BEFORE THE STATE CORPORATION COMMISSION
OF THE STATE OF KANSAS

In the Matter of the Application of Shakespeare Oil Company, Inc. for a permit to authorize injection into the Whitehorse and Cedar Hills formations at the Wells #2-27 well in Section 27, Township 16 South, Range 35 West, Cowley County, Kansas	)	Docket No. 25-CONS-3411-CUIC CONSERVATION DIVISION License No. 7311

PREFILED TESTIMONY

OF

ANDREW T. ECK

ON BEHALF OF APPLICANT,

SHAKESPEARE OIL COMPANY, INC.

Q. Please state your name and business address.

A. My name is Andrew T. Eck, and my business address is 125 N Market Street, Ste 1435, Wichita, KS 67202. On October 3, 2025, my business address will be moved to 333 S Greenwood Ave, Wichita, KS 67211.

Q. By whom are you employed and in what capacity?

A. I am employed by Shakespeare Oil Company, Inc. as a Geologist.

Q. Please summarize your educational background.

A. I graduated in 2011 from Fort Hays State University with a BS in Geology. In 2013, I received an MS in Geology from Wichita State University.

Q. Please summarize your professional experience.

A. After graduation from Fort Hays State in 2011, I went to work for Mull Drilling Company in Wichita as a geologist. I worked for Mull Drilling until 2014. I left Mull to begin working for Shakespeare Oil Company as a geologist, and I've been there since.

Q. As a geologist, do you have any professional certifications or licenses and, if so, what are they?

A. Yes, I am a Certified Professional Geologist with the American Association of Petroleum Geologists. My credentials are CPG #6383.

Q. Have you previously testified before the Kansas Corporation Commission or any other state's oil and gas regulatory commission or board?

A. No, I have not.

Q. Would you please provide a brief summary of your direct testimony in these proceedings in support of Shakespeare's pending Application for Injection Well?

A. Yes, in my testimony I will show the depths of the various stratigraphic formations of the Wells #2-27 as they correlate to established Kansas stratigraphy. My interpretation and

determinations were made by correlating the log for Wells #2-27 to nearby wells in the Kansas Geological Survey's 'Bob Slamal Digital Type Logs Project', a State of Kansas and Department of Energy-funded program meant in part to formalize statewide stratigraphic correlations. My interpretations show that the proposed completion of the Wells #2-27 well is compliant with the published KCC rules pertaining to the minimum depths for disposal wells in Wichita County. I will also testify to the thickness and the sufficiency of the confining layers that exist in the Wells #2-27 between the injection zones and the top of the Permian Red Beds which, by order of the KCC, is the minimum depth for disposal wells in Wichita County, Kansas.

Q. Have you prepared any exhibits to present and discuss in support of your testimony?

A. Yes, I have prepared four exhibits. Eck Exhibit No. 1 is a copy of Table II from the rules and regulations of the Kansas Corporation Commission. Eck Exhibit No. 2 is a copy of a portion of the Kansas Stratigraphic Column published by the Kansas Geologic Survey. Eck Exhibit No. 3 is a Stratigraphic Electric Log Cross-Section that shows correlations between the KGS type logs for identified nearby wells and the Wells #2-27. Eck Exhibit No. 4 is a copy of a portion of the Dual Induction Log for the Wells #2-27 well that is marked with formation tops, derived from Eck Exhibit No. 3, and identifies the confining layers in the upper Permian and the two uppermost perforated injection intervals in that well.

Q. Does the KCC have any rules regarding minimum depths for disposal wells?

A. Yes, it does. Those rules are set forth in Table II which was last amended by the KCC in an Order dated July 7, 1987. Eck Exhibit No. 1 is a copy of Table II. The minimum disposal well depths set forth in Table II have remained unchanged since 1987.

Q. What does Table II say regarding the minimum depth for disposal wells in Wichita

County, Kansas?

A. According to Table II, the minimum depth for disposal wells in Wichita County is the "Top of 'Red Beds'."

Q. What are the "Red Beds" that are referred to in Table II?

A. The red beds are known to be the upper Permian-aged formations, the youngest of which is known to be the Big Basin Formation (Permian age; Guadalupian Series). That is also shown on the KGS stratigraphic column for Kansas (Eck Exhibit No. 2). They get their "red bed" description from the rust-red color that is prevalent in the section. However, not all of the rocks within the red beds exhibit the rust color.

