February 16th 2023

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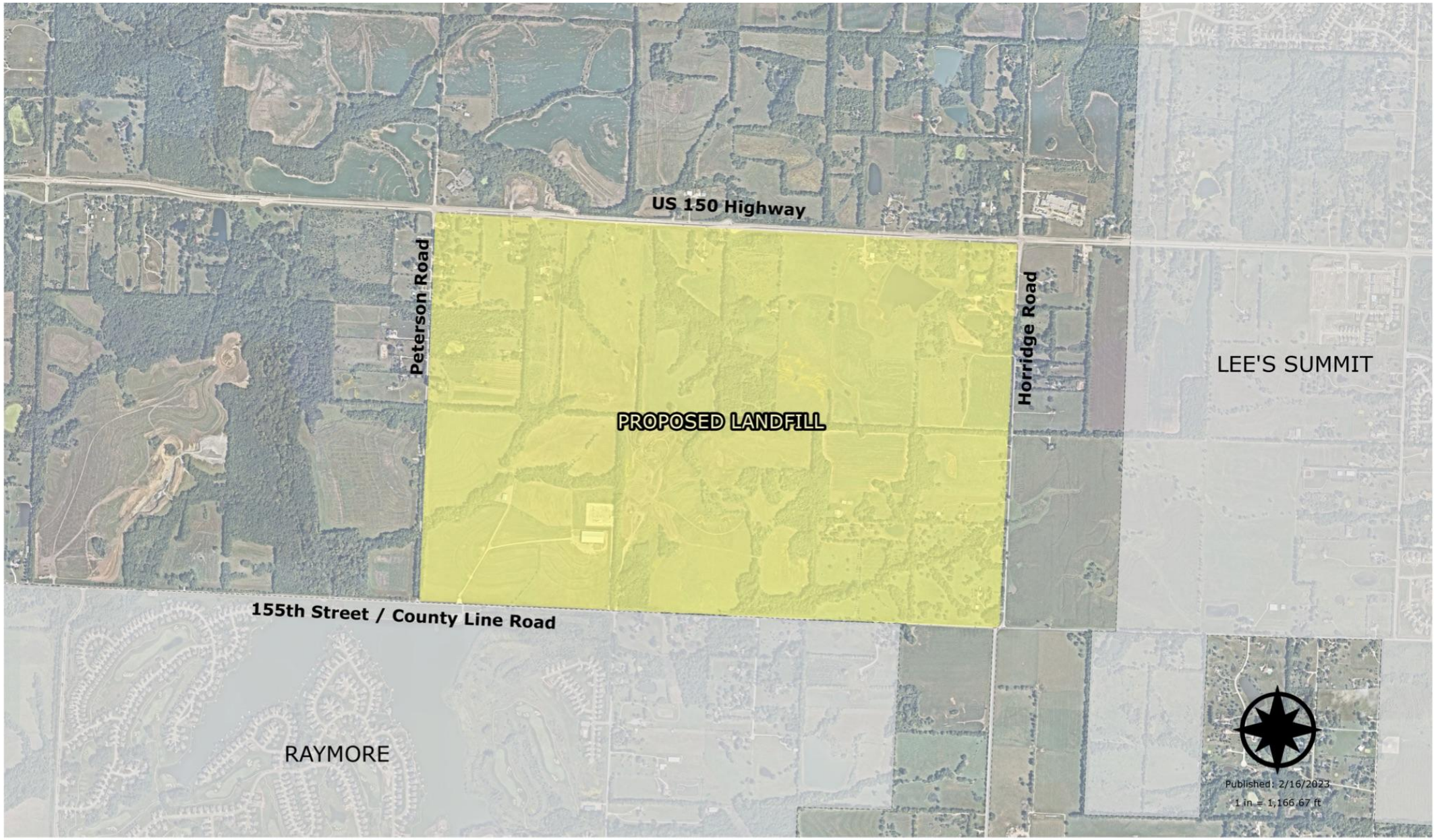

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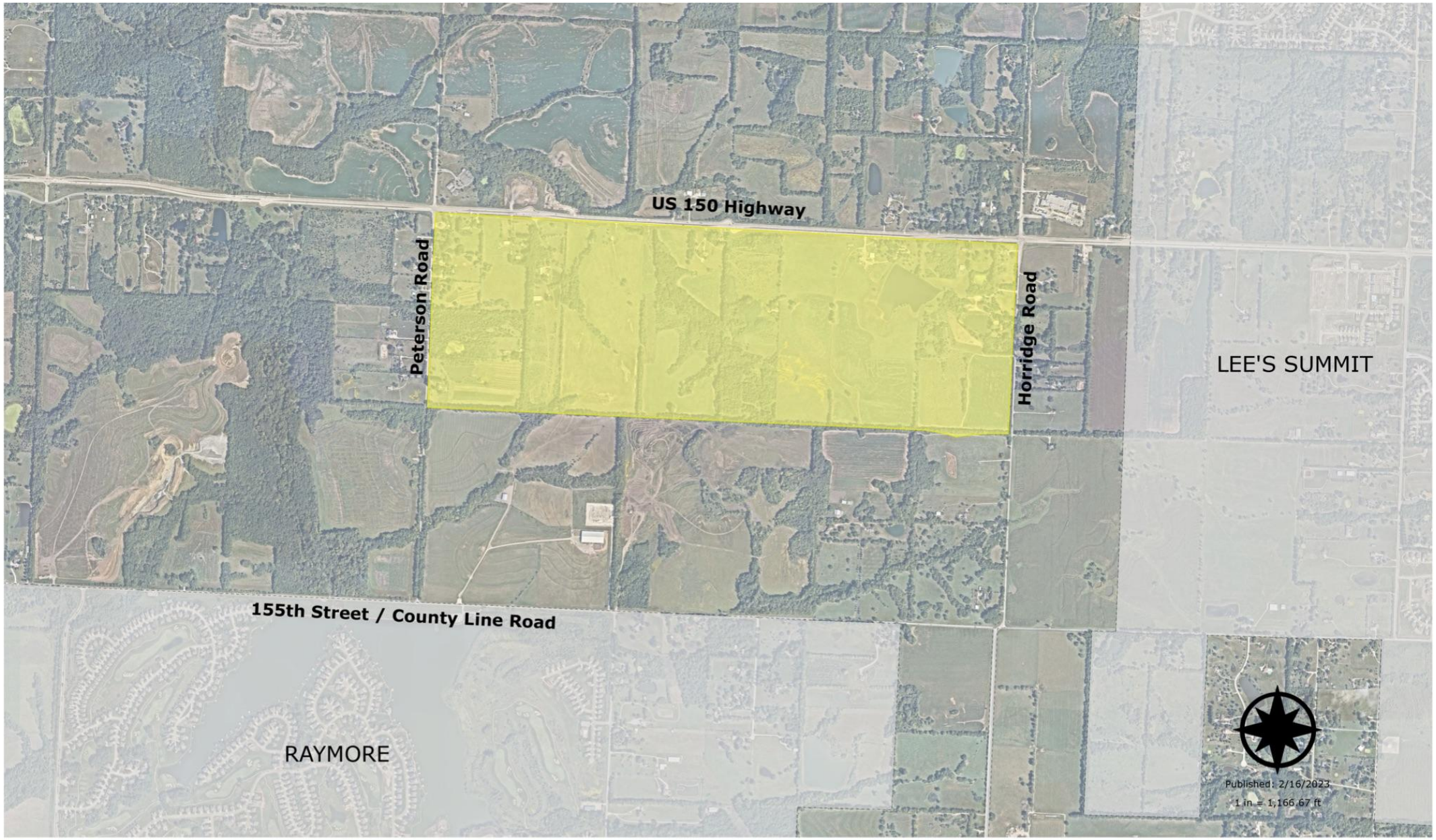

