US Army Corps of Engineers®
Buffalo District

FUSRAP

Preliminary Assessment

Bonebrake Theological Seminary Site
Dayton Unit III
Dayton, Ohio

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TABLE OF CONTENTS

1.0 INTRODUCTION

A Preliminary Assessment was performed, by the United States Army Corps of Engineers (USACE), on the former Bonebrake Theological Seminary under the authority of the Comprehensive Environmental Response, Compensation and Liability Act. The purpose of this assessment was to review information to determine the need for further action by USACE, under the Formerly Utilized Sites Remedial Action Program (FUSRAP), to ensure the protection of human health and the environment. The scope of the assessment included a review of existing information on the site and a site visit.

In 1943, Monsanto Chemical Company, under contract to the Manhattan Engineer District, began using Bonebrake Theological Seminary for the research, development, processing and production of polonium, and storage of processing residues. From 1948 through 1950, the site was decontaminated and released for unrestricted use by the Atomic Energy Commission. In 1950, the site was transferred back to the original owner, the Dayton School Board.

In 1974, FUSRAP was created to address sites used during the early atomic energy program that have contamination exceeding current regulatory requirements. Under this program, the U.S. Department of Energy (USDOE) determined the site is eligible for inclusion into the FUSRAP on February 10, 1999. Under the Memorandum of Understanding between the U.S. Army Corps of Engineers (USACE) and the USDOE, once this determination has been made by the USDOE, responsibility for action is transferred to USACE. The USACE has undertaken this preliminary assessment as the first step in the CERCLA process.

2.0 SITE DESCRIPTION, OPERATIONAL HISTORY AND WASTE CHARACTERISTICS

2.1 Location

The site of the former Bonebrake Theological Seminary is located at 1601 West First Street in Dayton, Montgomery County, Ohio. The site includes two primary areas. The first is the Dayton Board of Education Maintenance Facility bounded on the west by Como Lane, on the south by West First Street, on the east by North Euclid Avenue and on the north by Edison Street . The second area is comprised of an approximate 7.5 acre area located north of Edison Street and adjacent to the Maintenance Facility. The Grace A. Greene Elementary School Athletic Field currently comprises the majority of the second area. Refer to Attachment A.

The Montgomery County climate is typical of the continental interior. Summers are moderately warm and humid, and winters are cold and cloudy (ODNR 1995).

National Oceanic and Atmospheric Administration precipitation data for the thirty year period from 1961 to 1990 averaged 38.82 inches per year at Dayton. May is typically the wettest month and January the driest month (ODNR 1995).

All of Montgomery County is within the Ohio River Drainage basin. The majority of the county is drained by the Great Miami River and its tributaries. Only the southeast corner of the county is drained by tributaries of the Little Miami River (ODNR 1995).

2.2 Site Description

The former Bonebrake Theological Seminary site is located in a residential setting and is comprised of the Dayton Board of Education Maintenance Facility. Included in the area of concern and immediately down gradient of the former Bonebrake Theological Seminary site is the Grace A. Greene Elementary School Athletic Field. Both active locations are owned by the Dayton Board of Education and operated by Dayton Public Schools. The Maintenance Facility consists of seven buildings on approximately 2 acres of land located on the opposite side of Edison Street from the Grace A. Greene Elementary School. The Athletic Field is approximately 85 feet down gradient from the northeast corner of

Grace A. Greene Elementary School. The field is surrounded by a cinder running track and encompasses approximately 2 acres of land (OEPA 1998).

2.3 Operational History and Waste Characteristics

In 1943, Monsanto Chemical Company, under contract to the Manhattan Engineer District, began using Bonebrake Theological Seminary for the research, development, processing and production of polonium, and storage of processing residues. Between 1944 and 1946, Monsanto Chemical Company constructed several structures on this property to support the site operations.

Two processes were utilized in obtaining polonium-210 (Po-210). The first process involved the extraction of Po-210 from lead dioxide wastes generated by the Port Hope radium refinery, located in Ontario, Canada. After treating the lead dioxide with nitric acid and hydrogen peroxide, and subsequently raising the pH of the solution; a precipitate containing Po-210 was formed.