Q. Have you determined whether any "Red Beds" are present above the top of the shallowest proposed injection zone in the Wells #2-27?

A. Yes, I have. Based on my log analysis there are approximately fifty-seven (57) feet of Permian red beds above the uppermost perforations in the Wells #2-27 meaning that Shakespeare's proposed completion in the Wells #2-27 is in compliance with Table II requirements. This is depicted in Eck Exhibit No. 4.

Q. Please explain how you made that determination?

A. Eck Exhibit No. 3 shows how I made that determination. To prepare Eck Exhibit No. 3, I used the accepted KGS Type Log Project's tops for the nearest type logs in Wichita, Logan, and Scott Counties. I used 8 type logs in total in the cross-section. Each of those type logs is associated with a well that is identified across the top of Eck Exhibit 3. The formation picks in the type logs are not mine but rather were picked by KGS scientists working on the Type Log Project. These logs and tops were then imported into the cross-section shown in Eck Exhibit No. 3 with the Wells #2-27 log suite. I was able to correlate the tops of the Fort Hays, Greenhorn, Dakota, Kiowa, Cheyenne, Big Basin, Day Creek,

Whitehorse, and Blaine formations from the type logs to the Wells #2-27 with high confidence. This was done by overlaying the log suites and picking the formation tops in the Wells #2-27 consistent with the Kansas Geologic Survey's established Type Log picks. Correlations were made by using pattern recognition and curve responses in the gamma ray, photoelectric, neutron porosity, density porosity, and resistivity curves. Based on that analysis, I determined the top of the Big Basin formation (which is the top of Permian red beds) to be at 1395 feet in the Wells #2-27. Thus, the "top of the red beds" is 57 feet above the uppermost perforation in the Wells #2-27.

Q. Is the fifty-seven (57) feet of Permian red beds lying directly above the uppermost perforations an adequate confining layer?

A. Yes, in my opinion that is an adequate confining layer. Electric log responses in the Big Basin formation indicate shale with no effective permeability. You will notice that the caliper log reads above the bit diameter of 7-7/8 inches. This shows a lack of mud cake on the wellbore that would indicate permeability (mud cake happens when fluid from the drilling mud invades permeable zones, leaving the solids caked on the sides of the wellbore. In that case the caliper log will kick to the left, and is highlighted yellow in the logs in Eck Exhibit No. 3 where it is less than the drilling bit diameter of 7-7/8 inches). Further, the resistivity curves have little to no separation. This means that the deep, medium, and shallow resistivity readings are all effectively the same, thus giving no evidence of a near-wellbore fluid invasion profile. Again, this means that the interval is impermeable. Fifty-seven (57) feet of impermeable shale section is more than enough to provide topset confinement for a permeable injection layer, especially considering there would be no surface injection pressure applied. Eck Exhibit No. 3 also shows that the Big Basin shale is correlative over the entire area, providing an adequate and laterally-

continuous top seal for the injection zones.

Q. What are the proposed injection depths in the Wells #2-27?

A. Shakespeare has perforated the intervals from 1452'-1476' and from 1522'-1582' and from 1800' – 2000'. The interval at 1800'–2000' proved ineffective for injection purposes, and is therefore left off of my exhibits.

Q. Have you determined what formations correlate with those injection depths?

A. Yes, the uppermost perforation interval is in the Day Creek formation, the next perforation interval is in the Whitehorse formation, and the lowermost perforation interval is in the Flowerpot and Cedar Hills formations. All of those formations are within the Permian red bed section, meaning that they are below the top of the red beds. I would mention again that the Flowerpot/Cedar Hills perforations are not shown on Eck Exhibits No. 3 & 4 because they are deeper and proved ineffective for injection purposes.

Q: Please explain how you made those determinations?

A: This was determined from my interpretation and correlation of the type logs shown in Eck Exhibit No. 3.

Q. In your opinion, will the proposed injection of produced water into the Day Creek and Whitehorse formations in the Wells #2-27 endanger usable groundwater?