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Potential Effects of Landfills

City of Raymore, Missouri
Community Information Meeting
February 16, 2023

Steve Jeffery
Jeffery Law Group, LLC

Potential Effects of Landfills

International Journal of
Environmental Research and Public Health

MDPI

Article

Health and Environmental Risks of Residents Living Close to a Landfill: A Case Study of Thohoyandou Landfill, Limpopo Province, South Africa

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check for updates

Potential Effects of Landfills

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Advance Access Publication Date: 24 May 2016
Original article

Environmental Exposures and Cancer

Morbidity and mortality of people who live close to municipal waste landfills: a multisite cohort study

Francesca Mataloni,[1]* Chiara Badaloni,[1] Martina Nicole Golini,[1] Andrea Bolignano,[2] Simone Bucci,[1] Roberto Sozzi,[2] Francesco Forastiere,[1] Marina Davoli[1] and Carla Ancona[1]

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Potential Effects of Landfills

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Relation between malodor, ambient hydrogen sulfide, and health in a community bordering a landfill

Christopher D. Heaney, Ph.D.[1], **Steve Wing, Ph.D.**[1], **Robert L. Campbell**[2], **David Caldwell**[2], **Barbara Hopkins**[2], **David Richardson**[3], and **Karin Yeatts, Ph.D.**[1]

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Potential Effects of Landfills

Ecological Economics 85 (2013) 116–129

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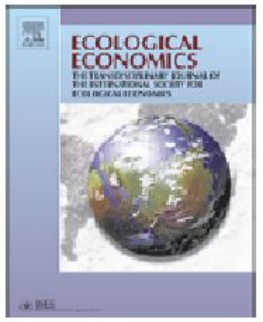
journal homepage: www.elsevier.com/locate/ecolecon



Analysis

The valuation of landfill disamenities in Birmingham

Yun-Ju Ham, David J. Maddison *, Robert J.R. Elliott

Department of Economics, University of Birmingham, Birmingham B15 2TT, United Kingdom

Findings

Njoku, Prince et al., **Health and Environmental Risks of Residents Living Close to a Landfill: A Case Study of Thohoyandou Landfill, Limpopo Province, South Africa**, *Int. J. Environ. Res. Public Health* 2019, 16, 2125.

Findings

Njoku, Prince et al., **Health and Environmental Risks of Residents Living Close to a Landfill: A Case Study of Thohoyandou Landfill, Limpopo Province, South Africa**, *Int. J. Environ. Res. Public Health (*2019), 16, 2125.

- "78% of participants . . . Often experience a bad odour."

Findings

Njoku, Prince et al., **Health and Environmental Risks of Residents Living Close to a Landfill: A Case Study of Thohoyandou Landfill, Limpopo Province, South Africa**, *Int. J. Environ. Res. Public Health (*2019), 16, 2125.

- "Respiratory diseases and breathing disorders can be caused by bioaerosols and biological agents released from landfill sites."

Findings

Njoku, Prince et al., **Health and Environmental Risks of Residents Living Close to a Landfill: A Case Study of Thohoyandou Landfill, Limpopo Province, South Africa**, *Int. J. Environ. Res. Public Health (*2019), 16, 2125.

- "54% of the participants . . . indicated difficulties in the sale of the property. . . ."

Findings

Mataloni, Francesca et al., **Morbidity and mortality of people who live close to municipal waste landfills: a multisite cohort study**. International Journal of Epidemiology (2016), 45(3): 806–815.

Findings

Mataloni, Francesca et al., **Morbidity and mortality of people who live close to municipal waste landfills: a multisite cohort study**. International Journal of Epidemiology (2016), 45(3): 806–815.

- ". . . positive association between exposure to hydrogen sulphide (H_2S), . . . and mortality for lung cancer and respiratory diseases . . . ."

Findings

Heaney, C. D., et al., **Relation between malodor, ambient hydrogen sulfide, and health in a community bordering a landfill**. Environmental Research, (2011), 111(6), 847-852.

Findings

Heaney, C. D., et al., **Relation between malodor, ambient hydrogen sulfide, and health in a community bordering a landfill**. Environmental Research, (2011), 111(6), 847-852.

- “. . . neighbors of a regional landfill experience malodor frequently.”

Findings

Heaney, C. D., et al., **Relation between malodor, ambient hydrogen sulfide, and health in a community bordering a landfill**. Environmental Research, (2011), 111(6), 847-852.

- ". . . evidence of impacts of landfill malodor on health and health-related quality of life . . . ."

Findings

Ham, Y, et al., **The valuation of landfill disamenities in Birmingham**, Ecological Economics 85, (2013), 116 – 129.

- ". . . the impact of landfill sites on house prices appears to endure over periods in excess of 20 years after closure."

Findings

Ham, Y, et al., **The valuation of landfill disamenities in Birmingham**, Ecological Economics 85, (2013), 116 – 129.

- ". . . impact of active and historical landfill sites on house prices extends over a different geographical range: 0–3 km for active landfill sites . . . ."

Findings

Ham, Y, et al., **The valuation of landfill disamenities in Birmingham**, Ecological Economics 85, (2013), 116 – 129.

- ". . . historical landfill sites continue to depress property prices more than 20 years after their closure."

