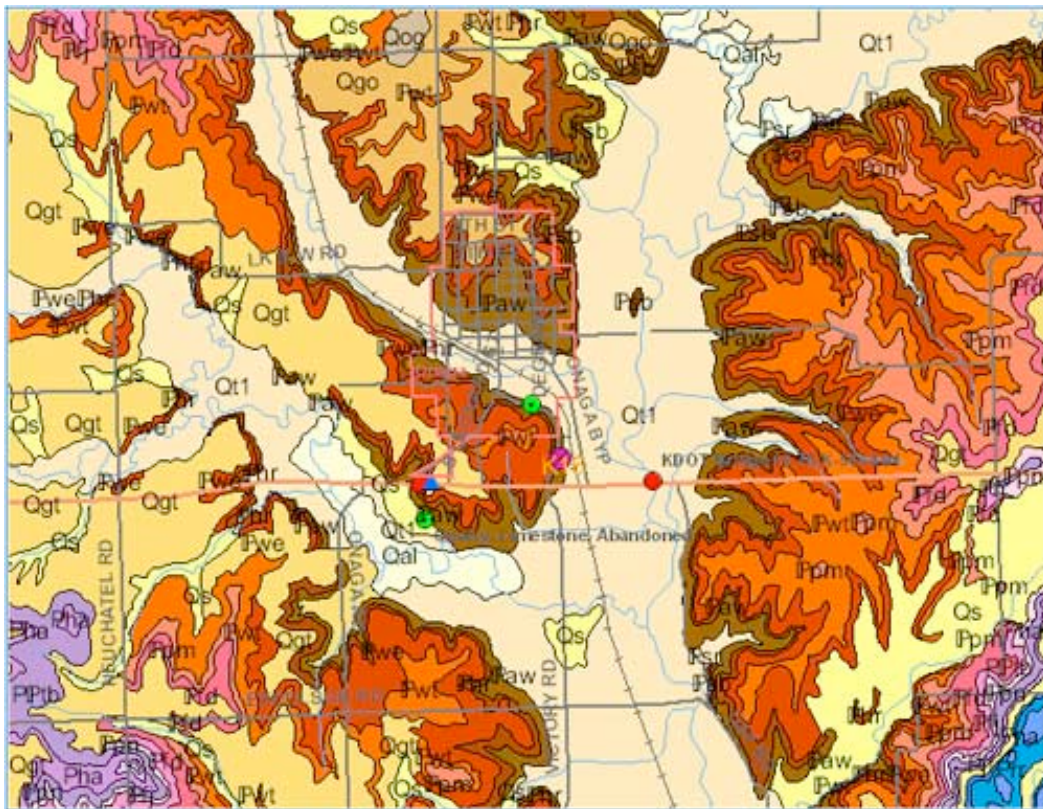


Pottawatomie County Geology Overlay. In the image below, we have set our zoom level to 3 and clicked twice on the city of Onaga. We have turned on Highways, Roads, Railroads, Rivers and Streams, and Pottawatomie County Geology overlays. "County Boundaries" is turned off, which means the term "Pottawatomie" won't clutter the map. Take note of the

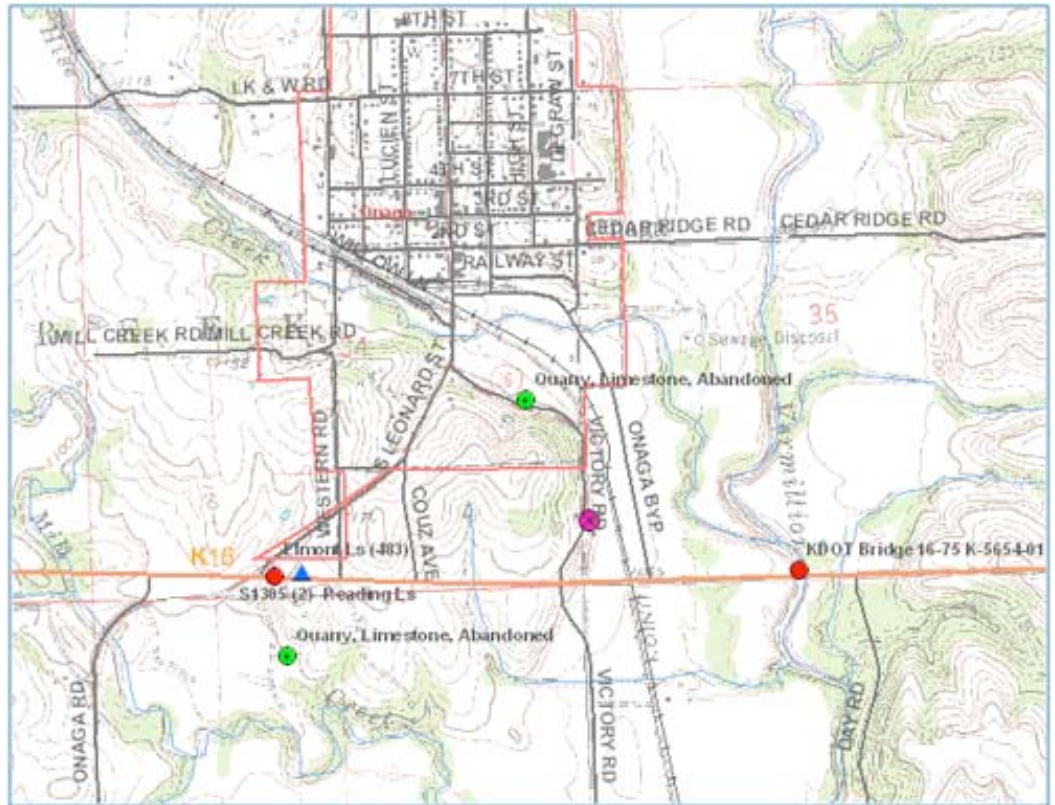
geology symbology now present (e.g. Qgt, Pha).



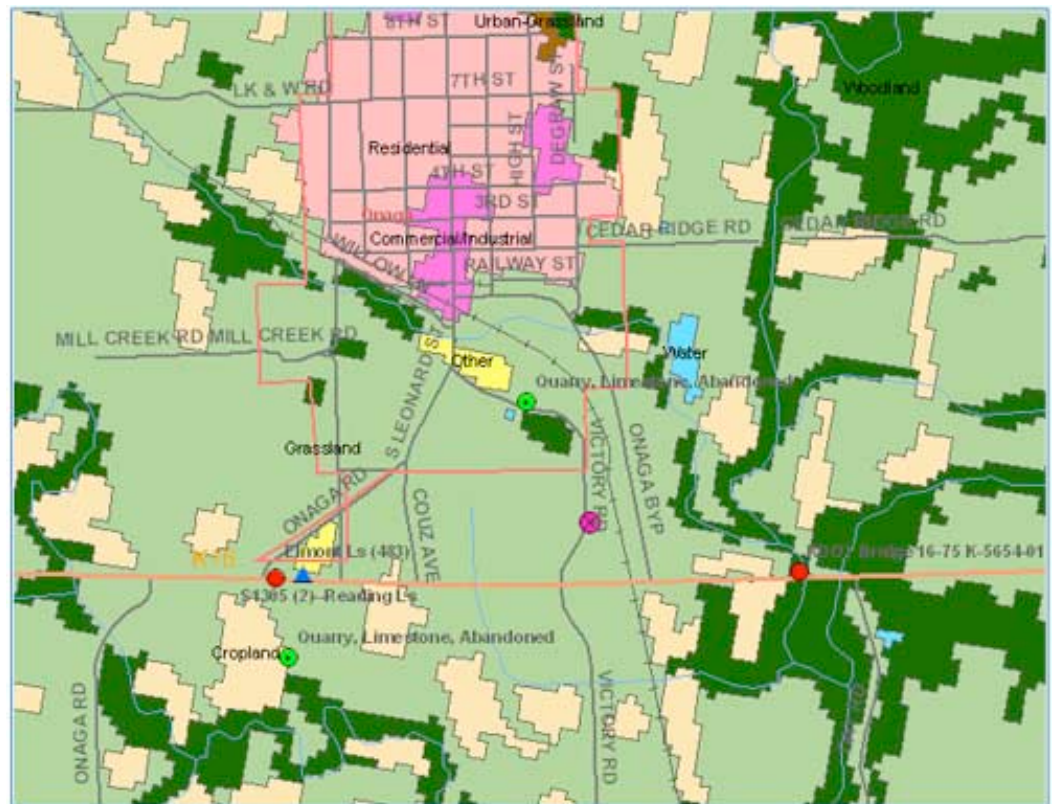
Checking on the **Geology Contacts** overlay and clicking "Update Map" will draw lines that sharpen the boundaries between geological units (as stated before, if you wish to view the geological relationships at a county-level or "Full Extent," leave the Geology Contacts overlay unchecked).



The **View Topo** option adds a layer containing scanned 7 1/2-minute topographic maps of the county.

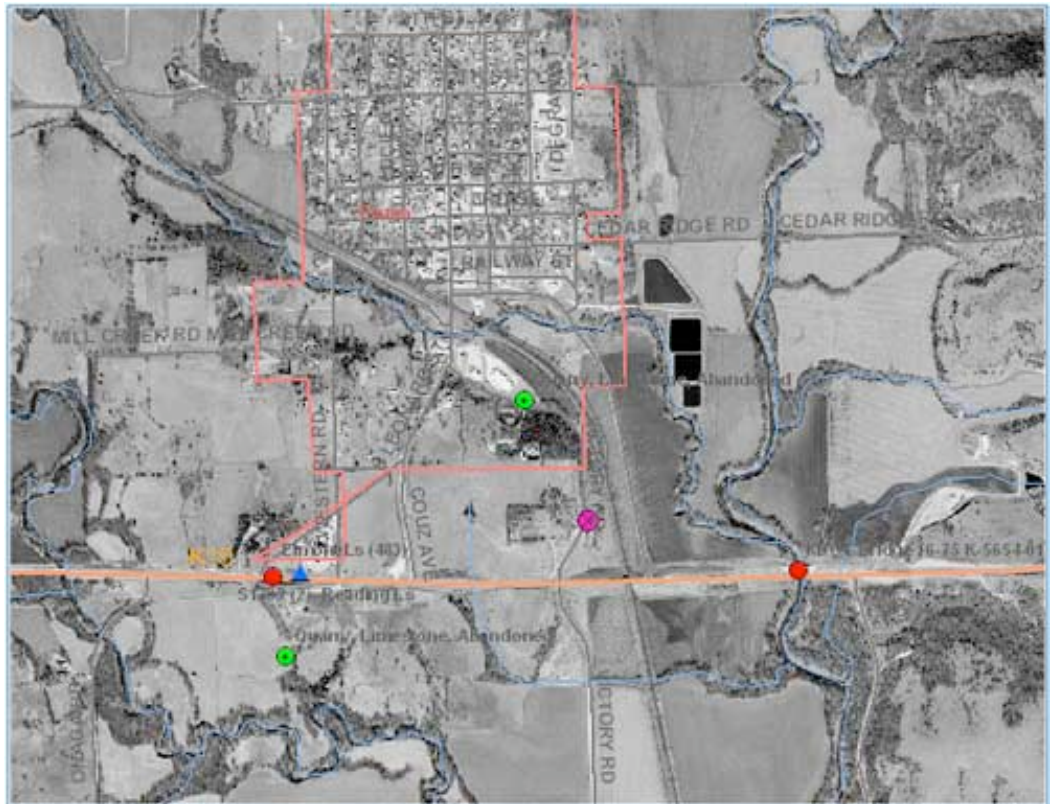


Land Cover overlay shows land classifications (cropland, woodland, etc.) The database depicts 10 general land cover classes for the State of Kansas.