The second process, found superior to the lead dioxide process, involved the chemical separation of Po-210 from bricks containing bismuth-209. The bricks were irradiated via neutron bombardment at the Clinton Reactor in Oak Ridge, Tennessee, and shipped to the Bonebrake site for the chemical separation. (DOE 1998)

The potential contaminants of concern derived from the two processes described include Polonium-210 and Lead-210. The inorganic contaminant, lead, may also be associated with these processes.

In 1948, the project was moved to Mound Laboratories and operations at Bonebrake Theological Seminary ceased. Following decontamination efforts supported by the Atomic Energy Commission in 1948 through 1950, the site was released for unrestricted use and transferred back to the Dayton School Board in 1950. No materials were buried onsite, sent to city landfills or other disposal facilities. According to available information, the resulting radioactive wastes were packaged and may have been shipped to Oak Ridge National Laboratories in Oak Ridge, Tennessee for burial. Presently, several structures[1], utilized for the polonium production operation, remain on site and are utilized by the Dayton Board of Education as a maintenance facility (USAF 1997).

3.0 SOIL EXPOSURE AND AIR PATHWAYS

3.1 Physical Conditions

The site is presently utilized as a maintenance facility and an athletic field for Grace A. Greene Elementary School. The maintenance facility portion of the site consists of several buildings with floor drains and subsurface plumbing and electrical conduit. The majority of the area surrounding the facility consists of an asphalt parking lot with some adjacent concrete walkways. There are also small areas of maintained landscape, surrounding the buildings, within the site fence line.

The athletic field is a maintained landscape with grass surrounded by cinder running track.

3.2 Soil and Air Pathways

The maintenance facility is operated by the Dayton School Board and the athletic field by attendants at the Grace A. Greene Elementary School. The athletic field is used by a local high school football team and local residents for other activities. Residential housing borders the remainder of the site.

On August 27, 1997 Ohio EPA conducted surface soil sampling (0-5cm) at the former site of

[1] Based on information from the Ohio EPA and Dayton Public Schools, the original seminary building was found to be inadequate and subsequently demolished. It is unclear where the debris from this building were disposed.

Bonebrake Theological Seminary. Three surface samples were taken at the City of Dayton Board of Education maintenance facility, and two from the Grace A. Greene Elementary School property. Two samples exhibited levels of polonium-210 at greater than expected values, 14 and 43 pCi/g. (OEPA 1998).

On March 10, 1998, an investigation of the manholes and floor drains was conducted to find possible sources for the elevated readings. Two samples (at 5.1 and 37.0 pCi/g) taken from manholes (where roof run-off from the Grace A. Greene Elementary School was routed) exhibited levels of polonium-210 at greater than expected levels (OEPA, ODH 1998).

Soil sampling results from 149 surface soil samples collected on April 13, 1998 resulted in a range from 0.7 to 21.0 pCi/g polonium-210. Three of these samples exhibited readings above background levels and were all located at the location of the former Bonebrake Seminary, the location where operations actually took place. [2] (OEPA, ODH 1998)

3.3 Soil Exposure and Air Pathway Conclusions

In conclusion, there is a likelihood of release to soil, from activities associated with the Nation's early atomic energy program, based on results from surface soil samples and samples taken from two manholes, indicating the presence of FUSRAP related waste. Potential exposures to radionuclides could occur during disturbance of site soils without proper controls. Release to air pathways is not likely due to the characteristics of the waste and the non-disturbance of loose contamination.

4.0 GROUND WATER PATHWAY

4.1 Hydrogeologic Setting

Montgomery County lies within the Glaciated Central hydrogeologic region. The county is covered by variable thickness of glacial till, lacustrine deposits, and outwash. These unconsolidated glacial deposits are underlain by limestone, shale, and shaley limestone bedrock. Ground water yields are dependent on the type of aquifer and vary greatly throughout the county. Pollution potential indexes are relatively low to moderate in areas of till or lacustrine cover over bedrock. Buried valleys containing sand and gravel aquifers, and areas covered by outwash have moderate to high vulnerabilities to contamination (ODNR 1995).