Conclusions:

Based on these research studies, there can be an increased likelihood of:

Conclusions:

Odor

Conclusions:

Odor

Dust

Conclusions:

Odor
Dust
Respiratory disease

Conclusions:

Odor
Dust
Respiratory disease
Lung cancer

Conclusions:

Odor
Dust
Respiratory disease
Lung cancer
Decrease in property values

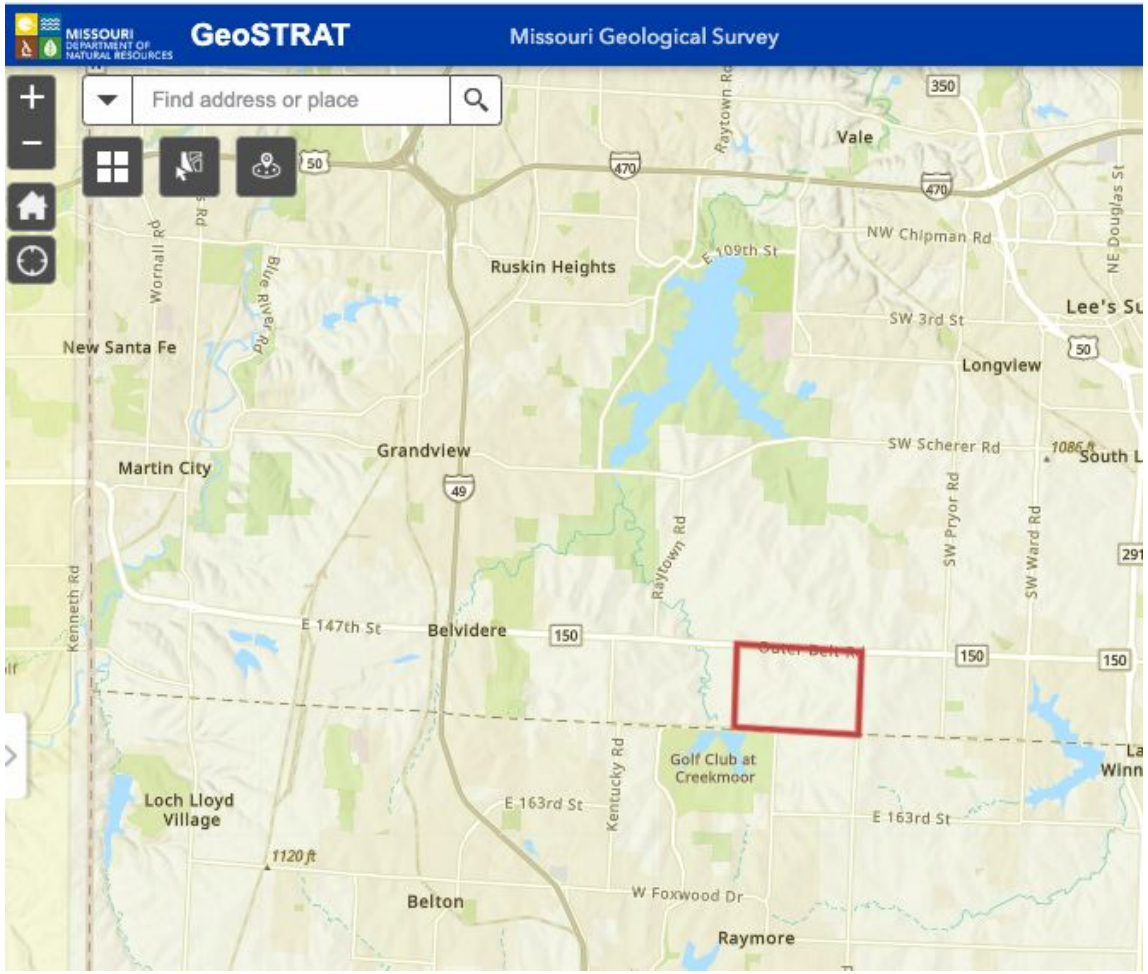
Conclusions:

Odor
Dust
Respiratory disease
Lung cancer
Decrease in property values
Difficulty in selling property

Geologic -Hydrogeologic Information

A look at some government data sources for a Property of Interest

MDNR – GeoStrat – Missouri Geologic Survey GIS Geologic Database https://modnr.maps.arcgis.com/