Two generations of aerial photos can be added. This is an example of the **2002 Black and**
Page 23

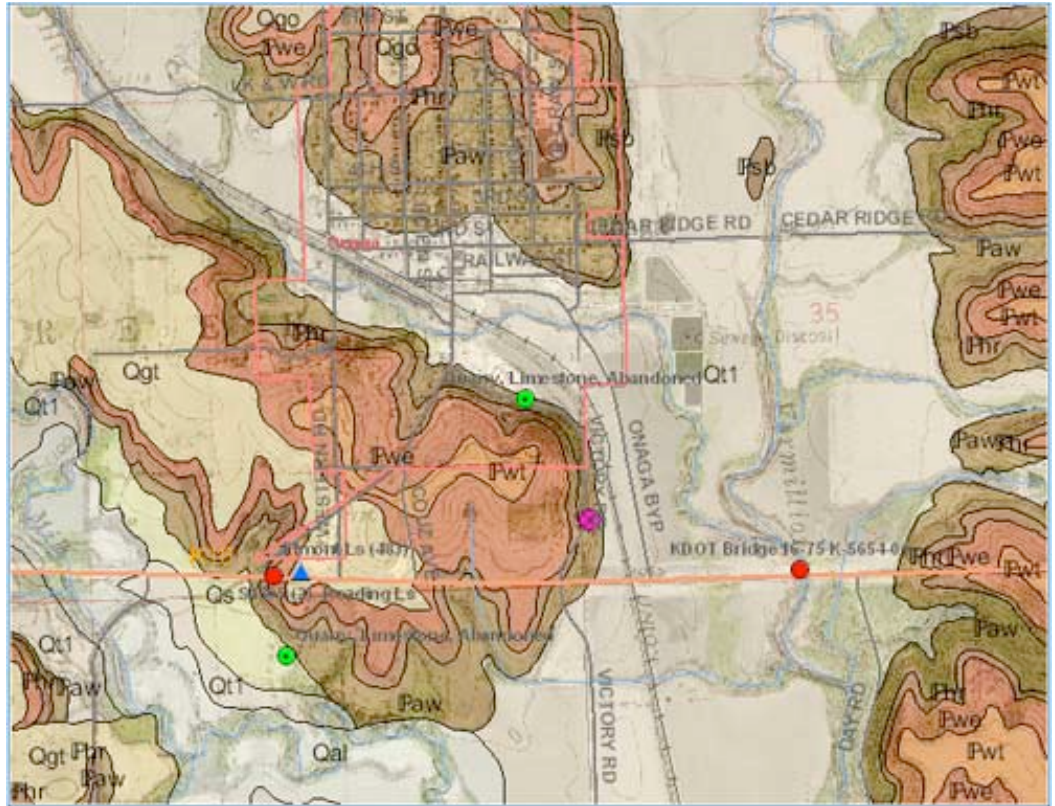
White Aerial overlay.



The 2005 Aerial Photos were taken in color.

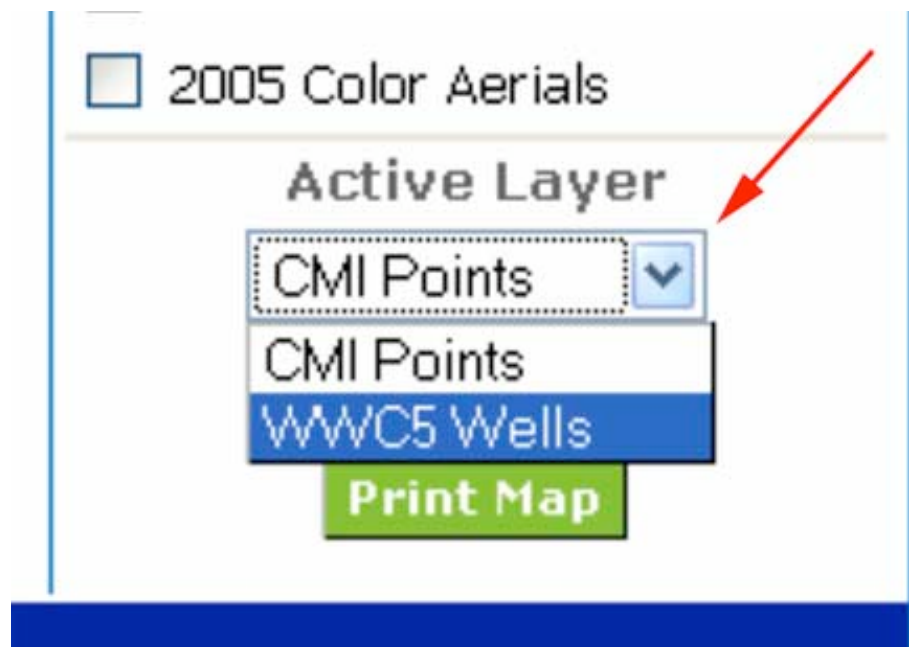


An example of Geology, Topo, and Black and White Aerials overlays active. There are pre-defined levels of transparency to some layers so they can be used together.



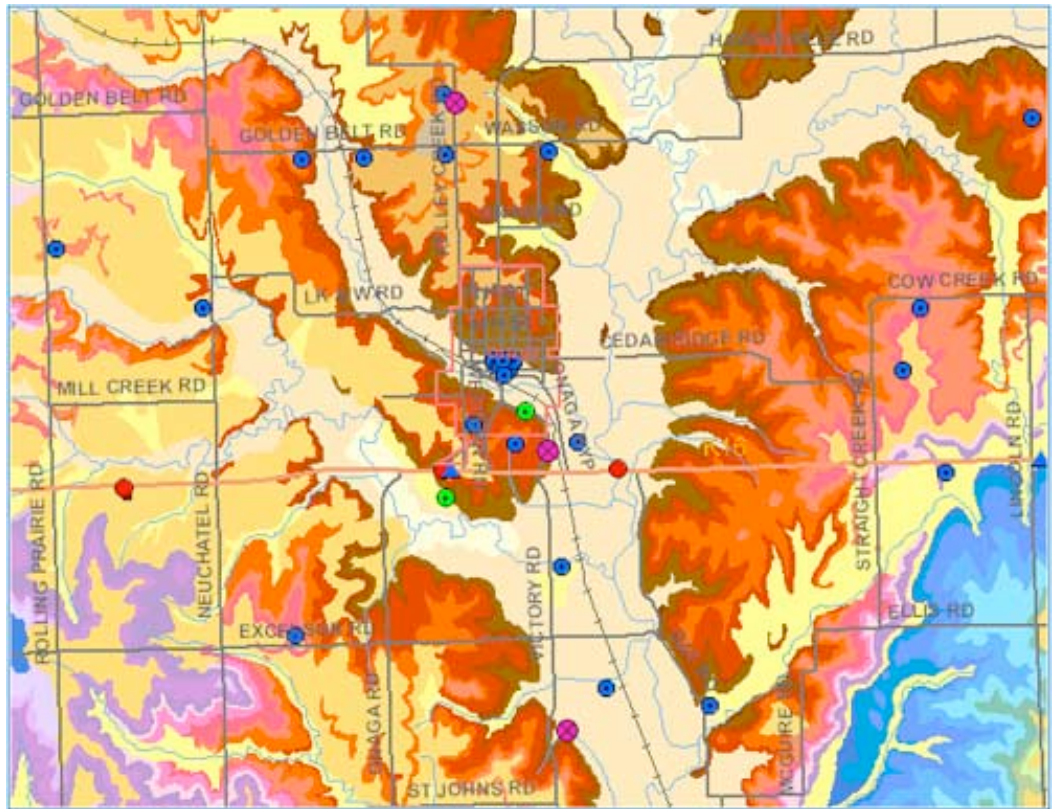
Part III--Website Databases, Types of Information Available

CMI Points and WWC5 Wells: These are two separate databases within the website. Both sets of points can have their respective boxes checked and can be seen on the interactive map at the same time, but you can only access the specific data at a particular point if that category is selected in the "Active Layer" menu and the "Update Map" has been clicked.



The **WWC5** database only contains one category, the water wells (indicated by a blue octagon with a black dot in the center). In the image below, sites from both the CMI Points

database and the WWC5 database are visible. The placement of the water well sites are generally accurate to three quarter-sections in the interactive map, as the sites are placed according to the location information given in the original documents.



To recap,

1. Use the "Table of Contents" to overlay CMI data or WWC5 locations (or both) onto the interactive map;
2. Use the "Identify Site Data" option on the toolbar if you want to click on points to retrieve data;
3. Use the "Active Layer" menu to select whether WWC5 or CMI points will be selected when you click within the map.

If "Identify Site Data" in the tool bar is selected, and one of the blue octagons is clicked on, then a web page for that site is created. Additional information regarding the lithology and unit thickness may be present in many, if not all, of the WWC5 records.

KGS--Water Wells Query Answer--Specific Water Well Detail

http://abyss.kgs.ku.edu/pls/abyss/wwc5.wwc

KGS Water Well Database Query
Hydrology

Specific Water Well Detail

Well T7S, R11E, Sec. 11, NW SE NW, Action: Constructed

Location Info	
County: Pottawatomie	Location: T7S, R11E, Sec. 11, NW SE NW
Owner: Zabel, Steve	Status: Constructed
Directions: from Onaga: 1.75 mi S	

<input type="checkbox"/>	Longitude: -96.15909	Latitude: 39.4598
<input type="checkbox"/>	View section on interactive map This link will create a new window and display an interactive map of this well and its neighbors.	
General Info		
<input type="checkbox"/>	Well Depth: 50 ft.	Elevation: ft.
<input type="checkbox"/>	Static Water Level: 12 ft.	Well Use: Domestic
<input type="checkbox"/>	Est. Yield: 8 gpm.	Other ID:
Driller Info		
<input type="checkbox"/>	Driller: Strader Drilling Co., Inc.	License #: 182
<input type="checkbox"/>	Comp. Date: 14-Dec-1994	DWR Applic. #:
Scanned Form		
<input type="checkbox"/>	View scan of this form in PDF format.	
<input type="checkbox"/>	You will need the Acrobat PDF Reader , available free from Adobe, to read this file.	
Grout Info		
<input type="checkbox"/>	Grout used: BENTONITE	
<input type="checkbox"/>	From: 4 to 24 ft.	
<input type="checkbox"/>	From: 0 to 0 ft.	
<input type="checkbox"/>	From: 0 to 0 ft.	
Contamination Info		
<input type="checkbox"/>	Contamination type: LIVESTOCK PENS	
<input type="checkbox"/>	Direction: W	Distance: 999
Screen and Perforation Info		
<input type="checkbox"/>	Screen Type: TORCH CUT	Screen Openings: SAW CUT
<input type="checkbox"/>	From: 30 ft. to 50 ft.	From: 0 ft. to 0 ft.
<input type="checkbox"/>	From: 0 ft. to 0 ft.	From: 0 ft. to 0 ft.
Lithologic Log		
<input type="checkbox"/>	From: 0 ft. to 29 ft.	Type: CLAY
<input type="checkbox"/>	From: 29 ft. to 34 ft.	Type: FINE SAND
<input type="checkbox"/>	From: 34 ft. to 37 ft.	Type: SAND & GRAVEL
<input type="checkbox"/>	From: 37 ft. to 50 ft.	Type: SHALE
<input type="checkbox"/>	From: 50 ft. to 51 ft.	Type: LIMESTONE

Kansas Geological Survey
Comments to webadmin@kgs.ku.edu
URL=<http://www.kgs.ku.edu/Magellan/WaterWell/index.html>
Display Programs Updated July 29, 2004
Data added continuously.

In most WWC5 records it should also be possible to view the original document in PDF format. At the bottom of the image below is the lithologic log, and it should be possible to see, in this particular well, that the first limestone ledge started at a depth of about 4 feet. In many cases, the WWC5 records should be able to give an indication of the overburden thickness and the depth to bedrock in the area.