A. No, in my opinion, injection of water into those two formations will not endanger usable groundwater. I believe that there is an adequate confining layer of impermeable rock between the uppermost perforations in the Wells #2-27 and any potentially usable water in the Cheyenne. In addition, in its Application, Shakespeare is not asking for permission to inject water under pressure so the injected water will remain in the high-permeability perforated formations.

Q. Does this conclude your direct testimony?

A. Yes, but I reserve the right to supplement my testimony and to file rebuttal testimony following the filing of Staff's direct testimony.

THE STATE CORPORATION COMMISSION
OF THE STATE OF KANSAS

In the Matter of the Application of Shakespeare Oil Company, Inc. for a permit to authorize injection into the Whitehorse and Cedar Hills formations at the Wells #2-27 well in Section 27, Township 16 South, Range 35 West, Wichita County, Kansas	)	Docket No. 25-CONS-3411-CUIC CONSERVATION DIVISION License No. 7311

CERTIFICATE OF SERVICE

The undersigned hereby certifies that on the 26th day of September, 2025, I caused a true and correct copy of the foregoing Pre-Filed Testimony of Andrew (Toby) Eck to be electronically filed with the Kansas Corporation Commission, and that I caused a copy to be served via electronic mail to the following parties:

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/s/ David E. Bengtson
David E. Bengtson

TABLE II

ESTABLISHED MINIMUM SURFACE DEPTHS FOR DISPOSAL WELLS

Eck Exhibit No. 1

THE STATE CORPORATION COMMISSION
OF THE STATE OF KANSAS

Before Commissioners: Keith R. Henley, Chairman
Rich Kowalewshi
Margalee Wright

In the matter of the general rules and regulations for the conservation of crude oil and natural gas, K.A.R. 82-3-400.	)))))	DOCKET NO. 156,397-C (C-22,607) CONSERVATION DIVISION

ORDER

Now, the above-captioned matter comes on before the State Corporation Commission of the State of Kansas on its own motion. Being fully advised in the premises and having examined the files and records, the Commission makes the following findings and conclusions, pursuant to K.A.R. 82-1-232 and 82-3-100.

1. K.S.A. 1986 Supp. 55-152 and 55-901 authorize the Commission to issue rules and regulations pertaining to the conservation of crude oil and natural gas and the protection of fresh and usable waters of this state.

2. In February of 1967, this Commission initiated an informal investigation to determine whether certain rules and regulations for the conservation of crude oil and natural gas should be amended to incorporate within such rules certain changes relating to surface pipe requirements and minimum depth requirements for salt water disposal wells. After concluding its investigation, the Commission issued an order March 1, 1967, whereby revised table I and II were adopted and made part of the Commission rules and regulations.

3. Early in 1986, this Commission initiated a subsequent investigation to determine if additional changes should be made to the minimum depth requirements for salt water disposal wells, as contained in revised Table II. Such investigation is made pursuant to K.S.A. 1986 Supp. 55-152, which mandates that the Commission annually review current drilling methods, geologic formation standards, plugging techniques and casing and cementing standards and materials to insure the protection of usable water from pollution.

The investigation particularly centered upon the advisability of continued use of the Cedar Hills formation for disposal in certain areas of Kansas.

4. Such investigation included consulting the 10-member Advisory Committee, as established by K.S.A. 55-153. The Advisory Committee is made up of a representative from the Mid-Continent Oil and Gas Association, the Kansas Independent Oil and Gas Association, the Eastern Kansas Oil and Gas Association, the groundwater management districts, the Department of Health and Environment, the Kansas Geological Survey, the Kansas Water Office, the Division of Water Resources, the general public and the Commission.

5. The Advisory Committee established a Cedar Hills Study subcommittee as part of its review of Table II revisions. This subcommittee recommended to the full committee that Table II be modified in order to more adequately protect usable water from pollution. The 10-member Advisory Committee approved the subcommittee's recommendation at its June 18, 1987, meeting. Such recommendation requires that disposal into the Cedar Hills Formation in the following areas be strictly prohibited:

> All of Pratt, Stafford, Barber, Barton, Comanche and Kiowa Counties, Kansas.
>
> The East Half (E/2) of Range 18, all of Ranges 17 and 16 in Rush, Pawnee and Edwards Counties, Kansas.
>
> All of Townships 27, 28 and 29 in Ranges 21 and 22, Ford County, Kansas.