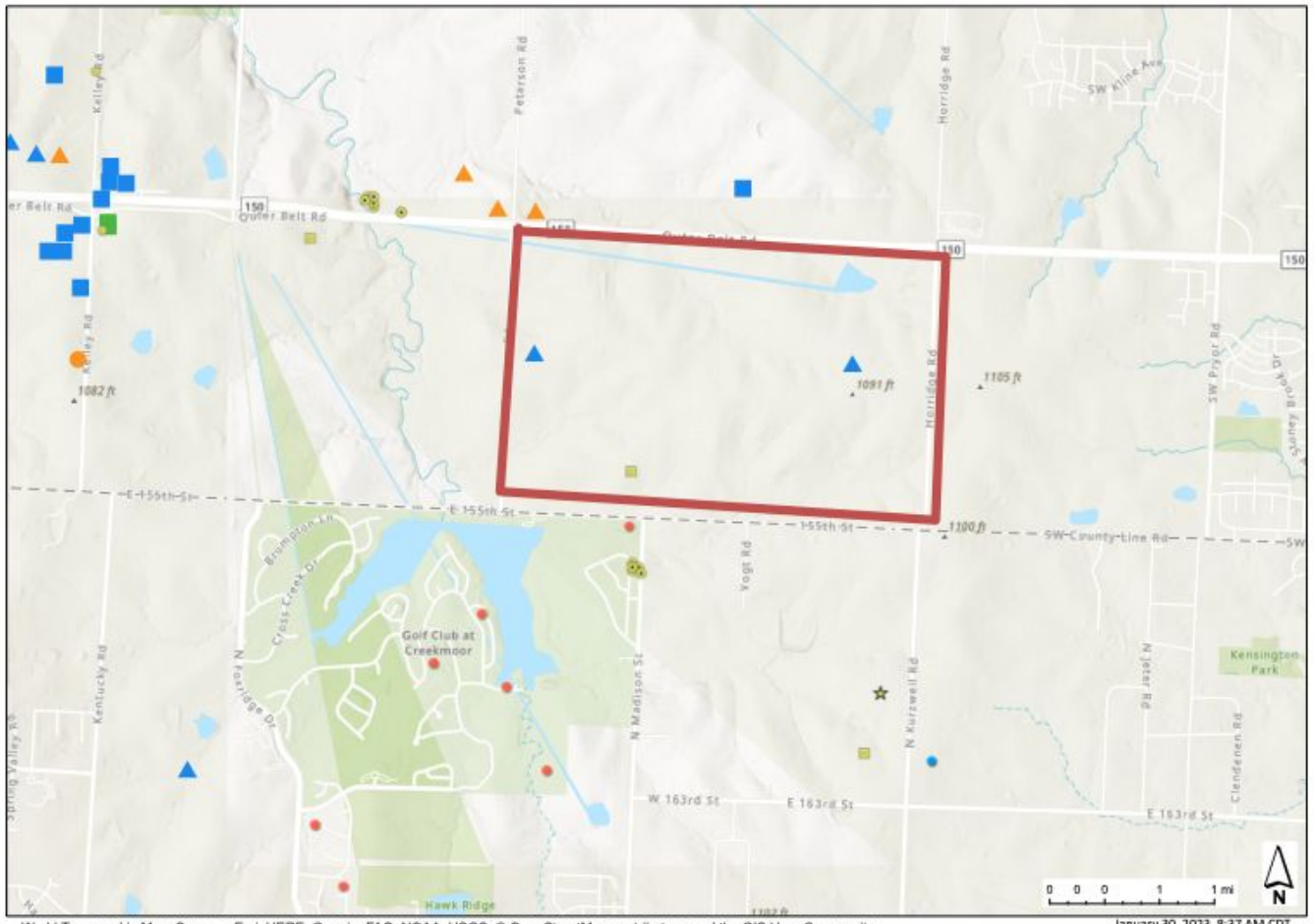


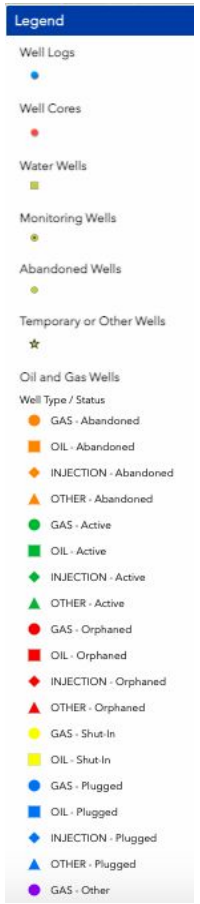
Preliminary Geologic Site Investigation

A look at some government data sources for a Property of Interest

- A site may be UNSUITABLE for a landfill due to one or more of these geologic conditions being present
  - Groundwater must be pumped to keep waste isolated above water table
  - Permeable geologic media and structures that provide a rapid migration of fluids to uppermost aquifer or surface water body outside the boundaries
  - Permeable geologic media and structures that provide for migration of landfill derived gasses outside the boundaries
  - A fault that has moved in recent geologic time (approximately 12,000 years)
  - Groundwater that cannot be effectively monitored on-site due to karst terrain conditions , and/or
  - Subsurface voids that present significant collapse potential.

Subsurface Geologic Data Points Available





MISSOURI DEPARTMENT OF NATURAL RESOURCES

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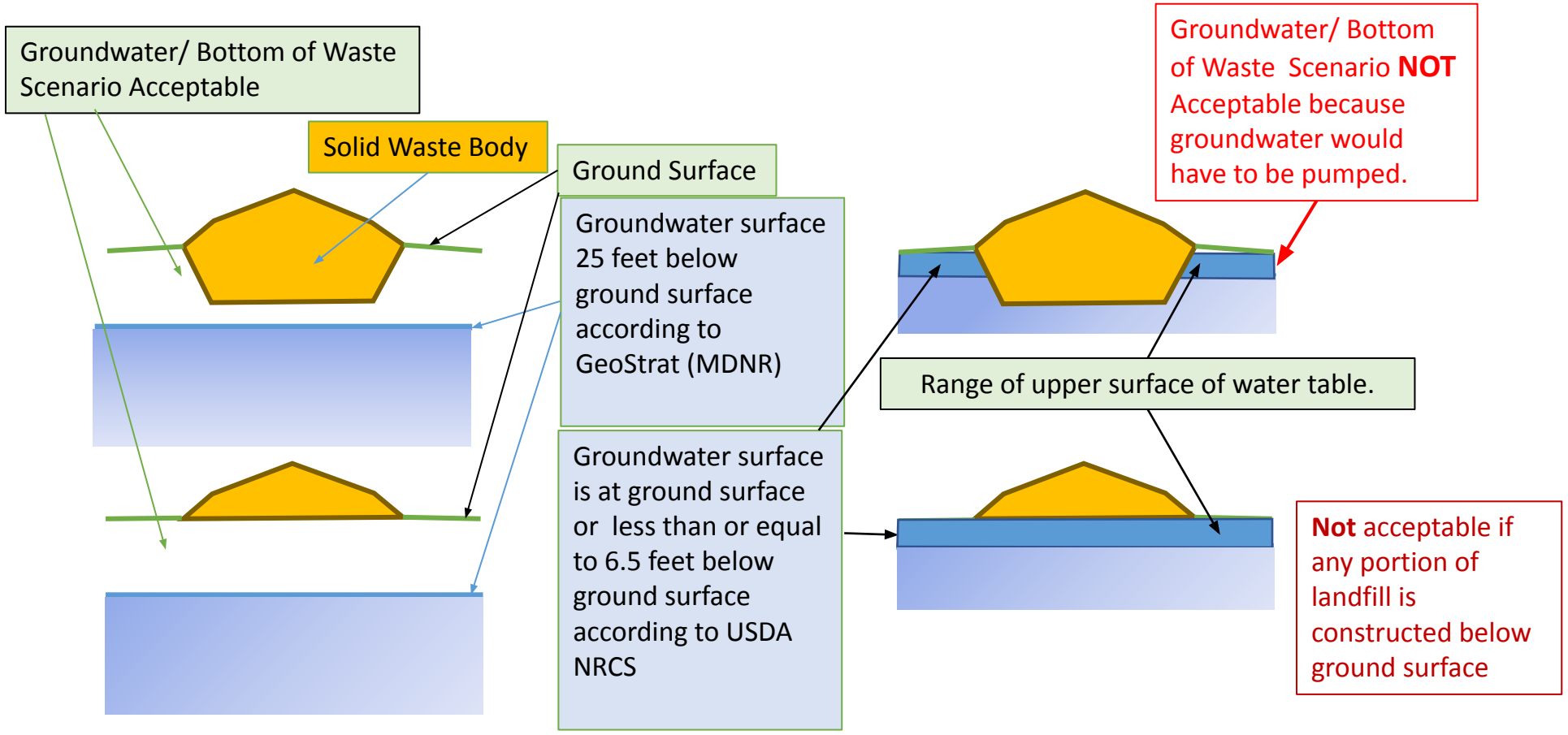
Preliminary Site Investigation – Independent Review of Existing Geological Data Applied to Six Geologic Conditions

Condition 1 of 6 - Groundwater must be pumped to keep waste isolated above water table