WATER WELL RECORD Form WWC-5 KSA 82a-1212

1) LOCATION OF WATER WELL: County: <u>Pottawatomie</u>		Fraction: <u>SW 1/4</u> <u>10W 1/4</u> <u>10W 1/4</u>	Section Number: <u>8</u>	Township Number: <u>T 8 S</u>	Range Number: <u>R 10 W</u>
Distance and direction from nearest town or city street address of well if located within city? <u>8 1/2 south, 3/4 west of Wheaton</u>					
2) WATER WELL OWNER: <u>Arvie Howard</u>		Board of Agriculture, Division of Water Resources Application Number: _____			
R/R#, St. Address, Box # : <u>Rt. 1</u>		City, State, ZIP Code : <u>Onaga, KS 66521</u>			
3) LOCATE WELL'S LOCATION WITH AN 'X' IN SECTION BOX:		4) DEPTH OF COMPLETED WELL: <u>100'</u> ft. ELEVATION: _____			
		Depth(s) Groundwater Encountered: 1. <u>75'</u> ft. 2. _____ ft. 3. _____ ft.			
		WELL'S STATIC WATER LEVEL: <u>.43'</u> ft. below land surface measured on mo/day/r: <u>2-08-95</u>			
		Pump test data: Well water was _____ ft. after _____ hours pumping _____ gpm			
		Est. Yield: <u>11</u> gpm: Well water was _____ ft. after _____ hours pumping _____ gpm			
		Bore Hole Diameter: <u>8 3/4</u> in. to _____ ft. and _____ in. to _____ ft.			
		WELL WATER TO BE USED AS: 1 Domestic 2 Irrigation 3 Feeder 4 Industrial 5 Public water supply 6 Oil field water supply 7 Lawn and garden only 8 Air conditioning 9 Dewatering 10 Monitoring well 11 Injection well 12 Other (Specify below)			
		Was a chemical bacteriological sample submitted to Department? Yes _____ No <u>X</u> If yes, mo/day/r sample was submitted: _____ Water Well Disinfected? Yes <u>X</u> No _____			
5) TYPE OF BLANK CASING USED:		CASING JOINTS: Glued <u>X</u> Clamped _____			
1 Steel 2 PVC 3 RMP (SR) 4 ABS 5 Wrought iron 6 Asbestos-Cement 7 Fiberglass 8 Concrete tile 9 Other (specify below) 10 Asbestos-cement 11 Other (specify) 12 None used (open hole)		Welded _____ Threaded _____			
Blank casing diameter: <u>5"</u> in. to <u>0-40</u> ft. Dia. <u>5"</u> in. to <u>90-100</u> ft. Dia. _____ ft.		Casing height above land surface: <u>24"</u> in. weight: <u>2.82</u> lbs./ft. Wall thickness or gauge No.: <u>.258</u>			
TYPE OF SCREEN OR PERFORATION MATERIAL:		7 PVC 8 RMP (SR) 9 ABS 10 Asbestos-cement 11 Other (specify) 12 None used (open hole)			
1 Steel 2 Brass 3 Stainless steel 4 Galvanized steel 5 Fiberglass 6 Concrete tile 7 Gauze wrapped 8 Wire wrapped 9 Saw cut 10 Drilled holes 11 None (open hole)		SCREEN OR PERFORATION OPENINGS ARE: 1 Continuous slot 2 Louvered shutter 3 Mesh slot 4 Key punched 5 Torch cut 6 Other (specify) _____			
SCREEN-PERFORATED INTERVALS:		From: <u>40</u> ft. to <u>90</u> ft. From: _____ ft. to _____ ft.			
GRAVEL PACK INTERVALS:		From: <u>24</u> ft. to <u>100</u> ft. From: _____ ft. to _____ ft.			
6) GROUT MATERIAL:		1 Neat cement 2 Cement grout 3 Bentonite 4 Other _____			
Grout intervals: From: <u>4</u> ft. to <u>24</u> ft. From: _____ ft. to _____ ft.		What is the nearest source of possible contamination: 1 Septic tank 2 Sewer lines 3 Watertight sewer lines 4 Lateral lines 5 Cess pool 6 Seepage pit 7 Pit privy 8 Sewage lagoon 9 Feedyard 10 Livestock pens 11 Fuel storage 12 Fertilizer storage 13 Insecticide storage 14 Abandoned water well 15 Oil well/Gas well 16 Other (specify below) _____			
Direction from well? _____		How many feet? <u>100'</u>			
		LITHOLOGIC LOG		PLUGGING INTERVALS	
FROM	TO		FROM	TO	
0	1	Top Soil	68	72	Shale-Grey
1	4	Clay-Brown	72	75	Limestone-Yellow-Loose
4	5	Limestone-Yellow	75	100	Shaley Limestone-Grey
5	16	Shale-Yellow			
16	18	Limestone-Grey			
18	24	Shale-Grey			
24	26	Shale-Yellow			
26	29	Limestone-Yellow			
29	34	Shale-Yellow			
34	39	Shale-Grey			
39	41	Shale-Red			
41	47	Shale-Yellow			
47	53	Limestone-Yellow-Loose			
53	61	Shale-Grey			
61	68	Shale-Yellow			

The website default setting is to have the CMI Points active, not the WWC5 points. These points include the seven categories shown in the Legend feature:

CMI Points

- KDOT Highways and Bridges
- ⊗ Material Analysis / Data (1060-C)
- ▲ Measured Sections, Rock Exposures, Cores
- Quarry, Limestone, Abandoned
- Quarry, Limestone, Active
- Quarry, Sand and Gravel, Abandoned
- Quarry, Sand and Gravel, Active

KDOT Highway and Bridge Projects are mapped with a solid red circle. The types of [detailed information available for these points](#) was shown earlier.

Material Analysis Sites are drawn from USGS 1060-C Publication, indicated with a pink circle with two crossed lines symbol, and consist of two types: Untested, with the primary information being a cubic yards estimate of material:

Construction Material Inventory--Untested Material Site 9

<http://www.kgs.ku.edu/CMI/nop/PT/Chem/ums9.html> Google

Construction Material Inventory

ABOUT

A prototype web system to help understand the construction resources of Kansas, starting with Pottawatomie County.

PARTICIPATING GROUPS

[Kansas Department of Transportation](#)
[Kansas Geological Survey](#)

Pottawatomie County--Lab Analyses

Data extracted from Plate 5 in U.S. Geological Survey Bull. 1060-C.

Location: SE SE NE SE SE Sec. 34, T. 6 S., R. 11 E.

Type of pit or quarry: **Operated**

Material: **Limestone**


Quantity: **4,000 cubic yards**

This site has not yet been field-checked or verified.

This server is run by the [Kansas Geological Survey](#).
This page updated March 18, 2007.
The URL for this page is <http://www.kgs.ku.edu/CMI/nop/PT/Chem/ums9.html>
Comments to webadmin@kgs.ku.edu

Tested samples from other points were fully analyzed, with various petrophysical indicators (specific gravity, absorption, soundness test results, etc.)

Construction Material Inventory--Lab Analysis--Limestone 7
<http://www.kgs.ku.edu/CMI/nop/PT/Chem/lis7.html> Google



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Pottawatomie County--Lab Analyses

Data extracted from Table 1 in Bull. 1060-C; full table can be view on main [Pottawatomie](#) page.

Classification of material:	Limestone		
Location:	NE SE sec. 28, R. 6 S., R. 10 E.		
	39.49859, -96.29771		
Lithologic unit:	Cottonwood limestone member		
Estimated amount of material (cubic yards)	Average thickness (feet)		Accessibility
	Material	Overburden	
8,000	6	1.5	Poor

Authority for Test Data	State Highway Commission of Kansas
Laboratory No.	30275
Date of Test	11-23-1936

Description of materials

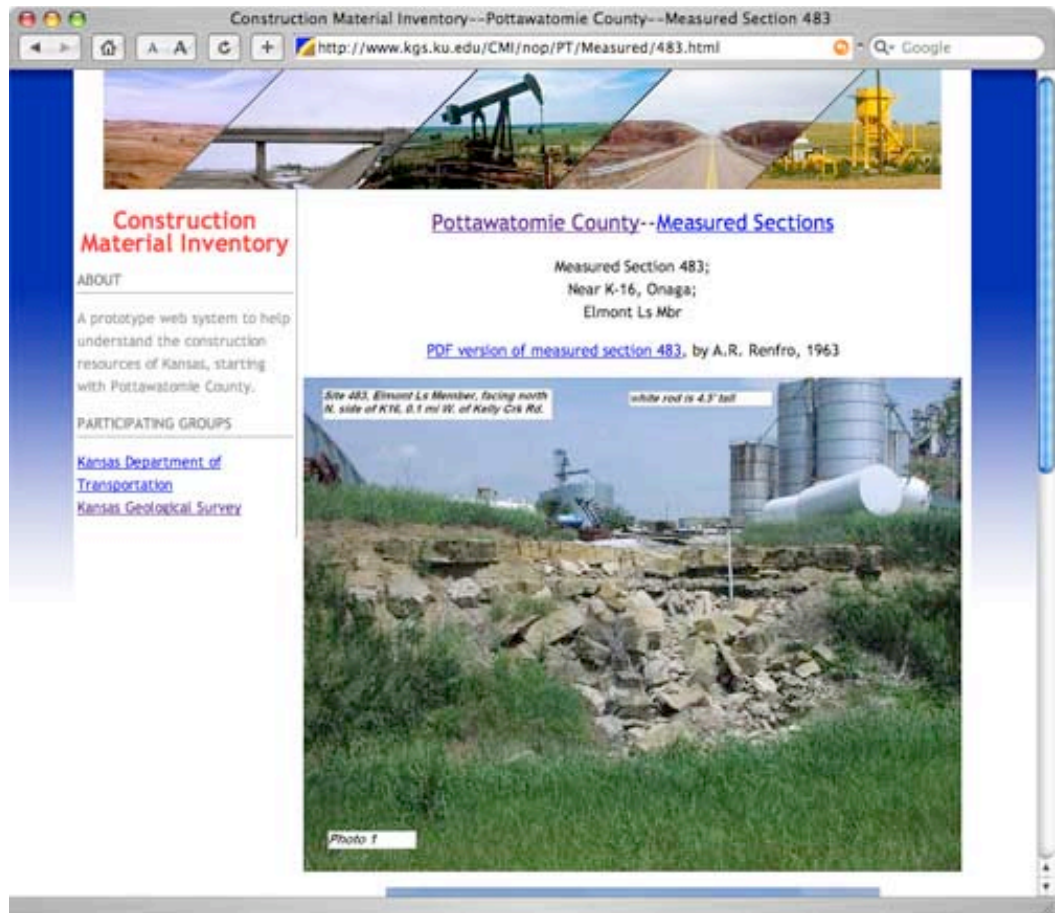
Massive light-gray limestone with a few divitrified chert nodules. Acceptable for aggregate under secs. 58, 59, 60, 61, and 63 of 1934 specifications.

Laboratory Test Data	
Weight per cubic foot (pounds dry)	
Specific Gravity (saturated)	2.43
Comprehensive strength ratio (figures in parenthesis refer to numbered days)	
Los Angeles abrasion percent wear	
Los Angeles grading	
Deval abrasion (rock) percent wear	6.5
Freeze and Thaw Soundness loss ratio (25 cycles)	Satisfactory
Toughness	8
Absorption	3.9

This site has not yet been field-checked or verified.

This server is run by the [Kansas Geological Survey](#).
 This page updated Jan. 9, 2007.
 The URL for this page is <http://www.kgs.ku.edu/CMI/nop/PT/Chem/lis7.html>
 Comments to webadmin@kgs.ku.edu

Measured Sections, Rock Exposures, Cores: Posted with a blue triangle symbol, measured sections generally contain one or more photos of the rock outcrop where a geological professional or a student measured and described a stratigraphic unit. Sometimes an Acrobat PDF of the measured section is available.



Example of one measured section by an author. In this case, the geological worker had a description only (no rock column graphic), and the description was placed in a standard format created for this website.

Measured Section: 483 State: KS County: Pottawatomie Quad: Duluth

Locality Description: SW, SE, Sec 34, T6S, R11E. Roadcut on north side of Highway K16, 1 mile east of Osaga. (website manager note: the above TRS would place the outcrop about 1 mile south of the center of the town of Osaga.)