Such recommendation further requires that Table II be amended to reflect that injection depths be set at the base of or below the Stone Corral Anhydrite formation in Pratt, Stafford, Barber, Barton and the above-described portions of Rush, Pawnee and Edwards Counties, Kansas. Injection depths for Comanche and Kiowa Counties, Kansas, should be set at the base of the Cedar Hills formation.

6. The Cedar Hills Study subcommittee recommended and the Advisory Committee approved this recommendation that no new Cedar Hills disposal wells would be authorized in the areas described in Find (5) nor would amendments to increase the injection rate or pressure for existing Cedar Hills disposal wells be authorized. The Advisory committee further adopted the recommendation that upon the failure of existing Cedar Hills disposal wells that such well be plugged and abandoned with no replacement Cedar Hills disposal well to be authorized.

7. The Commission finds that the recommendations of the Advisory Committee are in keeping with insuring protection of the fresh and usable water of the state and that such recommendations should be adopted by the Commission. Table II, as referred to in K.A.R. 82-3-400, should be revised to include the above recommendations.

8. Any person or corporation affected by this order and that deems it to be improper, unreasonable or contrary to law, may apply, by written petition, for a hearing thereon before the Commission, pursuant to K.A.R. 82-1-232. Such petition must be received by the Executive Director of this Commission no later than August 1, 1987.

IT IS, THEREFORE, BY THE COMMISSION ORDERED that the recommendation of the 10-member Advisory Committee to modify Table II, as referred to in K.A.R. 82-3-400, be and the same is hereby adopted.

IT IS FURTHER ORDERED that revised Table II, as attached hereto and made a part hereof, is in full force and effect as of August 1, 1987, until amended or further modified by the Commission.

BY THE COMMISSION IT IS SO ORDERED.

Henley, Chmn.; Kowalewski, Com.; Wright, Com.

Dated: July 7, 1987

Judith McConnell
Executive Director

SEAL

I CERTIFY THE ORIGINAL
COPY IS ON FILE WITH
The State Corporation Commission

APR 1 1994

EXECUTIVE DIRECTOR

Eck Exhibit No. 1

TABLE II

(Revised August 1, 1987)

ESTABLISHED MINIMUM DEPTHS FOR DISPOSAL WELLS

The following depths are the absolute minimum depths which will be permitted. Depths greater than those given may be required for some areas.

COUNTY	MINIMUM DEPTHS
Allen	350 feet.
Anderson	350 feet.
Atchison	500 feet.
Barber	Base of the Stone Corral Anhydrite.
Barton	Base of the Stone Corral Anhydrite.
Bourbon	300 feet and above the top of Mississippian in Township 24 South, Range 24 and 25 E; Township 25 South, Range 23, 24, 25 East; Township 26 South, Range 22, 23, 24, 25 East; Township 27 South, Range 21, 22, 23, 24, 25 East.
Brown	500 feet.
Butler	500 feet.
Chase	500 feet.
Chautaugua	Ranges 8, 9 and 10 East - 500 feet. Ranges 11, 12, 13 East -450 feet.
Cherokee	Below the top of Precambrian.
Cheyenne	Top of "Red Beds".
Clark	500 feet.
Clay	400 feet.
Cloud	400 feet.
Coffee	500 feet.
Comanche	The base of the Cedar Hills Sandstone.
Cowley	700 feet.
Crawford	200 feet and above top of Mississippian.
Decatur	Top of "Red Beds".
Dickinson	500 feet.
Doniphan	500 feet.
Douglas	700 feet.
Edwards	Top of "Red Beds" except in all of Ranges 16 and 17 and the E/2 of Range 18 - Base of Stone Corral Anhydrite.
Elk	Ranges 8, 9, 10 East - 500 feet. Ranges 11, 12, 13 East - 450 feet.
Ellis	Top of "Red Beds".
Ellsworth	500 feet.
Finney	Top of Cedar Hill (Glorieta) Sandstone.
Ford	Top of "Red Beds" but not less than 700 feet except in Townships 27, 28 and 29 in Ranges 21 and 22 - Base of the Stone Corral Anhydrite.
Franklin	500 feet east of Highway U.S. 59; 700 feet west of Highway 59.
Geary	500 feet.
Gove	Top of "Red Beds" but not less than 700 feet.
Graham	Top of "Red Beds".