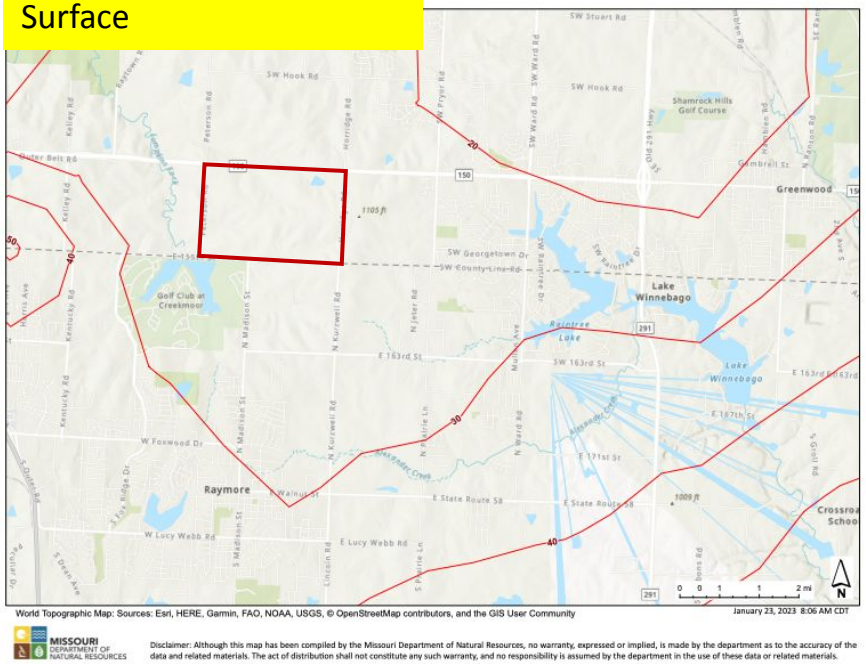
A landfill design is only acceptable if groundwater does not have be be pumped to keep it from being equal to or less than the lowest elevation of the waste body.

Groundwater / Waste Isolation Scenarios – MDNR & NRCS

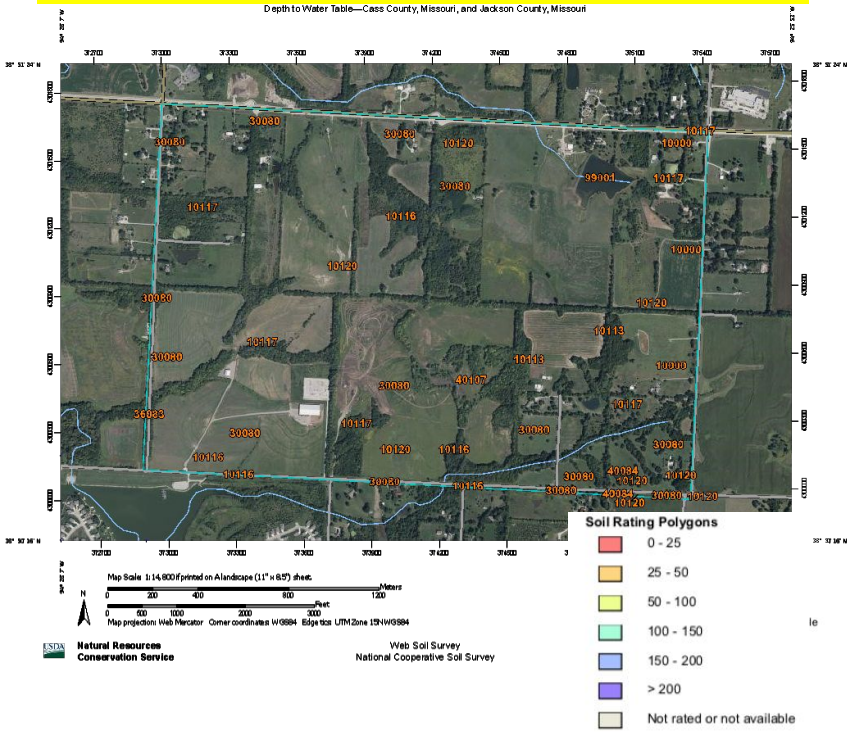


Groundwater Depth Occurrence – Conflicting Information

GeoStrat Reports Depth to Groundwater 20 – 30 Feet Below Ground Surface



Depth to Water Table - USDA NRCS Reports that approximately 90% of Property of Interest Ranges from 0 to less than 200 centimeters (6.5 feet)



Preliminary Site Investigation – Independent Review of Existing Geological Data Applied to Six Geologic Conditions

Condition 2 of 6 - Permeable geologic media and structures that provide a rapid migration of fluids to uppermost aquifer or surface water body outside the boundaries

Condition 3 of 6 - Permeable geologic media and structures that provide for migration of landfill derived gasses outside the boundaries