Date: 1963 Source: A.R. Renfro (1963) p. 59-60. Unpublished MS Thesis Page 1 of 1

Stratigraphic Column	Unit Descriptions	Ft	M
No graphic available	Elmont Ls Member.		
	Biosparite: yellowish brown, weathers brown. Massive and dense. Fusulinids, Osagia, Marginifera, Chonetes, crinoid columnals, and fenestrate bryozoans. Fusulinids and Osagia most abundant. Fusulinids weather in relief.	1.3	
	Intrasparadite: yellowish brown to brown, weathers yellowish brown. Pebbles play to near spherical, well rounded to subangular. Most are moderately well rounded. Bed is approximately 80% pebbles. Non-fossiliferous. Pebbles resemble next lower limestone bed.	0.7	
	Mudstone: yellowish gray, weathers gray, moderately well indurated, unfossiliferous.	0.7	
	Biosiltite: brown, weathers yellowish brown. Upper part contains distinct algal laminations. Lower part massive, more dense, and hard.	0.7	
	Diumicrite: yellowish gray to gray, weathers dark gray. Massive, soft, poorly indurated. Contains small (1/2 to 3 millimeters in diameter) sparry calcite vug fillings. Unfossiliferous.	1.1	
	Total thickness of Elmont	4.5	


There also exists some information on the following commercial quarries:

- Active Limestone Quarries
- Inactive Limestone Quarries
- Active Sand and Gravel Quarries
- Inactive Sand and Gravel Quarries

For most of the above sites, only some very general information is available: A township, range, section and quarter for location, and occasionally the quarry operator or the stratigraphic unit involved.

In some cases, particularly the active quarries, a quarry site has been visited, photographed, and a more accurate gps coordinate taken. Geological units exposed in these areas have been examined and confirmed to be the originally identified unit. In many of the inactive quarry sites, evidence of their existence has vanished over time, and it is no longer possible to know with certainty where a site was located.

Construction Material Inventory--Pottawatomie County--Abandoned limestone quarry 26
http://www.kgs.ku.edu/CMI/nop/PT/Measured/abq26.html



Construction Material Inventory


ABOUT
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Pottawatomie County--Measured Sections

Abandoned limestone quarry 26
Northeast side of Kansas Highway 13
This abandoned quarry is located on the west side of Kansas Highway 13 and the Florence limestone was being quarried based on the road cut exposures on both sides of Kansas Highway 13 immediately adjacent to the old quarry.
Photos taken from the top of the east wall of the quarry looking west.

AbQ-26-1. Florence limestone in west wall of old quarry looking west.



AbQ 26-1

This server is run by the [Kansas Geological Survey](#).

This page updated July 24, 2007.

The URL for this page is http://www.kgs.ku.edu/CMI/how_to_use.html

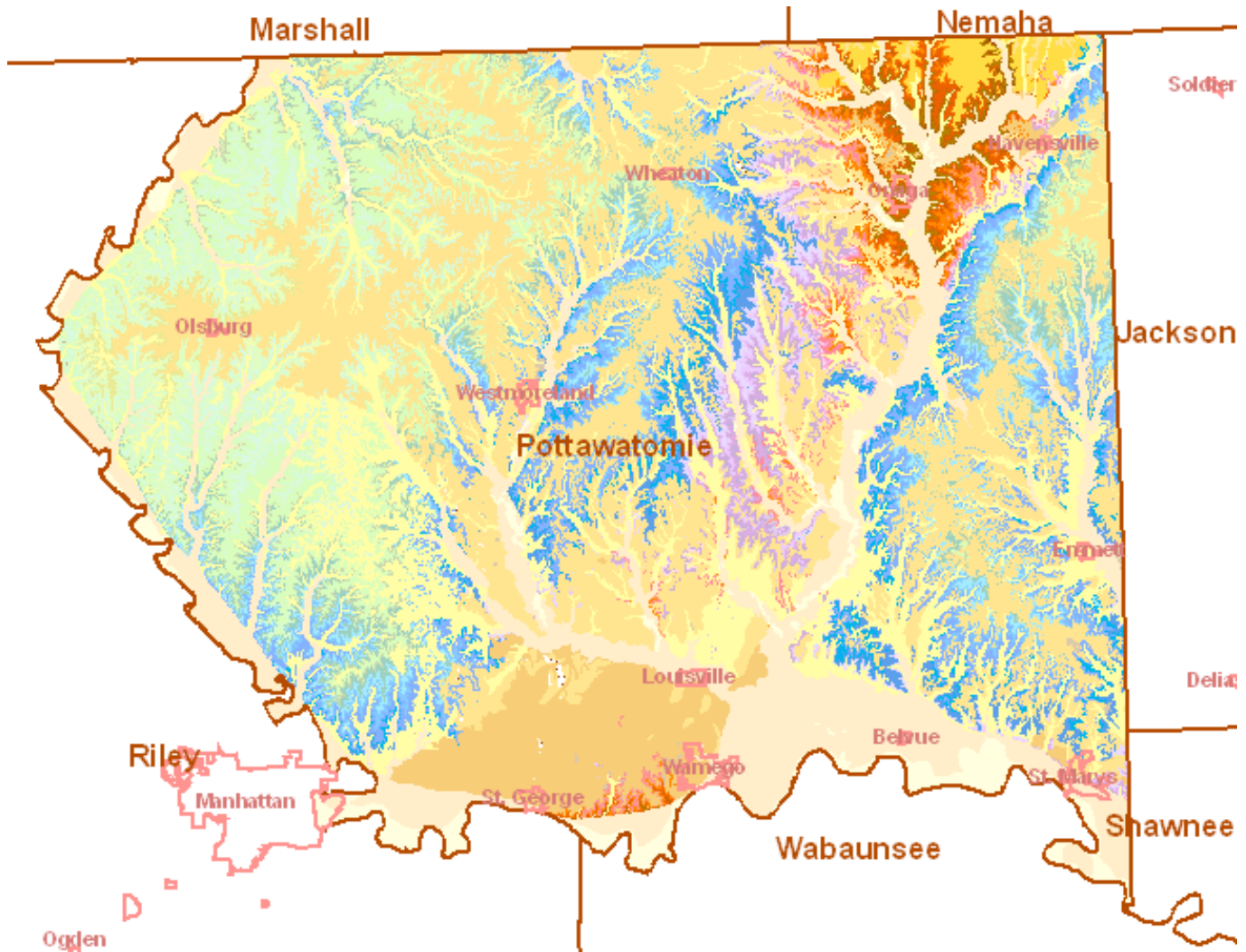
Comments to webadmin@kgs.ku.edu



Pottawatomie County General Stratigraphy

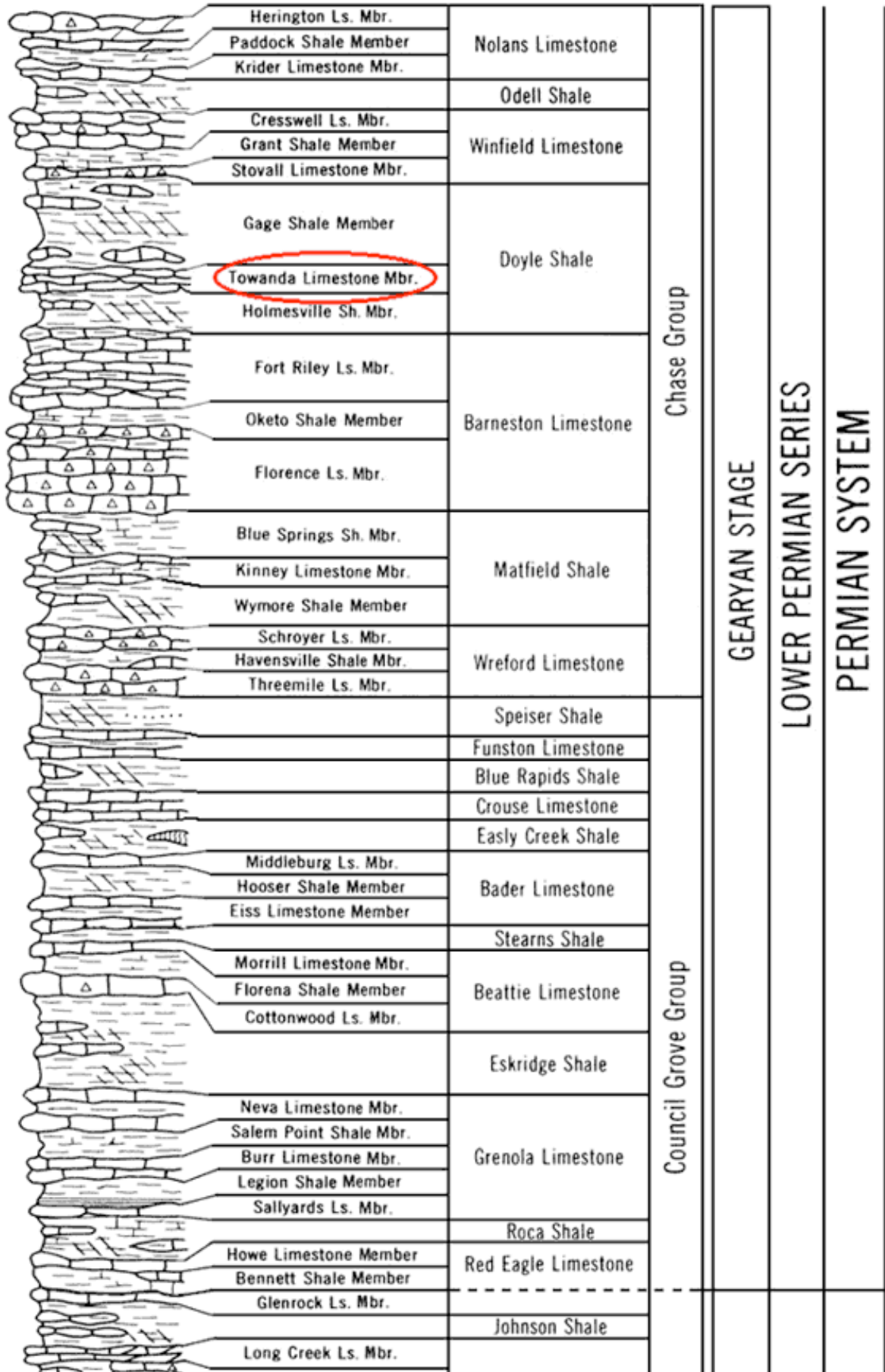
The stratigraphic units present in Pottawatomie County range from the late Pennsylvanian System to the early Permian System, and include the Wabaunsee, the Admire, the Council Grove, and the Chase.

