

KANSAS GEOLOGICAL SURVEY

1930 Constant Ave., Campus West
The University of Kansas
Lawrence, Kansas 66047-3726
phone 785-864-3965
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May 17, 2005

Catherine J. Rocky, P.G., I.E.
Terracon Consults, Inc.
2111 West Harry Street
Wichita, Kansas 67213-3299

**Re: Geologic Assessment for the Linn County Construction and Demolition
Landfill Expansion, Terracon Project #01047046**

Dear Ms. Rocky,

I received your request for comment by the Kansas Geological Survey (KGS) on the proposed expansion of the Construction & Demolition (C&D) Landfill and Tire Monofill for Linn County. The proposed disposal area is located northeast of Prescott, Kansas in the SW $\frac{1}{4}$ SW $\frac{1}{4}$ of Section 33, Tier 22S, Range 25E.

Your letter included a geologic stability assessment of the landfill site based on currently published data. It contained sections on landslides, karst topography, foundation areas, and seismic risk. The assessment also contained descriptions of the site morphology and geology along with some history of the site. No soil test or drill data was provided. The summary stated "Based on our (Terracon's) review, information was not developed to indicate that the Facility is located in a geologically unstable area."

Besides the references provided in section 4.0 of the geologic assessment, I examined two other references related to karst hazards in Kansas: Young and Beard (1993) and Merriam and Mann (1957). These references have no information on karst hazards in Linn County. Thus, the Kansas Geological Survey has no information on unstable locations at the landfill site.

Young and Beard (1993), *Caves in Kansas*: Kansas Geological Survey, Educational Series 9, 48 p.

Merriam and Mann (1957), *Sinkholes and related geologic features in Kansas*: Transactions, Kansas Academy of Science, v. 60, pp. 207-243.

The Bureau of Waste Management, Kansas Department of Health and Environment (KDHE) intends to rewrite the section of *Kansas Statutes Annotated ... Administrative Regulations Article 29-Solid Waste* with respect to "unstable areas." The change involves removing the requirement of "approval and exemption" from the KGS in 28-29-302(h)(4). Paul Graves (letter dated April 15, 2005) at KDHE informed me that "the amended regulations might simply list a number of relevant agencies (including KGS),

requiring applicants to notify agencies about proposed new/expanded landfills and request whether the agencies have information on the suitability of the proposed site for the intended use." KDHE intends to post an interim policy on their web site. As of this morning, the interim policy had not been posted. In anticipation of the interim policy, I have responded to your request without approval or exemption of the landfill site. If you have question regarding landfill regulations, please contact:

Paul Graves, P.E.
Chief, Solid Waste Landfills Unit
Bureau of Waste Management
Kansas Department of Health & Environment
Phone: (785) 296-1596
E-mail: pgraves@kdhe.state.ks.us

If you have any questions about my comments, feel free to contact me at (785) 864-2194 or ohlmac@kgs.ku.edu.

Sincerely,

A handwritten signature in black ink, appearing to read 'G. Ohlmacher', with a stylized flourish extending to the right.

Gregory C. Ohlmacher, P.G.
Engineering Geologist

May 6, 2005



Mr. Gregory Ohlmacher, P.G.
Kansas Geological Survey
1930 Constant Ave.
University of Kansas
Lawrence, Kansas 66047-3726

Terracon Consultants, Inc.
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Re: Permit Application Notification
Geologic Assessment
Linn County Construction and Demolition Landfill
Linn County Tire Monofill
Linn County, Kansas
Terracon Project No. 01047046

Dear Mr. Ohlmacher:

The Linn County Solid Waste Facility (Facility) consists of a municipal Solid Waste Transfer Station, Construction and Demolition (C&D) Landfill, a Waste Tire Monofill, and a Yard Waste Composting operation. The Facility is located at 4067 Vernon Road, Prescott, Kansas and is situated on a 40-acre parcel in the SW/4, SW/4 of Section 33, Township 22 South, Range 25 East. The Facility is permitted (Permit No. 421) by the Kansas Department of Health and Environment (KDHE).