Rock Layers and Geologic Map – Upper Bedrock

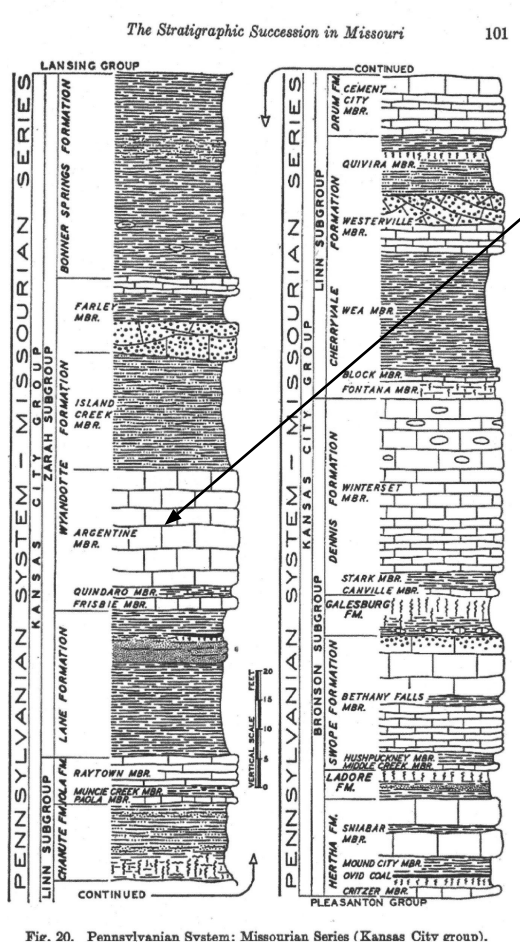
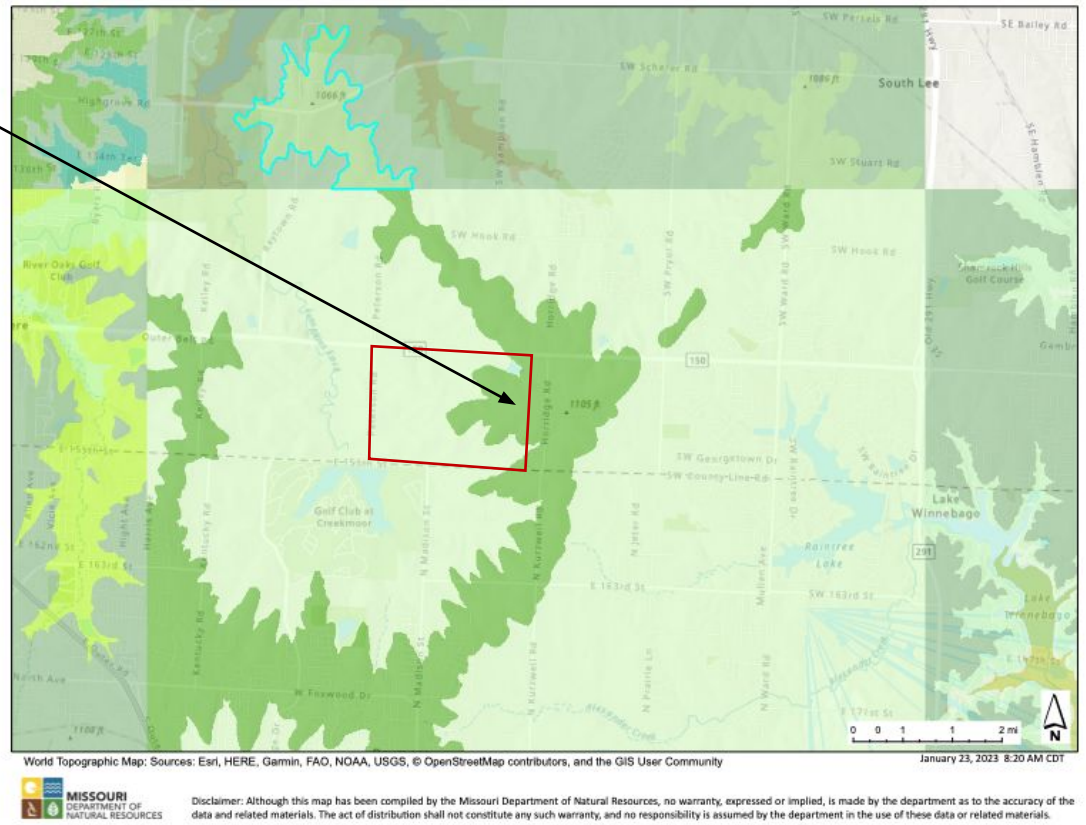


Fig. 20. Pennsylvanian System: Missourian Series (Kansas City group).

Argentine Limestone Member

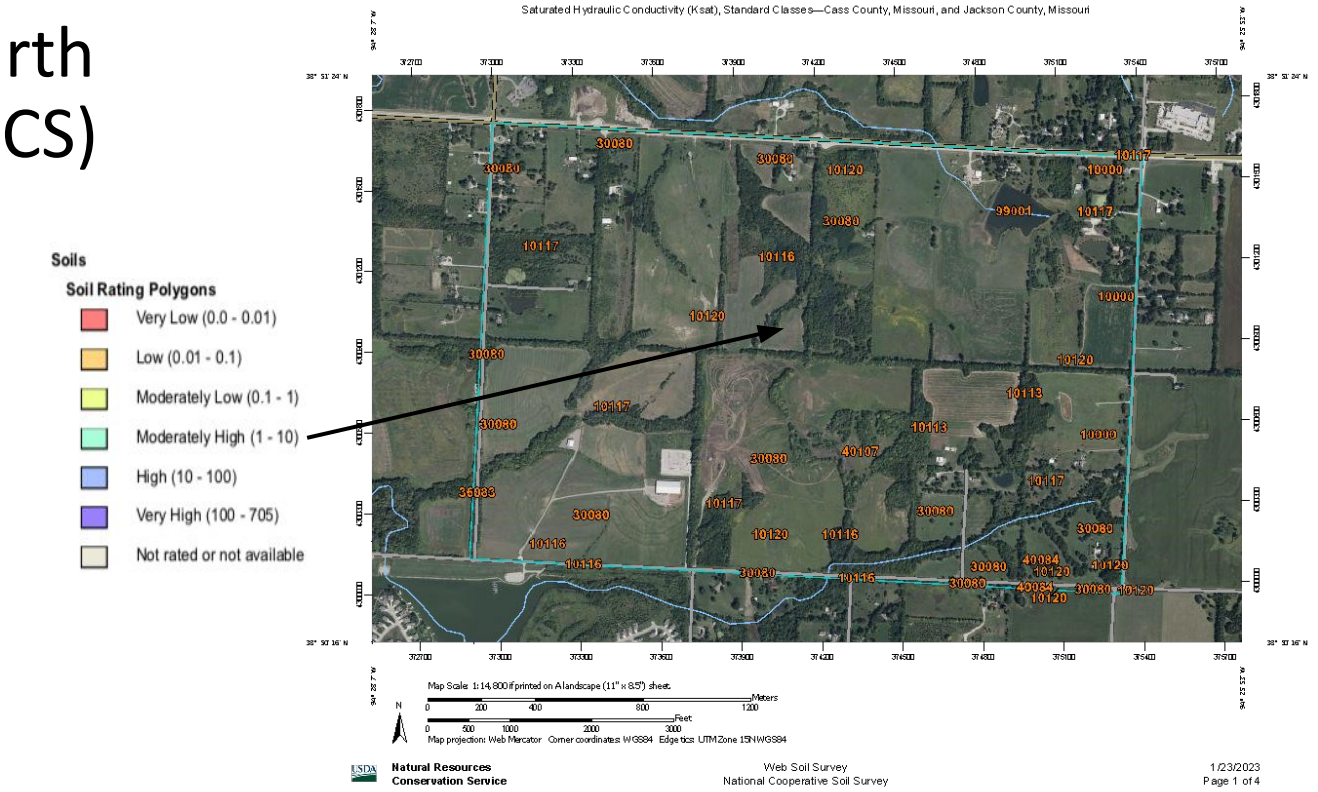
The Argentine Limestone Member is one of the upper bedrock units. Its permeability vertically and horizontally are not known.



Saturated Hydraulic Conductivity (Permeability) of Surface Unconsolidated Earth Media (USDA – NRCS)

Saturated hydraulic conductivity refers to the ease which water flows through pores in a saturated soil.

The hydraulic conductivity is reported as moderately high (**green shaded area**) in most of the several soil types present.