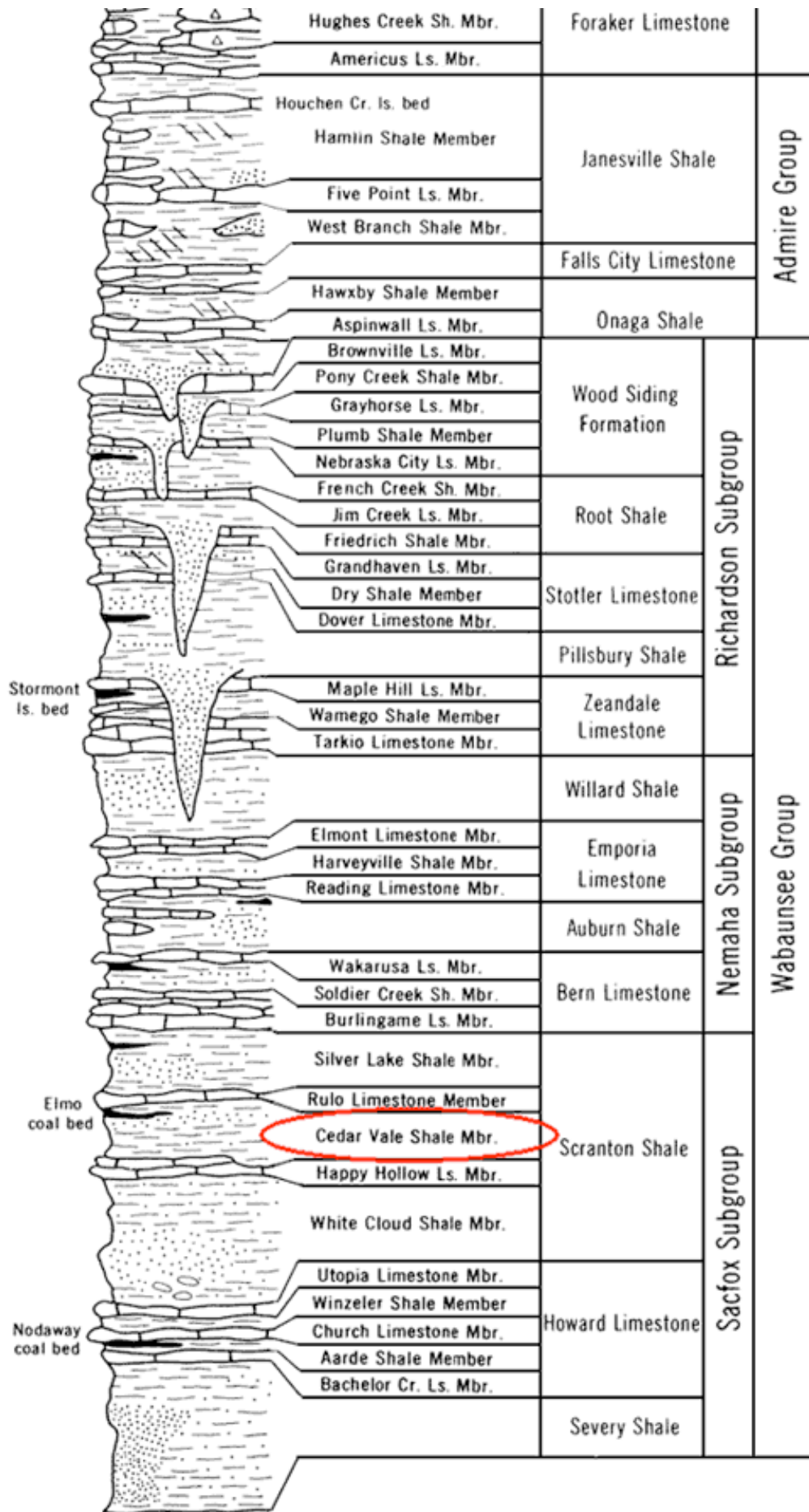
The topography throughout much of Pottawatomie County is the result of past glacial activity. Glacial-related surface deposits include glacial till, outwash, and glaciolacustrine sediments. Glacial erratics ranging in size from marbles to cars dot the landscape. The dark yellow region in the south-central Pottawatomie County, covering 40 square miles and bounded by Louisville, Wamego, and St. George, is almost entirely glacial outwash deposits of well-sorted silt and fine- to medium-grained sands up to 100 ft thick.



In Pottawatomie County, there are 34 distinct limestone members, the highest bedrock unit exposed being the Towanda Limestone Member (Middle Doyle Shale Formation) in the northwest corner around Olsburg, and the lowest ledge the Rulo Limestone Member (Middle Scranton Shale Formation) which crops out in the northeast area around Onaga. In addition, many shale units contain unnamed limestone ledges.

Source: KGS Bulletin 189, "Stratigraphic Succession in Kansas," Plate 1. Highest stratigraphic point in Pottawatomie County is Towanda Limestone Member. Lowest stratigraphic point in Pottawatomie County is the Cedar Vale Shale Member.





VIRGILIAN STAGE
UPPER PENNSYLVANIAN SERIES
CARBONIFEROUS SYSTEM

The following data table indicates the range of thicknesses of units present in Pottawatomie County, going from upsection to downsection (e.g., the Towanda Limestone Member overlies the Holmesville Shale Member, etc.) From Zeller, 1968.

Formation	Member	Thickness (ft)
Doyle Sh	Towanda Ls	5-15
	Holmesville Sh	70
Barneston Ls	Fort Riley Ls	30-45
	Oketo Sh	0-8
	Florence Ls	12-30
Matfield Sh	Blue Springs Sh	15-35
	Kinney Ls	1-24
	Wymore Sh	9-25
Wreford Ls	Schroyer Ls	6-13
	Havensville Sh	1.5-27
	Threemile Ls	6-33
Crouse Ls	Speiser Sh	18-35
	Funston Ls	5-28
	Blue Rapids Sh	15-30
Easley Creek Sh	NA	10-20
Bader Ls	Middleburg Ls	1.5-8
	Hooser Sh	3-11
	Eiss Ls	7-18
Sterns Sh	NA	5-20
Beattie Ls	Morrill Ls	2-9
	Florena Sh	3-18
	Cottonwood Ls	6
Eskridge Sh	NA	20-41
Grenola Ls	Neva Ls	9-28
	Salem Point Sh	4-15
	Burr Ls	1-15
	Legion Sh	1.4-13
	Sallyards Ls	0.3-5
Roca Sh	NA	7-34
Red Eagle Ls	Howe Ls	1-6
	Bennett Sh	4-27
	Glenrock Ls	0-3
Johnson Sh	NA	13-26

Foraker Ls	Long Creek Ls	2.5-12
	Hughes Creek Sh	20-56
	Americus Ls	1.5-20
Janesville Sh	Hamlin Sh	34-52
	Five Point Ls	1-13
	West Branch Sh	20-43
Falls City Ls	NA	6-17
Onaga Sh	Hawxby Sh	4-19
	Aspinwall Ls	1-15
	Towle Sh	2-15
Wood Siding	Brownville Ls	1-5
	Pony Creek Sh	5-50
	Grayhorse Ls	0.5-6
	Plumb Sh	10-30
	Nebraska Ls	1-5
Root Sh	French Creek Sh	20-45
	Jim Creek Ls	0.3-2
	Friedrich Sh	5-40
Stotler Ls	Grandhaven Ls	2-10
	Dry Sh	0-26
	Dover Ls	1-5
Pillsbury Sh	NA	1-50
Zeandale Ls	Maple Hill Ls	1-5
	Wamego Sh	4-25
	Tarkio Ls	0-10
Willard Sh	NA	30-65
Emporia Sh	Elmont Ls	1-15
	Harveyville Sh	1-25
	Reading Ls	1.5-15
Auburn Sh	NA	20-70
Bern Ls	Wakarusa Ls	2-18
	Soldier Creek Sh	1-25
	Burlingame Ls	2-16
Scranton Sh	Silver Lake Sh	4-45
	Rulo Ls	0-4
	Cedar Vale Sh	16-60

The following photographs and descriptions chronicle in greater detail the characteristics of major limestone units in Pottawatomie County. Some of the described units have been or continue to be of commercial interest.

Towanda Limestone Member
(NW corner of Booth Creek Rd and Case Ravine Rd)

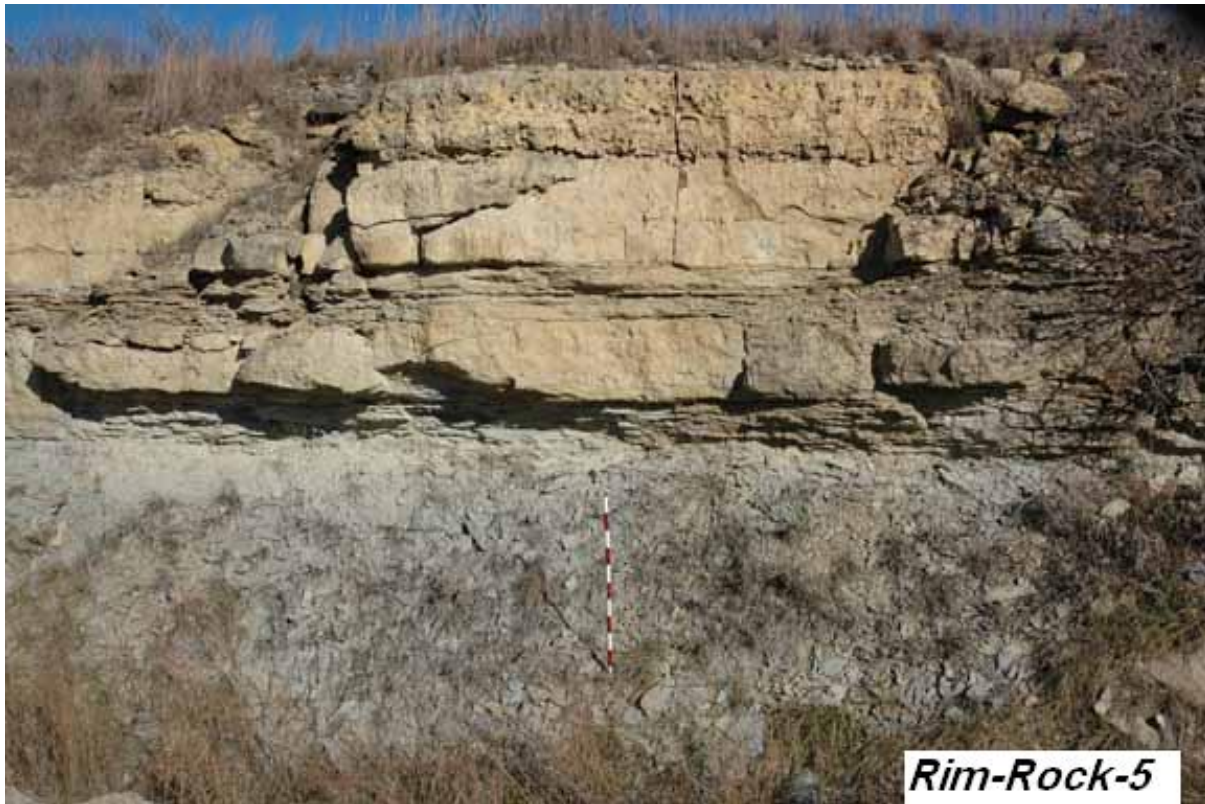


The Towanda Limestone, generally 15 ft thick in Pottawatomie County, has been described as a tan-gray, or light bluish-gray to yellow, platy to massive fine- to coarse-grained crystalline limestone that forms a gently rounded bench above the Fort Riley Limestone. It contains pockets of calcite crystals and weathers to porous crumbly yellowish nodules. Thin layers of calcareous tan shale separate some of the platy beds. The finer grained limestone layers contain silt. The Towanda Limestone can be brecciated in the upper part and fossils are rare (Scott et al., 1959; Zeller, 1968).

The Towanda Limestone has been quarried as a Class 0 and Class 1 Aggregate in Pottawatomie County and as a Class 0, 1, and 2 aggregate in other counties. (KDOT "A" List, 2007). It crops out only in the northwestern part of the county, capping the highest ridges and plateaus.

There is one site where lab analysis and testing data is available for the Towanda Limestone ([Limestone 14](#)).

