

Missouri Department of Natural Resources



Standard Procedures for Completing an Earthen Basin Geologic Collapse Potential Evaluation

(07/2006, revised 08/2019)

Introduction

Geologists with the Missouri Geological Survey (MGS) perform geohydrologic evaluations to support Water Protection Program (WPP) construction and operating permit decisions for wastewater treatment facilities in accordance with Missouri Code of State Regulations Title 10 CSR 20-6.010 through 10 CSR 20-6.030, 10 CSR 20-7.015 through 10 CSR 20-7.031, 10 CSR 20-8.110, 10 CSR 20-8.200, and 10 CSR 20-8.300. The overall objective of the geohydrologic evaluation is to examine site-specific geologic and hydrologic conditions to determine the potential of a permitted facility to impact groundwater. As part of a geohydrologic evaluation for new or modified wastewater lagoons and storage basins constructed with earthen materials, the potential for failure or collapse of the basin due to geologic or hydrologic processes and/or conditions is also evaluated.

Pursuant to 10 CSR 20-8.110(5)(E)6.G. and 10 CSR 20-8.200(2), a request for a geohydrologic evaluation is required to be included with an Antidegradation Review Request or a Facility Plan, and a collapse potential evaluation is required to be performed for all new or major modifications to earthen basin structures. A geohydrologic evaluation is requested from the [GeoEDGE](#) website by the applicant.

A geologic collapse potential evaluation is performed by considering several geologic factors, while also taking into account the operating depth and surface area of the basin. Best professional judgment and interpretation of site conditions based on observation and data collection is also used in determining the potential for collapse. Following the evaluation, the facility is assigned a collapse potential rating.

MGS provides WPP a report signed and sealed by a Missouri Registered Geologist detailing the geohydrologic evaluation and collapse potential rating, and provides specific recommendations, if warranted, for siting and construction of the earthen basin. The WPP sets the minimum engineering design and construction standards of wastewater lagoons and storage basins.

Guidelines for Completing an Assessment of Earthen Basin Geologic Collapse Potential

The geologic collapse potential rating is determined by professional experience, judgment, and knowledge of the wastewater lagoon or storage basin site geology and hydrology. Interpretation of site conditions is based on observation and best available information. If additional information is submitted for MGS consideration to modify a collapse potential rating, the additional information will be reviewed.

Each on-site geologic and hydrologic consideration contains criteria to be evaluated to determine a collapse potential rating. The selected criteria are assigned a numeric risk factor score, which are totaled to produce a collapse potential evaluation rating in [GeoEDGE](#). Scores of two (2) through nine (9) are classified as having a slight collapse potential rating, scores of ten (10) through twenty-two (22) are classified as having a moderate collapse potential rating, and scores of twenty-three (23) or greater are classified as having a severe collapse potential rating. The rating is included in the geohydrologic evaluation report sent to the property owner, requestor, WPP, and the appropriate regional office.

Pursuant to 10 CSR 20-8.110(5)(E)6.G.(III) and 10 CSR 20-8.200(2)(B)1., earthen basin structures shall not be located in areas receiving a severe collapse potential rating. Earthen basin structures located in areas receiving a moderate collapse potential rating with an appropriate engineering solution are reviewed on a case-by-case basis.

Onsite Geologic and Hydrologic Considerations:

Geologic Stream Classification: May be obtained by performing a losing/gaining stream evaluation and/or field verifying the GIS Losing Stream dataset value. When available, additional geologic and hydrologic information may be used to determine the appropriate selection and will be noted in the Remarks section.

- Gaining (Risk Factor - 0)
- Losing (Risk Factor - 4)

Depth to Water Table: Professional interpretation, observation of nearby streams and springs, seasonal variability of water levels, and available data is considered. Data may include, but are not limited to onsite or drilling logs, well certification records, or static water level measurements from the nearby area.