The former site of Bonebrake Theological Seminary is located within the Till Plains section of the Central Lowland Province. Depth to ground water in the Till Plains section is five to fifteen feet. The site overlies a sand and gravel buried valley aquifer that is near the surface. The aquifer is directly recharged from precipitation and is in direct hydraulic connection with the Great Miami River and its tributaries (Refer to Attachment B). This site is rated higher in the pollution potential index range (ODNR 1995).

4.2 Ground Water Pathway

About 42 percent of Ohio citizens rely on ground water for drinking and household use from both municipal and private wells. Industry and agriculture also utilize significant quantities of ground water for process and irrigation. Over 10,000 rural households depend on private wells in Montgomery County (ODNR 1995). The Montgomery County Water Authority supplies the area encompassing the former Theological Seminary location. The distance to the nearest well field is approximately 5 miles.

The site is situated within a residential area. Approximately 200,043 people live within a 4 mile radius of the site, including about 33,885 children between the ages of 5 and 17 (1990 Census).

4.3 Ground Water Pathway Conclusions

[2] Background levels of Polonium 210 were found to be between 1 and 3 picocuries per gram by the Ohio EPA.

The shallow water table and the high hydraulic conductivity of this hydrogeologic setting has the potential for a large influx of liquid to reach the aquifer and, in turn, Wolf Creek through a naturally occurring migration path. However, sample results from the Ohio Environmental Protection Agency report, issued in February 1998, show soil concentrations of Polonium 210 to be only slightly above background levels. Based on this data, there is a slight likelihood of release to groundwater from the migration of contaminants through soil.

5.0 SURFACE WATER PATHWAY

5.1 Hydrologic Setting

Overland drainage of the former Bonebrake Theological Seminary site is controlled by a municipal sewer system in the areas surrounding the Dayton School Board Maintenance Facility. The discharge point of the system is into Wolf Creek. The Grace A. Green School overland drainage flows to the north, towards Wolf Creek.

Wolf Creek, a tributary of the Great Miami River, runs about 900 feet due north of the site boundary. Wolf Creek reaches the confluence with the Great Miami River approximately 1 mile from its nearest location with Grace A. Greene Elementary School. From this point, the Great Miami River meanders in a south, southwest direction for greater than 15 miles (Topographic Map).

5.2 Surface Water Pathways

The potential exists for contaminants to migrate from the site into the Great Miami River drainage basin where they could enter the food chain.

5.3 Surface Water Pathway Conclusion

In conclusion, there is a slight likelihood of release to surface water due to the limited ability of the contaminant of concern to reach surface water via stormwater runoff. Migration of the contaminant of concern is directly limited by the vegetative covering and gentle contour of the terrain found between the Grace A. Greene Elementary School Athletic Field and Wolf Creek.