Ft. Riley Limestone Member
(E. side of Shannon Creek Rd, and 1/3 mi N. of Swede Rd)

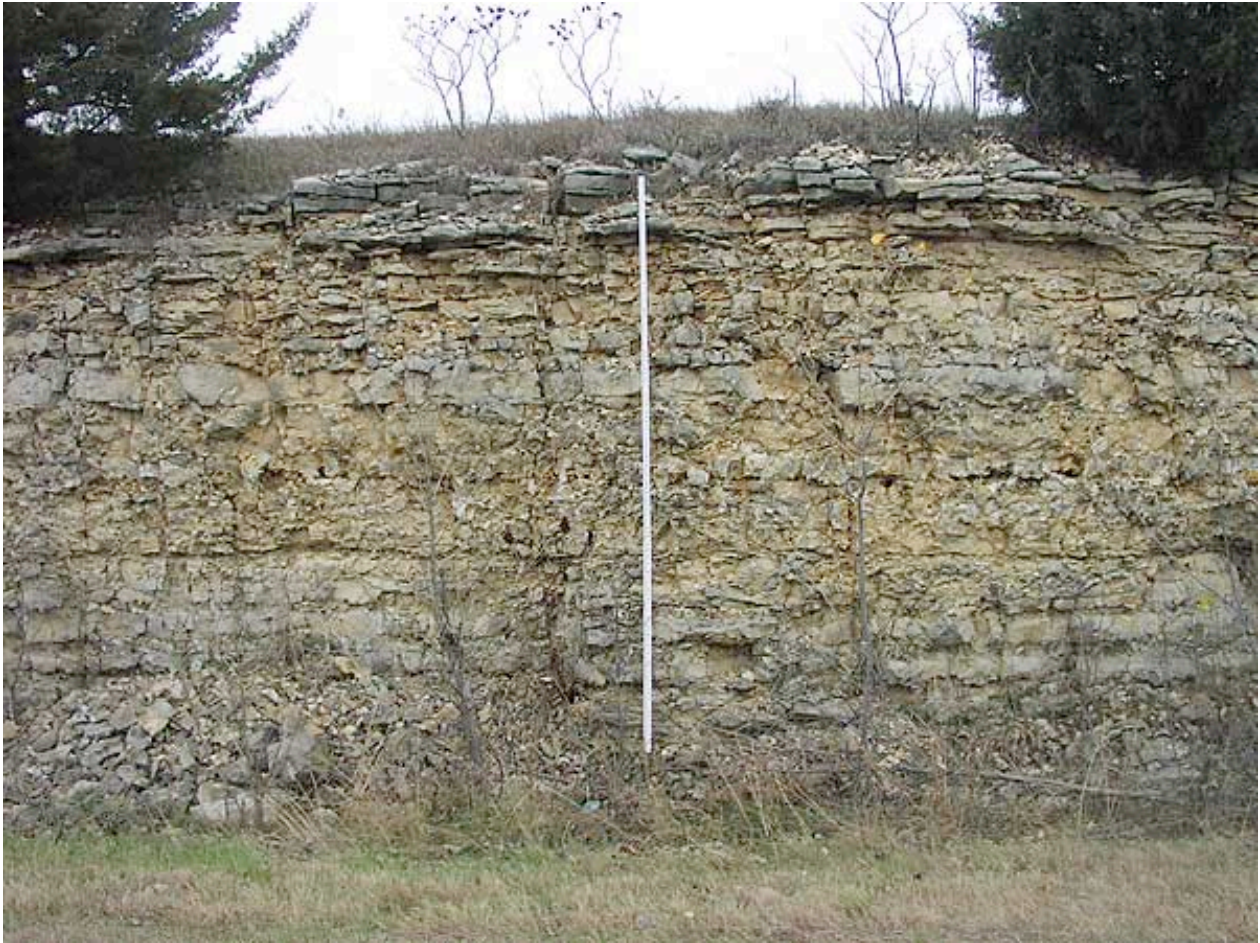


The Fort Riley Limestone Member, having a maximum thickness of 18 ft, is described as a sharply defined bench cropping out only in northwestern Pottawatomie County. There are layers of massive tan-gray coarse crystalline, porous limestone in the upper part, sometimes referred to as the "Rimrock," that weathers tan-gray and contains small limonite-stained cavities and pockets of calcite crystals. Algae are locally abundant. The lower part is generally a tan-gray thin-bedded calcareous silty shale and shaly fine-grained limestone. Both upper and lower parts are fossiliferous (Scott et al., 1959; Zeller, 1968).

There are two sites north of Olsburg where the Fort Riley Limestone was quarried and has been a source of building stone. In other counties the limestone has been evaluated as a Class 0, 1, and 2 aggregate (KDOT "A" List, 2007).

There is one site where lab analysis and testing data is available for the Fort Riley Limestone ([Limestone 15](#)).

Florence Limestone Member
(SW corner of Highway K-13 and Westmoreland Rd)



(west side of Highway 13, facing due west, measuring stick is 15 ft tall)

The Florence Limestone Member caps most of the buttes in the western half of the county, averages about 30 feet in thickness, and is one of the most prominent benches in Pottawatomie County. In general, the unit has abundant chert, scarce shale, and is a light-gray to yellowish-gray limestone with bluish-gray chert nodules. Fossils include brachiopods, pelecypods, bryozoans, and fusulinids. The upper part of the Florence contains distinct 8-10 inch beds of bluish-gray chert nodules alternating with beds of dense light-gray limestone. In exposed layers, the chert nodules shatter and split away from the limestone matrix probably due to water and frost action. The lower part of the Florence Limestone is made up of alternating beds of cherty gray limestone and gray calcareous silty shale (Scott et al., 1959; Zeller, 1968).

Others describe the Florence Limestone in the upper part as tan to dark gray, fine-grained, thin to medium bedded, very cherty, with scattered quartz geodes, abundant brachiopods and mollusks, and large scale cross-bedding. The lower part is gray to light brown, fine-grained, massive, with numerous thin chert bands, and fewer fossils than in the upper part (Dishman, 1969).

No tests or analyses were performed on the Florence Limestone in Pottawatomie County. The Florence Limestone was quarried in only one recorded site.

Kinney Limestone Member
(E. side of K-13, about 0.15 mi S. of Bennett Rd)



There are few good exposures of the Kinney Limestone in Pottawatomie County, and in the western half of the county, it forms a weak bench about 2-4 ft in thickness. It is described as being a massive, soft, fine-grained light-gray limestone that weathers gray and shows yellow cavities. In some localities it consists of two gray fossiliferous limestone beds separated by a gray fossiliferous shale bed or parting (Scott et al., 1959; Zeller, 1968).

In other Pottawatomie County localities, the Kinney Limestone has been described in the upper part as a blocky, dense, bluish limestone that weathers gray and pitted, locally fossiliferous (allorisma, myalina). The middle part is a green or olive bedded or fissile shale that weathers gray or buff. The lower part is a bluish, dense, massive, argillaceous platy limestone that weathers buff (Kraemer, 1934).

Others describe the Kinney Limestone in the upper part as a light tan, argillaceous limestone that weathers to rounded cobbles; the middle shale layer is light tan to tan to olive calcareous siltstone or silty shale; the lower part is a light gray, fine-grained, dense limestone with abundant small crinoid fragments and a thin basal conglomerate (Dishman, 1969).

There are no test analysis sites for the Kinney Limestone and there is no record of it having been quarried in the county.

Schroyer Limestone Member
(NW side of Highway K-13, about half-mile S. of Jacobs Rd)



The Schroyer Limestone Member is a well developed bench, ranging 8 to 18 ft thick, in the central western and northwestern portions of the county but is sometimes obscured by Matfield Shale sediments. The unit consists of an upper part that is light gray to nearly white massive limestone, mostly chert-bearing, but commonly has a 3 ft thick non-cherty bed. The middle part is described as a cherty tan-gray fossiliferous limestone and the lower part has tan-gray calcareous silty shale beds, platy tan-gray limestone beds, and in some places a cross-bedded massive gray crystalline limestone containing flattened mudballs (Scott et al., 1959; Zeller, 1968). Others describe the Schroyer Limestone in the very upper part as gray or cream, weathers buff, recrystallized or partially recrystallized, fine-grained, sometimes oolitic with abundant ostracodes and small high spired gastropods (Stewart, 1963).

There is one lab analysis and test site for the Schroyer Limestone ([Limestone 22](#)), and at least one site in the county where the Schroyer Limestone was quarried. There are no records of paving class.

Three Mile Limestone Member
(East side of Highway K-63, 0.15 mi north of K-16 Highway)



The Three Mile Limestone Member is one of the most consistent cherty limestone members in the county in terms of thickness (7-8 ft) and lithology. The unit is light gray to nearly white limestone, and has a foot-thick massive light-gray finely crystalline limestone bed at the top and alternating bluish-gray chert layers and medium-bedded gray limestone layers. It contains massive and more resistant non-cherty beds in the middle and lower parts. Fossils are abundant and are especially well preserved on the outside of the chert nodules.

The Three Mile Limestone has been quarried for road metal but the crushed chert fragments made it less suitable for this purpose than other available limestone (Scott et al., 1959; Zeller, 1968).

No testing or analyses were performed on the Florence Limestone in Pottawatomie County. There is only one recorded site in the county where the rock was quarried. There is no available information as to its potential paving class.

Funston Limestone Member

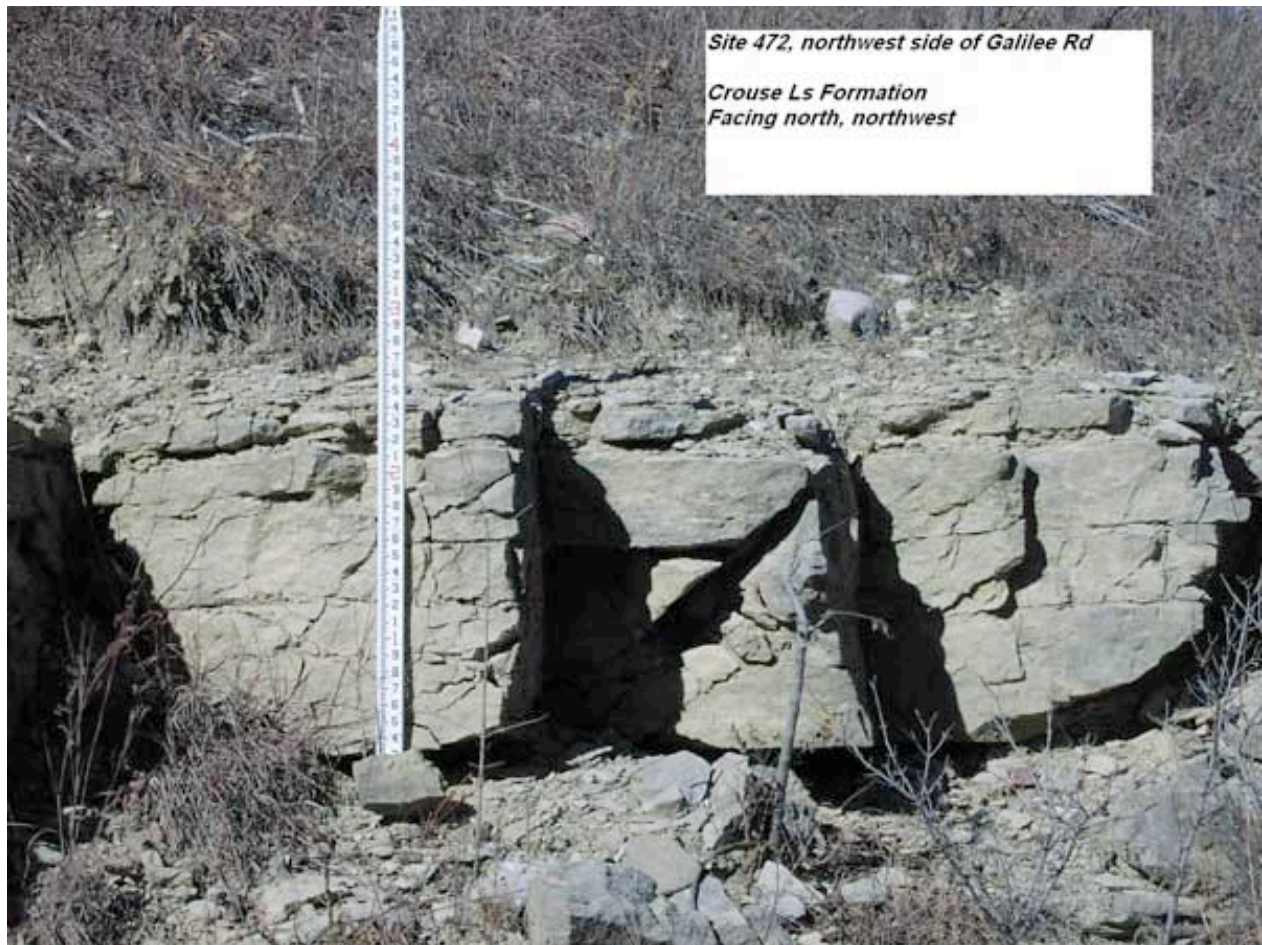
(W. side of Highway K-99, 1 mile N. of Godlove Rd)



The Funston Limestone Member crops out in both eastern and western Pottawatomie County, but forms a more prominent bench in the east because of its increased thickness and more massive appearance. It averages about 2.5 feet thick and locally contains chert nodules. The unit is a light-gray to bluish-gray limestone separated by gray to yellowish-gray shale that commonly is abundantly fossiliferous. The upper part is massive, porous, and soft. The lower part is harder, tan-gray with a mottled salt and pepper appearance on a fresh surface, and weathers dark gray (Zeller, 1968).