Eck Exhibit No. 1

COUNTY	MINIMUM DEPTHS
Grant	Top of Cedar Hill Sandstone. In those areas of Township 27 South, Range 37 West and Township 27 South, Range 38 West, where the Cedar Hill Interval consists of salt - 50 feet below the salt.
Gray	Top of Cedar Hill Sandstone. Where the Cedar Hill Interval consists of salt - 50 feet below the salt section.
Greeley	Top of "Red Beds" but not less than 700 feet.
Greenwood	Townships 24, 25, 26, 27, 28 South, Ranges 12, 13 East - 400 feet. In all other areas - 500 feet.
Hamilton	Base of the Day Creek Dolomite but not less than 750 feet.
Harper	500 feet.
Harvey	Range 2 East - 500 feet; all other areas - 1000 feet.
Haskell	Top of Cedar Hill Sandstone.
Hodgeman	Top of "Red Beds" but not less than 700 feet.
Jackson	500 feet.
Jefferson	500 feet.
Jewell	Top of "Red Beds".
Johnson	500 feet.
Kearny	Top of Cedar Hill Sandstone. Where Cedar Hill consists of salt or shale (parts of western Kearny County) - base of the Day Creek Dolomite but not less than 750 feet except within four (4) miles of the Bear Creek Fault, then 50 feet below the Cedar Hill salt or shale section
Kingman	500 feet.
Kiowa	Base of the Cedar Hills Sandstone.

COUNTY	MINIMUM DEPTHS
Labette	Ranges 17, 18 and 19 East - 350 feet. Ranges 20, 21 East - 350 feet and above the top of the Mississippi except that the upper 100 feet of the Mississippi may be used for disposal of water containing no more than 4000 milligrams per liter of chlorides.
Lane	Top of "Red Beds" but not less than 700 feet.
Leavenworth	700 feet.
Lincoln	Top of "Red Beds".
Linn	300 feet in western half; 500 feet in eastern half.
Logan	Top of "Red Beds".
Lyon	500 feet.
Marion	500 feet.
Marshall	400 feet.
McPherson	1000 feet.
Meade	Range 30 West - Top of Cedar Hill Sandstone. Elsewhere in County - base of Stone Corral Formation (Anhydrite).
Miami	350 feet.
Mitchell	Top of "Red Beds".
Montgomery	400 feet.
Morris	500 feet.
Morton	Top of Cedar Hill (Glorieta) Sandstone.
Nemaha	500 feet.
Neosho	350 feet and above the top of the Mississippian in Township 27 South, Range 21 East; Township 28 South, Range 21 East; Township 29 South, Range 20, 21 East; Township 30 South, Range 20, 21 East.