Our client, Linn County (County) is seeking a permit modification to increase the permitted areas of the existing Linn County C&D Landfill and Waste Tire Monofill. New C&D landfill regulation K.A.R. 28-29-300 (h) requires that the permittee submit an assessment of the geologic stability of the area under consideration. Terracon has prepared the following assessment for review and comment on the geologic stability of the site for the proposed expansion.

1.0 LINN COUNTY LANDFILL, GEOLOGIC STABILITY ASSESSMENT

Readily available published information pertaining to the geologic stability of the Facility area was reviewed. A list of references is included at the end of this document. Figure 1 is a Location Map indicating the proposed C&D Landfill Expansion (C&D LE) and proposed Tire Monofill Expansion (TME) on a portion of the Prescott, Kansas 7.5-Minute USGS Quadrangle map. Figure 2 is a Contour Map indicating the topography of the existing and proposed landfill expansions and adjoining areas.

1.1 Landslides

As indicated on Figure 1, the Facility is located within a strip-mined area. Figure 2 indicates that topographic relief across the C&D LE, TME, and immediately adjoining areas is less than 30 feet. The terrain of the Facility is generally characterized by "ridges" and intervening "valleys" with less than 15 feet of relief. The ridges are artifacts of strip-mining activities, and are generally composed of loose, jumbled fragments of shale, siltstone, sandstone, limestone, and coal. Approximately three feet of clayey shale underlies mining debris over most of the Facility; limestone locally occurs beneath the mining debris where the shale has been removed (see Section 1.2). The bedrock surface beneath mining debris is reported to be of low relief, and the seismic risk for the Facility area is low (see Section 1.4). Provided that mining debris is removed from the C&D LE and TME, and that adjoining slopes are properly graded and stabilized to reduce the possibility of mass movements, the potential for landslides within the C&D LE and TME would appear to be low.

1.2 Karst Topography

The bedrock of the Facility is the Pennsylvanian-age Bandera Shale formation (Marmaton Group), which consists predominantly of interbedded shale, siltstone and sandstone, with a few thin limestone beds. An approximate 2-foot thick coal bed, the Mulberry Coal, occurs near the base of the formation, and was the object of strip-mining activities within the Facility. The formation as a whole is 30 to 35 feet thick in the Facility area. However, strip-mining has removed all but the basal three feet of Bandera Shale in most areas within the Facility, and in some places the Bandera Shale has been completely removed. The topographic "ridges" characteristic of the Facility (see Section 1.1) are composed of Bandera Shale debris stripped from the Mulberry Coal bed. It is unlikely that karst topography has developed within the largely insoluble lithologies of the basal Bandera Shale within the Facility.

The Bandera Shale is immediately underlain by the Pawnee Limestone, which consists of two limestone and two shale members and averages approximately 25 feet in thickness. The uppermost member of the Pawnee Limestone, the Laberdie Limestone, has been exposed by strip-mining in some areas of the Facility, and was reportedly quarried within the Facility for mine-road gravel. The Laberdie Limestone is approximately 6 feet thick, and is immediately underlain by the Mine Creek Shale Member. Though limestone is subject to dissolution and karst development, solution features in the Pawnee Limestone were not noted in the geologic references consulted for this assessment (see Section 4.0).

Karst topography is documented in Mississippian-age limestone and dolomite formations that occur approximately 500 feet below ground surface in the area of the Facility. Localized domes, depressions, and bedrock deformation have been observed in the Mound City-

Prescott-Pleasanton area, and these features appear to be related to underlying Mississippian karst topography. However, based up information provided by Facility operating personnel and Terracon observations, apparent karst-related features have apparently not been observed within the Facility, and the risk of future karst-related disruption of the Facility appears to be low.