The Funston Limestone has been quarried in at least three sites. Lab analysis and testing has been performed in three places ([Limestone 9](#), [Limestone 10](#), [Limestone 12](#)). There is no record of its paving class.

Crouse Limestone Member



The typical Crouse Limestone crops out in the northern and western portions of the county, and has at least three limestone beds with an overall thickness of about 16 ft. The upper part is light gray, platy, dense and weather tan to brown. The softer middle and lower limestone beds are separated from the upper part by a few feet of tan-gray, clayey, fossiliferous shale (Scott et al., 1959; Zeller, 1968).

Others describe the unit as an argillaceous mudstone, laminated, wavy bedded, platy fracture, bioturbated with both horizontal and vertical burrows, yellowish gray (5Y 8/1), weathers light olive gray (5Y 6/1), both upper and lower contacts gradational. The Crouse Limestone is locally stromatolitic and vuggy (Vorán, 1977).

There is no record of the Crouse Limestone being quarried but there is one lab analysis site ([Limestone 4](#)).

Middleburg Limestone Member
(Highway K-13, about 0.6 to 0.7 mi S. of Carnahan Rd)



In the above photo, the upper limestone outcrop is the Middleburg Limestone, which rarely exceeds 2 ft in thickness (Note: the upper limestone unit, the intervening shale unit, and the lower limestone unit in the lower right-hand corner [the Eiss Limestone] form the Bader Limestone Formation).

The Middleburg Limestone crops out in the north-central, southwestern, and east-central areas of the county, but does not form a prominent bench. It is described as a gray or tan-gray, massive, dense, fossiliferous, limonite-stained limestone (Scott et al., 1959).

There are no lab analysis sites for the Middleburg Limestone and there is no record of it having been quarried in the county.

Eiss Limestone Member
(Highway K-13, about 0.6 to 0.7 mi S. of Carnahan Rd)



In the above photo, the lower limestone outcrop is the Eiss Limestone.

The Eiss Limestone crops out in various locations all around the county and forms a prominent bench between 4.5 and 10 ft thick. The unit is made up of an upper and lower limestone bed with an intervening, fossiliferous calcareous light-gray clayey shale. The upper bed, generally 2 to 3 ft in thickness is massive, cavernous when weathered, siliceous, and locally cherty. The lower bed is 1.5 to 6 ft in thickness and is shaly, thin-bedded, and contains abundant small, high-spined gastropods (Scott et al., 1959; Zeller, 1968).

There is no record of the Eiss Limestone having been quarried in the county, but there are two lab analysis sites ([Limestone 8](#) and [Limestone 11](#)).

Morrill Limestone Member
(outcrop located above Spring Creek 100 yards S. of K-16)



The Morrill Limestone unit is a brown to grayish-brown argillaceous limestone that contains one or more thin shale partings, with thicknesses ranging from 2 to 9 ft. The unit is also described as generally consisting of two or more gray or light-gray limestone beds separated by thin light-gray clayey shale beds, is dense, hard, fossiliferous, in some places contains calcite geodes, and averages about 3.5 ft in thickness. A particularly thick 10 ft layer was described in the SW, NW, Sec. 10, T. 6 S., R. 8 E. with only about 4 ft of Florena Shale separating it from 7 ft of the Cottonwood Limestone (Scott et al., 1959; Zeller, 1968).

There are no lab analysis sites for the Morrill Limestone and there is no record of it having been quarried in the county.

Cottonwood Limestone Member

(W. side of Hwy 13, 0.4 mi NE of Dyer Rd [Tuttle Creek Dam])



The Cottonwood Limestone Member forms a characteristic shrub-lined prominent bench ranging 5-7 ft in Pottawatomie County. The unit is massive, light-buff, weathering nearly white, cherty with abundant fusulinids in the upper part. In southern Kansas and in some localities it is thin-bedded and shaly. In Kansas, the thickness is fairly constant at around 6 ft, although the unit thins toward the south of the state. (Scott et al., 1959; Zeller, 1968).

The Cottonwood Limestone has also been described, in the upper part, as fine calcirudite, packstone, gray to medium gray, weathering to yellow-gray, massive, with abundant fusulinids, scattered crinoids, and bedded chert 8-12 in. above the base. The lower part of the Cottonwood is medium calcilutite, wackestone, light-gray to gray, blocky or slabby, with common productids, crinoids and composite. It is locally argillaceous (Bogina, 1989).

The Cottonwood Limestone has been quarried in numerous locations in Pottawatomie County. Lab analysis and testing data are available in five locations ([Limestone 5](#), [Limestone 7](#), [Limestone 13](#), [Limestone 17](#), and [Limestone 24](#)).

Neva Limestone Member (according to geo map)
(SE corner of Rock Creek Rd and Flush Rd, about 1 mi W. of Hwy 99)



The Neva Limestone Member is currently one of the most extensively quarried limestone units in Pottawatomie County. The unit, ranging 10-20 ft, has gray limestone beds interbedded with gray and grayish-green shale beds. A fresh exposure gives an appearance of being a single bed but when weathered, it breaks down into four or five limestone beds with intervening silty shale beds. It has a basal bed of gray algal limestone 0.4-3.7 ft, overlain by a medium-gray to very dark-gray silty calcareous shale 3 ft thick. The main limestone ledge is a gray, massive limestone 1.8-14.4 ft thick. This bed has a brecciated, porous appearance with a diverse fauna of fusulinids, brachiopods, echinoids, and algae. The middle-upper layers contain a 3 ft gray to grayish-green fossiliferous shale, followed by the upper limestone layer of gray, fossiliferous limestone, and averaging about a half-foot to 6 ft in thickness (Scott et al., 1959; Zeller, 1968).

The Neva Limestone has been quarried in numerous locations throughout Pottawatomie County for road rock and Class 1 and 2 aggregate (KDOT "A" Listing, 2007). There are seven sites where lab analysis and testing has been performed ([Limestone 6](#), [Limestone 16](#), [Limestone 18](#), [Limestone 23](#), [Limestone 25](#), [Limestone 26](#), and [Limestone 30](#)).

Burr Limestone Member

(no photo available)

The Burr Limestone, about 8 ft in thickness, consists of two limestone beds separated by shale. The beds are massive, fine-grained, tan-gray, and fossiliferous, with the upper part being soft, porous, and containing small cavities; the lower part is hard, clayey, and weathers blocky. The intervening shale is a fissile black or olive-drab clay (Scott et al., 1959).

Others describe the Burr Limestone as tan, weathering gray, massive, and dense. The upper portion is generally 2.5 ft thick with an ostracode zone on the very upper surface, and the lower portion, also 2.5 to 3 ft in thickness, is brown, weathering buff, massive, dense, fine crystalline, with calcite-filled vugs. The intervening shale unit is typically 1 to 1.5 ft in thickness and is a friable black fissile or platy shale with a scattered burrow and root mottled appearance (Snyder, 1968, Bogina, 1989).

There is at least one record of the Burr Limestone being quarried in the north-central area of Pottawatomie County, and this site was abandoned in 1968. There are two sites where lab analysis and testing was performed ([Limestone 21](#) and [Limestone 29](#)). There is no record of paving class.

Sallyards Limestone Member
(no photo available)

The Sallyards Limestone is described as a massive, hard, dense light-gray limestone that weathers blocky. The upper part is fossiliferous in some outcrops, and the unit averages about 1 ft in thickness (Scott et al., 1959).

Other descriptions depict the Sallyards as a light gray, massive, dense, hard, argillaceous limestone that weathers blocky, contains crinoid columnals, brachiopods, pelecypods, and other fossil fragments, also about 1 ft in thickness. Outcrops to the north of Pottawatomie County also indicate a yellowish gray limestone weathering to tan, porous in lower 3 in., massive, dense in upper portion, medium hard and up to about 3 ft thick (Avers, 1968).

There are no test analysis sites for the Sallyards Limestone and there is no record of it having been quarried in the county.

Howe Limestone Member
(Tuttle Creek Spillway)
Underlain by Bennett Shale



The Howe Limestone Member (4.5 ft thick in Pottawatomie County) is a persistent uniform gray to grayish-brown, fine-grained algal limestone with tiny pelecypods, and gastropods, ostracodes, and foraminifers. The Howe Limestone is also described as forming a poorly defined bench, and generally consisting of two or more massive tan or tan-gray beds, with the upper being harder and more resistant to weathering. The lower part is iron-stained, and is separated from the upper part

by a blocky calcareous light-gray or tan-gray silty shale (Scott et al., 1959; Zeller, 1968).

There is no record of the Howe Limestone being quarried in Pottawatomie County, but there is one site in the northeast part of the county where a lab analysis and test was conducted ([Limestone 1](#)). The Howe Limestone has been quarried in Cowley County, Kansas for a Class 0 and Class 2 aggregate (KDOT "A" Listing, 2007).

Glenrock Limestone Member
(Tuttle Creek Spillway)



The Glenrock Limestone Member, up to 3 ft in thickness in southern Nebraska, is described as a gray to brownish-gray limestone with brachiopods, algae, gastropods, abundant fusulinids, and other smaller foraminifers. Others describe the unit as a massive, dense, petroliferous gray or tan-gray limestone between 0.5 and 1.6 ft thick in Pottawatomie County, fossiliferous, and locally has a brecciated appearance. The unit is absent in Wabaunsee County just south of Pottawatomie County (Scott et al., 1959; Zeller, 1968).

There are no test analysis sites for the Glenrock Limestone and there is no record of it having been quarried in the county. There is a record of the Glenrock Limestone being quarried as a Class 0 and Class 2 aggregate in Cowley County, Kansas (KDOT "A" Listing, 2007).

Long Creek Limestone Member
(no photo available)

The Long Creek Limestone, 6 to 7.3 ft thick, is a massive, clayey, dolomitic tan or gray-brown limestone containing jasper and pockets of crystalline quartz, calcite, and celestite. Extensive iron stains occur near the base. Fossiliferous, lower beds contain abundant fusulinids (Scott et al., 1959).

Others describe the upper 2.3 ft of the Long Creek Limestone being yellowish brown to orange, porous and hard, containing honey-comb structure, pores filled with clay-size material, with the middle portion being light to medium brown, weathering to tan, soft, and containing calcite geodes. The lower portion is a massive, porous, calcareous, argillaceous yellowish-brown siltstone (Avers, 1968).

There are no test analysis sites for the Long Creek Limestone and there is no record of it having been quarried in the county.

Americus Limestone Member

(E. side of Camp Creek Rd, about 1/3 mi N. of Oregon Trail Rd)



The Americus Limestone Member consists of two gray to bluish-gray limestone beds separated by a medium-gray to very dark-gray shale bed. The thickness ranges from 1.5 to 20 ft, although in Pottawatomie County the average is generally 2 to 4.5 ft. The upper and lower limestone beds are very fossiliferous (crinoids, brachiopods, bryozoans, pelecypods, fusulinids, and algae). In some outcrops, partly silicified algal nodules are present on the upper surface of the lower part of the unit (Scott et al., 1959; Zeller, 1968).