- Less than 50 feet (Risk Factor - 0)
- Greater than 50 feet (Risk Factor - 4)

Predominant Characteristics of the Upper 20 feet of Bedrock and/or Surficial Materials: Use available geologic information to determine the physical and hydrologic characteristics of the geologic materials to a depth of 20 feet below the base of the storage basin. Data may include, but is not limited to onsite or nearby exposures, subsurface maps, subsurface well logs, and information from the USDA Web Soil Survey.

- Solution free bedrock, glacial drift, or alluvium of a gaining stream. (Risk Factor - 0)
- Bedrock with a shallow, permeable weathered zone within the uppermost 10 feet of bedrock surface and its associated residuum. Minor solution voids (<1 foot wide) may be present. (Risk Factor - 2)
- Bedrock with deep, permeable weathering greater than 10 feet below the bedrock surface (even if it occurs greater than 20 feet below the base of the lagoon bottom) and, if present, relict bedrock structure residuum associated with it; significant solution voids (>1 foot wide) may be present; and alluvium of a losing stream. (Risk Factor - 4)

Proximity of Nearest Sinkhole to Facility: Measure the distance from the outside toe or the nearest cut of the proposed storage basin to the nearest sinkhole. In order to be considered, the sinkhole must be developed in the same or similar geohydrologic setting that is present at the site.

- Greater than one mile (Risk Factor - 0)
- Between ½ mile and one mile (Risk Factor - 1)
- Between ¼ mile and ½ mile (Risk Factor - 4)
- Between 500 feet and ¼ mile (Risk Factor - 6)
- Within 500 feet (Risk Factor - 8)

Residuum Thickness: Estimate residuum thickness by analyzing well logs and exposures of residuum profiles in the area when available. A more accurate thickness estimate may be obtained from boreholes or test pits at the proposed site. Residuum may not be the same as total soil or surficial material thickness. In some locations, residuum may be overlain by significant thicknesses of surficial material (i.e. till or loess).

- Less than 10 feet (Risk Factor - 0)
- Greater than 10 feet and less than 40 feet (Risk Factor - 1)
- Greater than 100 feet (Risk Factor - 2)
- Greater than 40 feet and less than 100 feet (Risk Factor - 4)

Distance of Nearest Underground Opening to the Facility: An underground opening is a natural void or artificial excavation under the surface of the earth, which includes, but is not limited to: caves, underground mines, and collapse features. Identify only the underground openings that are in the same or underlying stratigraphic units present at the proposed or existing basin location. Cave and mine maps may be consulted when available.

- ½ mile or greater (Risk Factor - 0)
- Between ¼ and ½ mile (Risk Factor - 2)
- Between 500 feet and ¼ mile (Risk Factor - 4)
- Within 500 feet, but not beneath the facility (Risk Factor - 8)
- Beneath the facility (Risk Factor - 16)

Maximum Operating Depth of Liquids: This information for the *proposed* basin is provided on the request for geohydrologic evaluation. The maximum operating depth of *existing* basins is estimated by determining the vertical distance from the downstream toe of the berm to the emergency spillway or overflow pipe. In cases where there are multiple cells, use the operating depth of the deepest cell.

- Less than 5 feet (Risk Factor - 1)
- Between 5 feet and 10 feet (Risk Factor - 2)
- Between 10 feet and 15 feet (Risk Factor - 3)
- Between 15 feet and 20 feet (Risk Factor - 4)
- Greater than 20 feet (Risk Factor - 5)

Surface Area of the Facility: Calculate the surface area of the proposed basin. In most cases the surface area will be given on the geohydrologic evaluation request. Total surface area is considered if more than one cell is existing or proposed.

- Less than 1 acre (Risk Factor -1)
- Between 1 acre and 2 acres (Risk Factor - 2)
- Between 2 acres and 3 acres (Risk Factor - 3)
- Between 3 acres and 4 acres (Risk Factor - 4)
- 4 acres or greater (Risk Factor - 5)

Remarks

Include any additional pertinent and important information used for completion of the evaluation.