1.3 Foundation Areas

The Soil Survey of Linn and Miami Counties, Kansas, identifies the soils within the Facility as Hilly Orthents. These are moderately to steeply sloping soils (4 to 50% slopes) occurring in strip-mined areas, and consist generally of olive brown and gray brown shaly silty clay loam. A portion of areas mapped as Hilly Orthents is generally dominated by ponded water and/or fragments of coal, limestone, sandstone, and shale. The Soil Survey indicates that Hilly Orthents are not generally well-suited to many uses, but that onsite investigation is required to determine whether or not a particular soil may be used for a specific purpose. Though the soils within the Facility may not be suitable for construction and engineering purposes, construction of structures is not planned or anticipated for the proposed C&D LE and TME. In addition, the mining debris has been and will be removed for construction of the C&D LE and TME, therefore, foundations concerns are not applicable.

1.4 Seismic Risk

Based upon the seismic risk map published by Jackson, 1979 (copy attached), the Facility is located within seismic risk Zone 1 – minor damage. A USGS Seismic Hazard Map of Kansas (copy attached) indicates the Facility area lies within a zone designated 4-6% *g*, *Peak Horizontal Acceleration with 10% Probability of Exceedance in 50 Years*. Therefore, the Facility area would not be considered unstable with respect to seismic risk.

2.0 SUMMARY

Terracon reviewed readily available published information regarding general stability issues in the Facility area, specifically addressing information relating to landslides, karst topography, foundations, and seismic risk. Based on our review, information was not developed to indicate that the Facility is located in a geologically unstable area.

3.0 GENERAL COMMENTS

The geological assessment conducted by Terracon was limited and should not be considered a comprehensive assessment of the site. Readily available published information was reviewed to evaluate the general geology of the study area. The limitations

of the assessment methods should be recognized. Please note that Terracon does not warrant the work of regulatory agencies or other third parties supplying information used in the compilation of reports.

4.0 REFERENCES

United States Geological Survey (USGS) Prescott, Kansas 7.5-Minute Quadrangle Map, 1958, Photorevised 1978.

KGS Bulletin 193, Geology and Ground-Water Resources of Linn County, Kansas, Seevers, William J., 1969.

Soil Survey of Linn and Miami Counties, Kansas, US Department of Agriculture, Soil Conservation Service, Penner, Harold L., 1981.

USGS Website, Seismic Hazard Map of Kansas (http://neic.usgs.gov/neis/states/kansas/kansas_haz.gif)

Please contact us if you need further information for your review. We respectfully request an expedited, approximately two weeks, review and response. You may fax (316-262-6997) results, followed by a hardcopy.

Sincerely,

TERRACON

Prepared By:



Michael Montgomery
Environmental Geologist

Reviewed By:

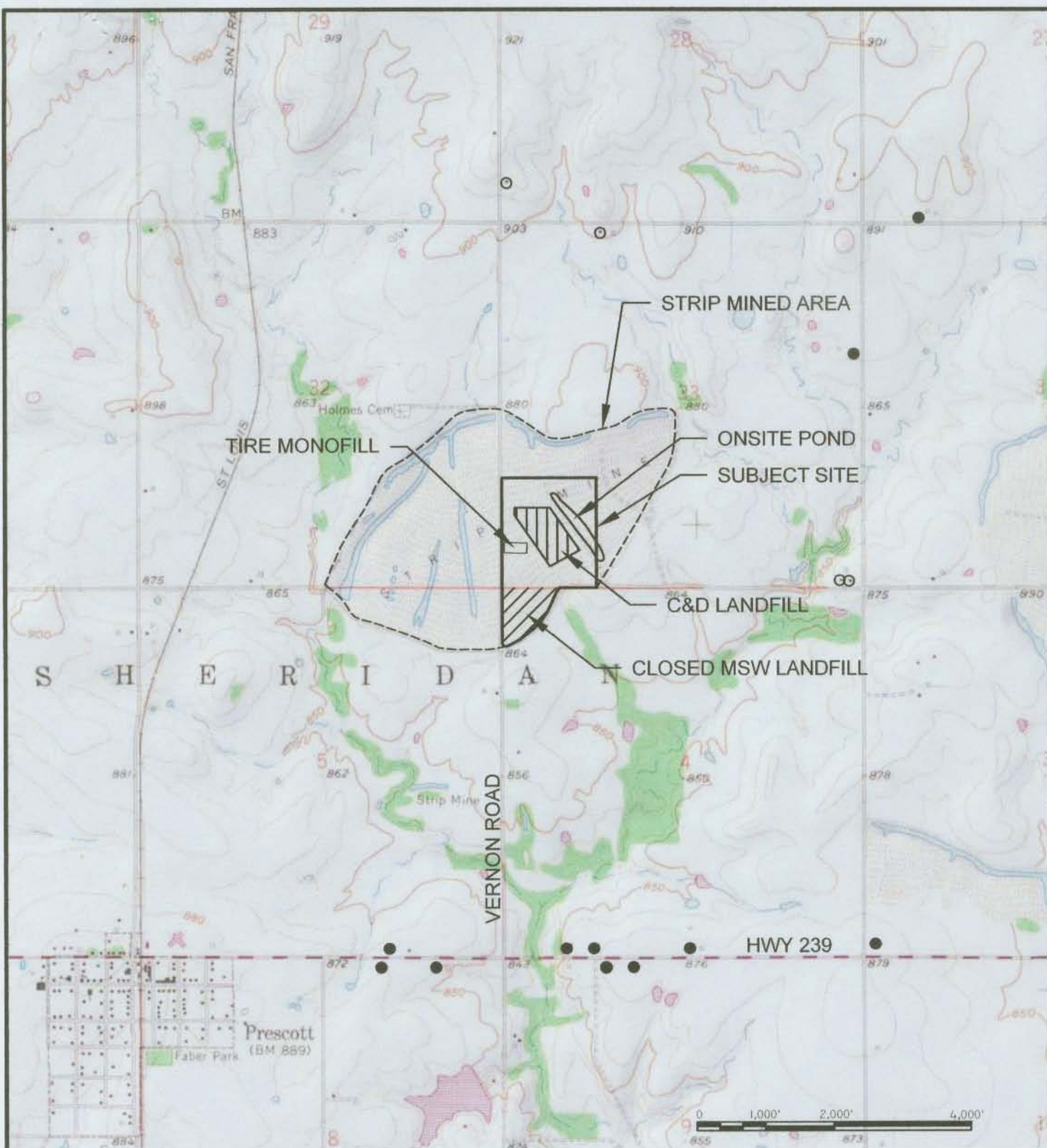


Catherine J. Rocky, P.G., I.E.
Senior Project Manager



James C. Bruggeman, P.G.
Sr. Project Manager/Hydrogeologist

Attachments



APPROXIMATE SW/4 SW/4
OF SECTION 33,
TOWNSHIP 22 SOUTH,
RANGE 25 EAST.



PRESCOTT QUADRANGLE
KANSAS - LINN COUNTY
7.5 MINUTE SERIES (TOPOGRAPHIC)
1960

LEGEND

- OCCUPIED STRUCTURE
- VACANT STRUCTURE

NOT TO BE USED FOR GENERAL USE OR FOR CONSTRUCTION PURPOSES. LOCATIONS ARE APPROXIMATE

Terracon

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LINN COUNTY SOLID WASTE FACILITY

LINN COUNTY, KANSAS

SHEET TITLE

SITE LOCATION MAP

FIGURE 1

MARK	DATE	DESCRIPTION
PROJECT NO:	01067066	
CAD DWG FILE:	7046FT.DWG	
DRAWN BY:	BCB	
CHK'D BY:	CJR	
DATE:	02/25/05	

N.W. CORNER
S.W. 1/4
SEC. 33-22-25
1/2" REBAR SET OVER
LIMESTONE 14"x10"x5"

1314.63'

N.W. 1/4, S.W. 1/4

S.E. CORNER
N.W. 1/4, S.W. 1/4
SEC. 33-22-25

S.W. CORNER
N.W. 1/4, S.W. 1/4
SEC. 33-22-25

112' 24.00" W 802.25'

PHYSICAL C/L VERNON ROAD

MAIL BOX
TEL. PED.