Others describe the upper part as a brachiopod or echinoderm lime packstone, hard, dense, light gray or light to pinkish gray. The lower part is a foraminifer or ostracode coated grain lime wackestone-packstone, hard, dense, thin-bedded, with an algal lime boundstone at the base. The shale between is fissile to blocky, calcareous, light gray to gray to dark gray (Peterson, 1978).

The Americus Limestone forms a distinct bench that and has been quarried as a building stone material in southeast Pottawatomie County. No paving class data is available. There is one lab analysis and test site ([Limestone 27](#)).

Five Point Limestone Member

(S. side of Grange Rd, 1 mi W. of Dutch Creek Rd)



The Five Point Limestone Member has been described as a massive hard coarse-grained tan or tan-gray coquinoidal limestone with variable thickness rarely exceeding 2 ft (Scott et al., 1959). It is also described as a unit that locally consists of an upper and lower bed, with a local thin green calcareous, fossiliferous shale in between, with the entire unit ranging in thickness from 2.3 to 3.3 ft. The upper bed is light gray to moderate orange pink (10R 7/4), weathering buff to dark buff, locally massive, porous, coquinoid, with brachiopods, crinoid columnals, and gastropods. The lower bed is grayish-green, slabby, with abundant fusulinids, bryozoans, brachiopods, crinoid columnals, and gastropods (Bernasek, 1967).

While not extensively quarried, the limestone is quarried as a building stone, especially near Duluth in Pottawatomie County where it is pink. There is one site where a lab analysis and test was performed ([Limestone 3](#)). No paving class data is available.

Falls City Limestone Member
(no photo available)

The Falls City Limestone in northeastern Kansas consists of an upper and lower fossiliferous limestone bed separated by gray shale containing fossiliferous carbonate lenses. The unit ranges 1 to 3 ft in thickness in Pottawatomie County. Both beds are argillaceous and fossils include mollusks, bryozoans, and brachiopods. More locally, the Falls City Limestone is a massive, dense brown limestone that weathers to small brown blocks with brown dendrites on surfaces (Scott et al., 1959; Zeller, 1968).

There are no lab analysis sites for the Falls City Limestone and there is no record of it having been quarried in the county.

Aspinwall Limestone Member

(N. side of Mt. Calvary Rd, about 0.35 mi E. of Shawnee Rd)



In Pottawatomie County the unit forms a thin bench. The Aspinwall Limestone is massive, laminated, contains clay balls flattened parallel to bedding. It has a mottled appearance with brown, gray-brown, and tan-gray streaks, and ranges in thickness from 0.6 to 4.2 ft (Scott et al., 1959).

Others describe the Aspinwall Limestone as a skeletal calcilutite; platy; pale yellowish brown (10YR 6/2), weathering to a moderate yellowish brown, (10YR 4/2). It contains rounded clay fragments (1-3 mm), is sparsely fossiliferous with productacean brachiopod fragments, echinoid spines, and other skeletal debris fragments (Bisby, 1986).

No record of commercial quarrying exists. Regular, rectangular jointing allowed the Aspinwall Limestone to be used as structural stone in small bridges. There is one analysis and test site ([Limestone 19](#)).

Brownville Limestone Member

(N. side of Cow Creek Rd, about 0.7 mi W. of K-63)



Site 421A
 Brownville Ls Mbr (about 2.2'
 thick)
 Facing North, Northwest

The Brownville Limestone forms a thin (2-3.5 ft) but persistent bench near Maryville and along Vermillion Creek, and is made up of upper and lower massive, dense fossiliferous limestone beds that weather tan and blocky or nodular. The two beds are separated by a fossiliferous tan-gray silty shale (Scott et al., 1959).

The upper bed gray weathers yellowish-brown, blocky; brachiopods (*Marginifera* and *Chonetes*), bryozoans, and crinoid columnals. The lower bed is greenish-gray, weathers buff, is massive, argillaceous, limonitic, fossiliferous (brachiopods, crinoids) and contains a very thin gray calcareous shale (Bernasek, 1967).

The Brownville Limestone Member has been quarried in at least one site in Pottawatomie County and there is one lab analysis and test site ([Limestone 20](#)). No paving class data is available.

Grayhorse Limestone Member (no photo available)

Only a few outcrops exist in the county. The Grayhorse Limestone is hard, slightly porous, tan to tan brown, and contains limonite and clay balls. The unit weathers blocky, has a conglomeratic appearance, and is half a foot to 2 ft thick (Scott et al., 1959).

There are no test analysis sites for the Grayhorse Limestone and there is no record of it having been quarried in the county.

Nebraska City Limestone Member (no photo available)

Only a few outcrops exist in the county. The Nebraska City Limestone, ranging in thickness from 1 to 1.5 ft, is described as a massive single bed of metallic-gray or mottled blue and gray fossiliferous limestone that weathers mottled brown and gray shaly limestone (Scott et al., 1959).

There are no test analysis sites for the Nebraska City Limestone and there is no record of it having been quarried in the county.

Jim Creek Limestone Member

(no photo available)

The Jim Creek Limestone weathers tan gray and blocky or nodular, ranging 1 to 2.5 ft in thickness. It is massive, fossiliferous, and on a fresh surface is tan mottled with light green (Scott et al., 1959).

Others describe the Jim Creek Limestone in some State of Nebraska outcrops as dark gray, weathers light greenish gray, splits into slabby plates, and contains crinoid columnals and broken shell fragments (Girardot, 1962).

There are no test analysis sites for the Jim Creek Limestone and there is no record of it having been quarried in the county.

Grandhaven Limestone Member

(no photo available)

This unit is believed to be undifferentiated in Pottawatomie County but would lie between the Dry and the Friedrich shale members (Scott et al., 1959).

There are no test analysis sites for the Grandhaven Limestone and there is no record of it having been quarried in the county.

Dover Limestone Member

(no photo available)

The Dover Limestone, averaging 2.5 to 3 ft in thickness, is a massive, dense, hard gray limestone that weathers light brown and nodular, and resembles the Tarkio Limestone. Both have large fusulinids, but the Dover Limestone has more corals and *Osagia*, a gray algal nodule 1 to 2 in. in diameter (Scott et al., 1959).

There is no record of the Dover Limestone having been quarried in Pottawatomie County, but there is one lab analysis and test site ([Limestone 28](#)).

Maple Hill Limestone Member

(photo tentatively identified as Maple Hill, as indicated by geological map)

(N. side of Highway US 24, 0.35 mi E. of Salzer Rd)



(Maple Hill Limestone close-up showing abundant fusulinids)
(N. side of Highway US 24, 0.35 mi E. of Salzer Rd)



The Maple Hill Limestone, ranging 1.8 to 3 ft in thickness, resembles the Tarkio in appearance, but the bench is less well-defined. The unit is massive, dense, dark gray, weathers light brown, forms rectangular blocks, and contains abundant small fusulinids (Scott et al., 1959).

There are no test analysis sites for the Maple Hill Limestone and there is no record of it having been quarried in the county.

Tarkio Limestone Member

(no photo available)

Development has erased most evidence of the old quarries and it is difficult to find a good Tarkio Limestone exposure in the area. The unit, up to 8 ft in thickness in the south and up to about 4 ft in the north, crops out as a very prominent bench in the south-central and northeastern portions of the county. It has been described as a light-gray or tan-gray massive, dense limestone that weathers slabby or blocky with large fusulinids (Scott et al., 1959).

Other descriptions include the Tarkio Limestone, with a thickness up to 10 ft, as gray and brown, massive but deeply weathered, containing giant fusulinids (*Triticites ventricosus*) (Harding, 1950).

The Tarkio Limestone has been quarried extensively in Pottawatomie County, particularly in the area around Wamego and St. George for road riprap. In neighboring Riley County the member has met Class 2 aggregate standards (KDOT "A" Listing, 2007). There is one lab analysis and test site ([Limestone 31](#)).

Elmont Limestone Member

(N. side of Hwy 16, W. of Kelley Creek Rd)



The Elmont Limestone Member (2-5 ft in thickness) forms a prominent bench in the south central and northeast portions of Pottawatomie County. The base of the Elmont Limestone is a thin bluish-gray conglomeric limestone overlain by 0.3 to 4 ft of clayey, calcareous gray shale containing *Derbyia* and *Chonetes*. The middle part is characterized as having vertical joints and is a persistent, dense, bluish-gray limestone containing small fusulinids, algae, brachiopods, and crinoid fragments. The upper part is a few inches up to 1 ft gray calcareous shale overlain by a thin algal-molluscan limestone (Scott et al., 1959; Zeller, 1968).

The Elmont Limestone has also been described in the lower part as an intrasparudite, brown to yellowish-brown, weathering grayish to yellowish brown with conchoidal fractures. Fossils include possible *Osagia*, *Anchicodium*, and *Bellerophon*. The upper part has been characterized as a biosparite, brown to yellowish brown, weathers yellowish to grayish brown to brown, dense, massive, locally containing hard platy limonitic fragments on the upper surface. Fossils include fusulinids, crinoidal columnals, fenestrate bryozoans, *Osagia*, *Anchicodium*, *Bellerophon*, *Marginifera*, and *Chonetes* (Renfro, 1963).

The Elmont Limestone was quarried at a couple of sites in Pottawatomie County although the quarries were abandoned as far back as 1952. There is no lab analysis site available and there is no paving class data available.

Reading Limestone Member
(N. side of Hwy 16, W. of Kelley Creek Rd)



The Reading Limestone Member primarily outcrops in northeastern Pottawatomie County, and commonly consists of usually three massive, hard, dense fossiliferous limestone beds averaging between 2 and 3 ft in thickness. A sometimes non-persistent lower bed is dark gray, crystalline. The middle bed is gray with fossil shells and calcite-lined cavities. The upper beds are gray or brown. Thin silty limonitic shale layers separate the limestone beds (Scott et al., 1959).

The unit, which in other parts of Kansas can vary between 1.5 to 15 ft in thickness, is also described as consisting of one to four limestone beds interbedded with a blue-gray shale and in southeastern Kansas it contains a coal bed. The most persistent part of the Reading Limestone is a dark bluish-gray, dense, hard limestone with closely spaced vertical joints that weathers light bluish-gray mottled with light brown or yellowish-brown. Fusulinids are characteristic of the main part of the unit although locally it contains algae (Zeller, 1968).

The Reading Limestone was quarried at several sites in Pottawatomie County although the quarries were abandoned as far back as 1952. There is one test analysis site available ([Limestone 2](#)). No paving class data is available.

Wakarusa Limestone Member (no photo available)

The Wakarusa Limestone Member, ranging 3 to 5.7 ft in thickness, forms a well-defined bench in the south-central and northeastern parts of the county and consists of several massive or shaly limestone beds separated by thick shale layers. The unit is tan-gray or gray, weathers tan gray, gray, light rose or red brown and is marked by dendrites. The Wakarusa Limestone contains abundant fossils (Scott et al., 1959).

There are no test analysis sites for the Wakarusa Limestone and there is no record of it having been quarried in the county.

Burlingame Limestone Member

(no photo available)

The Burlingame Limestone Member (1-3 ft thick) is characterized by a single persistent bed of massive conglomeratic tan or tan-gray limestone containing flattened clay balls. In some locations, a second massive tan limestone bed exists on top of the first bed, separated by a calcareous tan-gray silty shale. The lower bed is generally 1 to 1.6 ft in thickness, but where both limestone beds exist, the entire unit can be up to 3 ft in thickness. The Burlingame Limestone is limonitic and contains abundant large and small fusulinids (Scott et al., 1959).

There are no test analysis sites for the Burlingame Limestone and there is no record of it having been quarried in the county.

Rulo Limestone Member

(no photo available)

The Rulo Limestone is considered to be the very lowest stratigraphic member of Pottawatomie County. The Rulo Limestone is described as being a massive, dense, hard, dark-gray or tan limestone that is platy or shaly and weathers brown, averaging 1.5 ft in thickness (Scott et al., 1959).

There are no test analysis sites for the Rulo Limestone and there is no record of it having been quarried in the county.

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