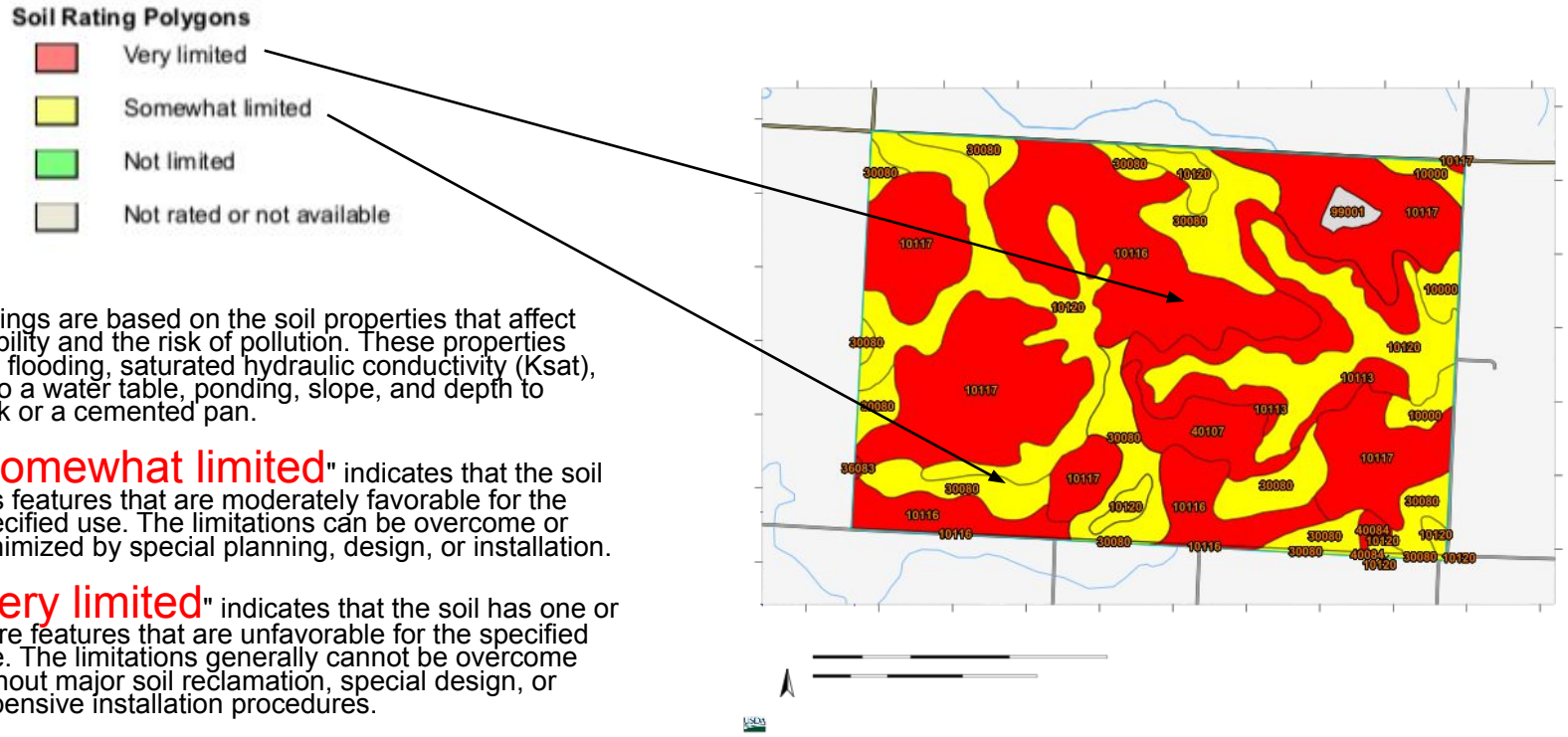


USDA NRCS Web Soil Survey - Reported Limitations of Unconsolidated Earth Media on Property of Interest for Landfill Application

- General Landfill Use – Somewhat Limited to Very Limited
- Daily Cover – Very Limited
- Saturated Hydraulic Conductivity – Moderately High
- Depth to Water Table (at most of of POI) – at surface to less than 6.5 feet below ground surface

https://websoilsurvey.sc.egov.usda.gov/App/HomePage.htm

USDA NRCS Landfill Use* Data



The ratings are based on the soil properties that affect trafficability and the risk of pollution. These properties include flooding, saturated hydraulic conductivity (Ksat), depth to a water table, ponding, slope, and depth to bedrock or a cemented pan.

- "Somewhat limited" indicates that the soil has features that are moderately favorable for the specified use. The limitations can be overcome or minimized by special planning, design, or installation.
- "Very limited" indicates that the soil has one or more features that are unfavorable for the specified use. The limitations generally cannot be overcome without major soil reclamation, special design, or expensive installation procedures.

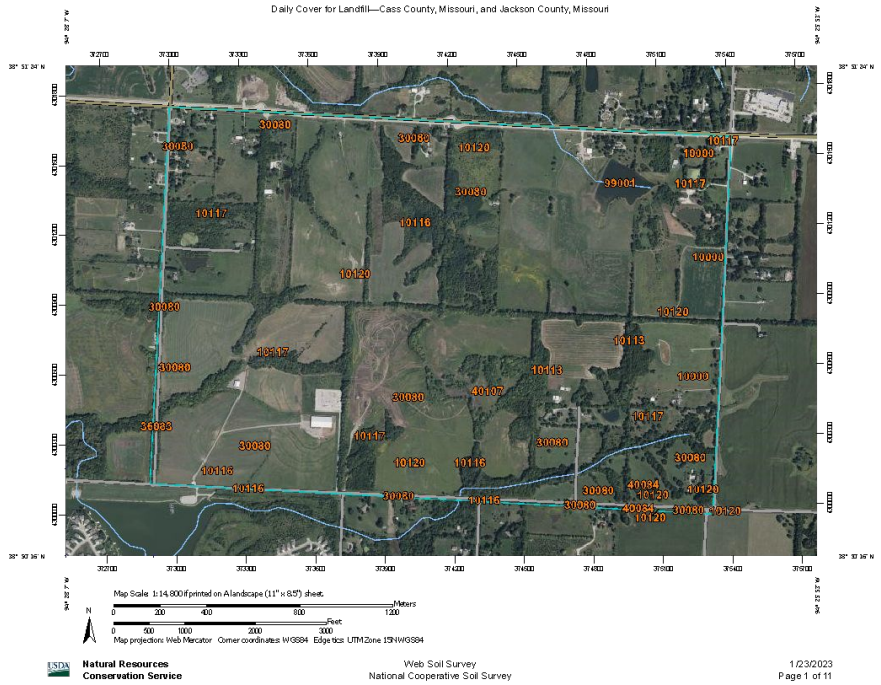
* (Limitation use classification assumes waste placed on ground surface.)