S.W. CORNER
S.W. 1/4
SEC. 33-22-25
1/2" REBAR WITH
PK NAIL ON TOP
ORIGIN UNKNOWN

BM ELEV. 881.41'
CHISELED SQUARE
IN N.W. CORNER OF
CONC. GAS PAD

S.E. CORNER
S.W. 1/4
SEC. 33-22-25
1/2" REBAR SET

APPROXIMATE SW/4 SW/4
OF SECTION 33,
TOWNSHIP 22 SOUTH,
RANGE 25 EAST.



0 125' 250' 500'

MAP IS INTENDED FOR GENERAL USE ONLY, NOT FOR
CONSTRUCTION PURPOSES. LOCATIONS ARE APPROXIMATE

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LINN COUNTY C&D LANDFILL SW FACILITY

LINN COUNTY, KANSAS

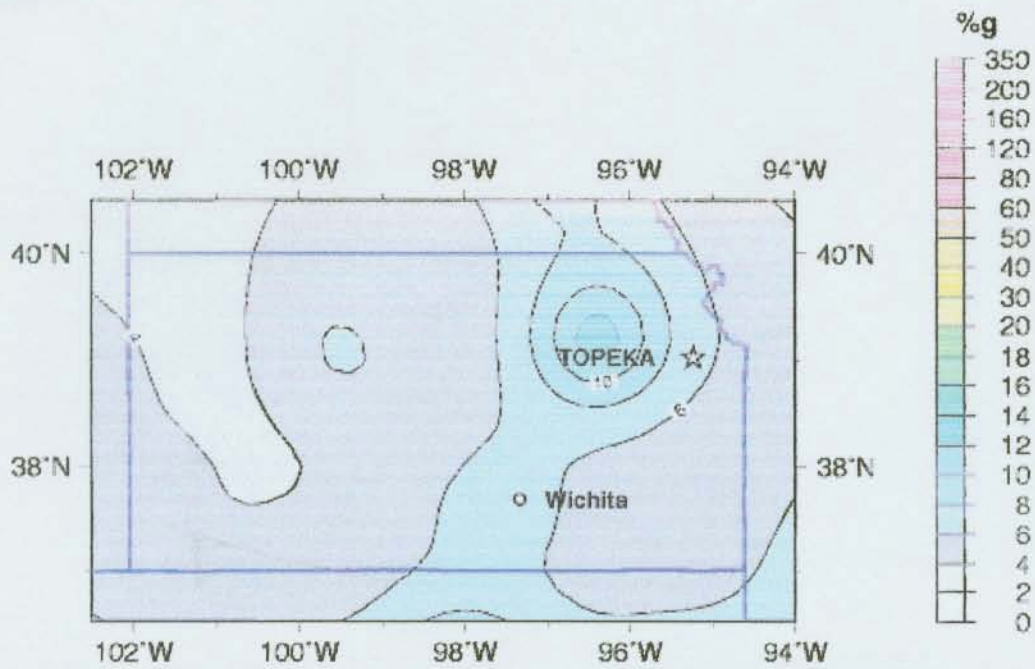
SHEET TITLE

CONTOUR MAP

MARK DATE DESCRIPTION

PROJECT NO: 01047046
CAD DWG FILE: 7046F2.DWG
DRAWN BY: BCB
CHK'D BY: CJR
DATE: 01/14/05

FIGURE 2



Peak Acceleration (%g) with 2% Probability of Exceedance in 50 Years
site: NEHRP B-C boundary
National Seismic Hazard Mapping Project