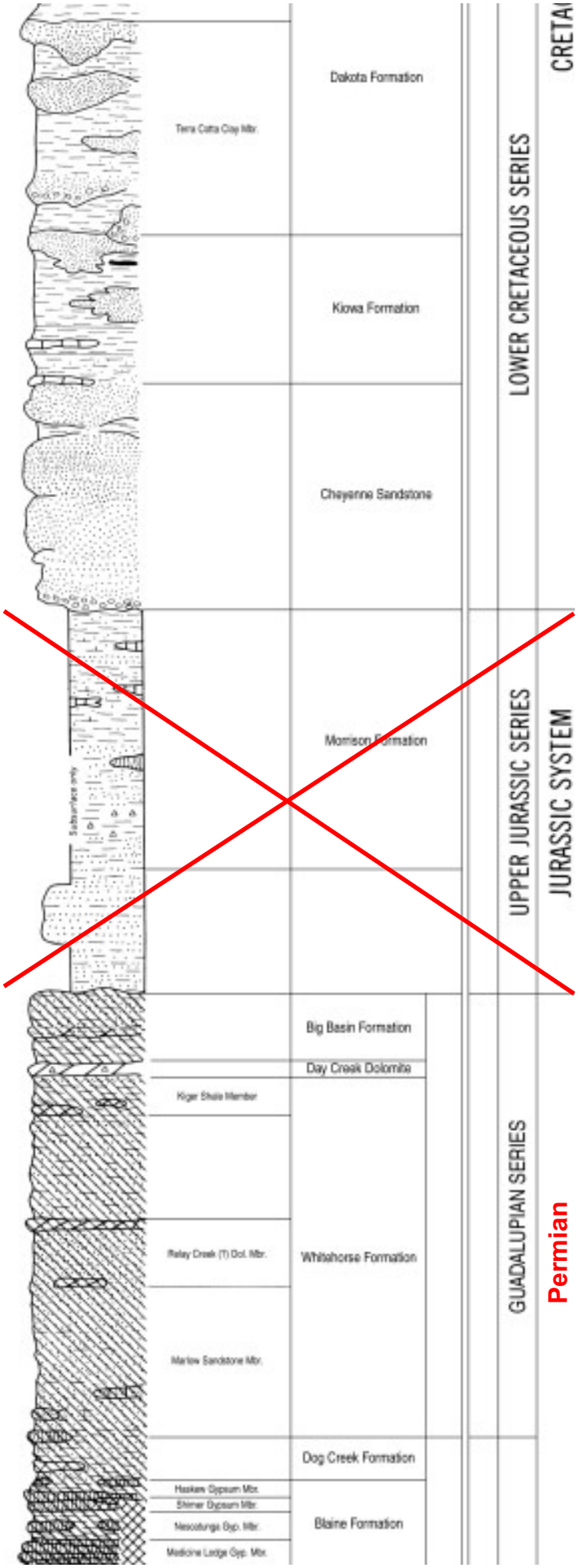
Eck Exhibit No. 1

COUNTY	MINIMUM DEPTHS
Ness	Top of "Red Beds" but not less than 700 feet.
Norton	Top of "Red Beds".
Osage	800 feet.
Osborne	Top of "Red Beds".
Ottawa	450 feet.
Pawnee	Top of "Red Beds" except in all of Ranges 16 and 17 and the E/2 of Range 18 - Base of the Stone Corral Anhydrite.
Phillips	Top of "Red Beds".
Pottawatomie	500 feet.
Pratt	Base of the Stone Corral Anhydrite.
Rawlins	Top of "Red Beds".
Reno	Township 22 South, Range 4 West and 5 West; Township 23 South, Range 4 West and 5 West; Township 23 South, Range 5 West; Township 24 South, Range 4 West and 5 West; Township 24 South, Range 5 West and Township 25 South, Range 4 West - 1000 feet. All other areas - 500 feet.
Republic	450 feet.
Rice	500 feet.
Riley	500 feet.
Rooks	Top of "Red Beds".
Rush	Top of "Red Beds" except in all of Ranges 16 and 17 and the E/2 of Range 18 - Base of the Stone Corral Anhydrite.
Russell	Top of "Red Beds".
Saline	500 feet.
Scott	Top of "Red Beds".
Sedgwick	Range 2 East and 4 West - 500 feet. All other areas - 1000 feet.

COUNTY	MINIMUM DEPTHS
Seward	Top of Cedar Hill Sandstone.
Shawnee	800 feet.
Sheridan	Top of "Red Beds".
Sherman	Top of "Red Beds."
Smith	Top of "Red Beds."
Stafford	500 feet.
Stanton	Top of Cedar Hill Sandstone. In Township 27 South, Range 39 West, Township 27 South, Range 40 West, and other areas where the Cedar Hill Interval consists of salt - 50 feet below the salt.
Stevens	Top of Cedar Hill Sandstone.
Sumner	500 feet.
Thomas	Top of "Red Beds".
Tergo	Top of "Red Beds".
Wabaunsee	500 feet.
Wallace	Top of "Red Beds".
Washington	600 feet.
Wichita	Top of "Red Beds".
Wilson	350 feet.
Woodson	350 feet.
Wyandotte	500 feet.

Eck Exhibit No. 1

ECK EXHIBIT #2
Kansas Stratigraphic Column
(Modified from Kansas Geological Survey's Stratigraphic Column of Kansas)



Jurrasic absent in far-eastern Wichita County