USDA NRCS Landfill Use Data
Daily Cover for Landfill

Soil Rating Polygons

- Very limited
- Somewhat limited
- Not limited
- Not rated or not available

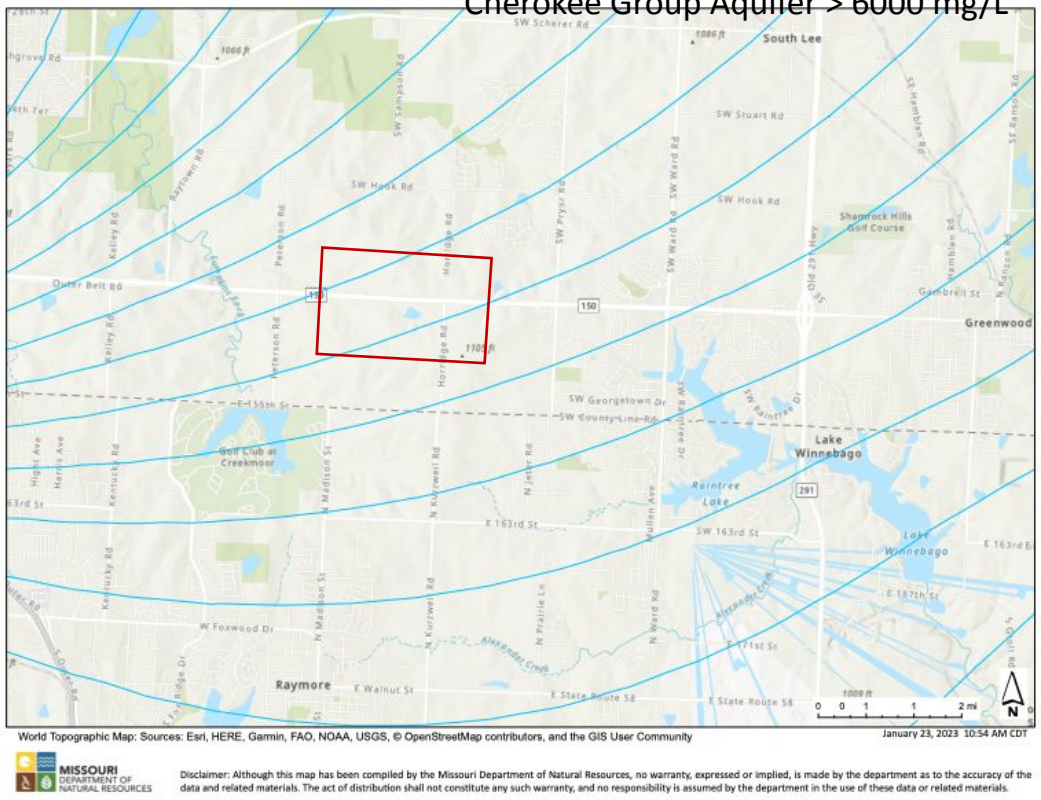
"Very limited" indicates that the soil has one or more features that are unfavorable for use as daily cover on the working face.



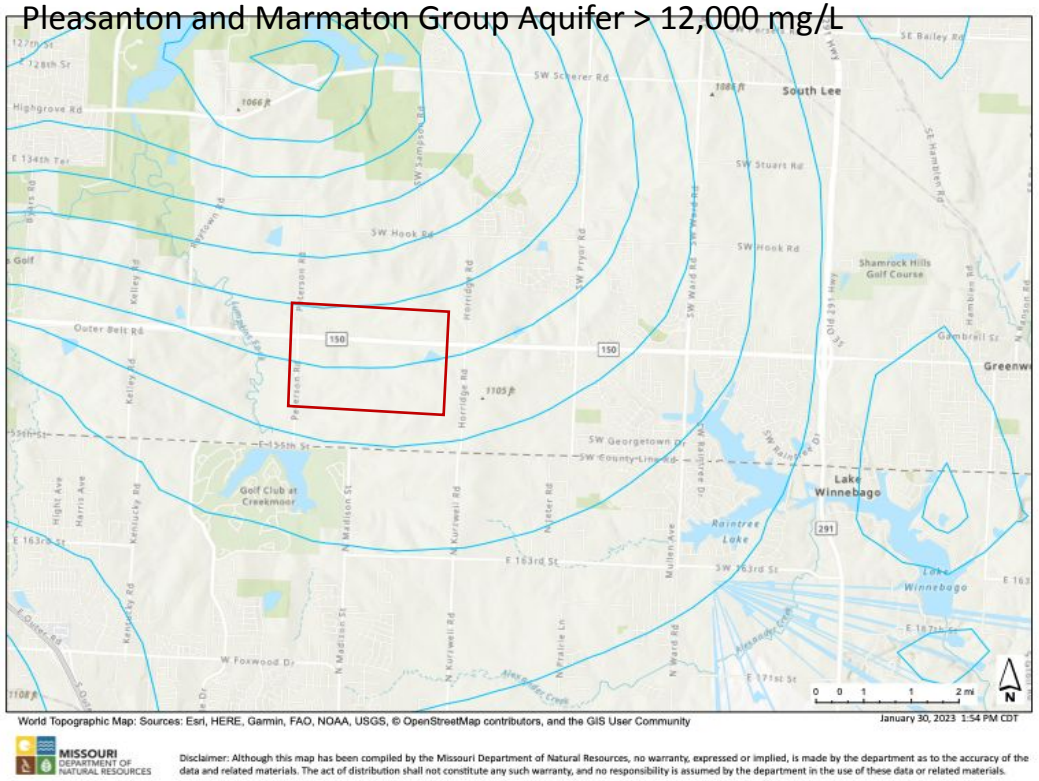
Other Geologic Related Observations
Water Quality of Underlying Units – (High Total Dissolved Solids)

For Drinking Water EPA suggests no higher than 500 mg/L

Cherokee Group Aquifer > 6000 mg/L



Pleasanton and Marmaton Group Aquifer > 12,000 mg/L



Concluded Concerns Related to Geology and Groundwater

A. Groundwater Occurrence – May be very shallow - requiring lowering of the water table to keep the landfill from being in direct contact with groundwater.

B. Ground Water Quality – Deep water bearing units are naturally high in total dissolved solids which could could lead some to lessen the importance of protecting groundwater quality.

C. Permeable Geologic Media Exists – Fugitive liquids (landfill leachate) and landfill derived gas have a porous media available in the subsurface through which it can move.
   1. The surficial unconsolidated earth media has moderately high permeability.
   2. The upper most bedrock unit (Argentine Limestone Member) is made of limestone. Limestone can have very high permeability both vertically and horizontally.

D. Stated Limitations of unconsolidated earth media for landfill application according to USDA NRCS Web Soil Survey