6.0 SUMMARY AND CONCLUSIONS

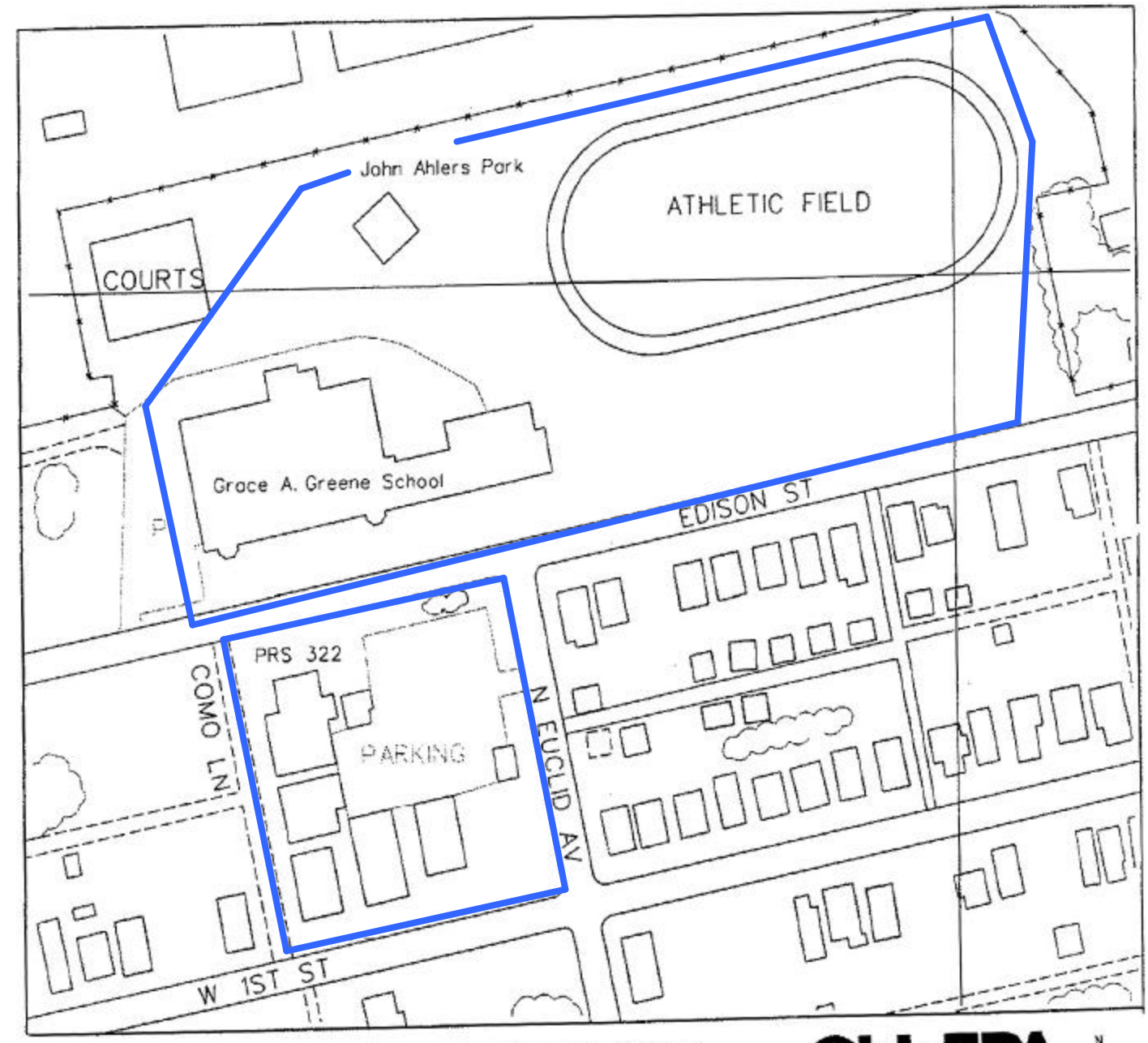
The data collected from the screening samples taken at Bonebrake Theological Seminary report concentrations of Po-210 in soils at greater than background values. Site history and the physics of Po-210 do not corroborate the samples. Based on the sample data and radiological survey conducted by the Ohio Department of Health, Ohio EPA determined that there is no immediate health risk at the site (OEPA 1998).

To better evaluate the potential risk to human health and the environment, it is recommended that a Site Inspection of the Bonebrake Theological Seminary be conducted to determine the type, quantity and extent of contaminants. It is further recommended specific Data Quality Objectives (DQO's) should include the screening for Lead-210, the parent nuclide of Po-210. This DQO will substantiate the activity exhibited by Lead-210, the potential source of Polonium, and model this activity to determine risk to the public. Information collected during the Site Inspection will be used to determine whether or not the former Bonebrake Theological Seminary site requires further investigation and/or remedial action under the Formerly Utilized Sites Remedial Action Program.

ATTACHMENT A
SITE MAP

Figure 1.0: Bonebrake Theological Seminary – Site Location

Figure 1.1: Site Overview



- Modified version of the Ohio EPA Site Map found in OEPA 1998

ATTACHMENT B

HYDROGEOLOGIC SETTING

Figure 2.0: Physiographic Provinces

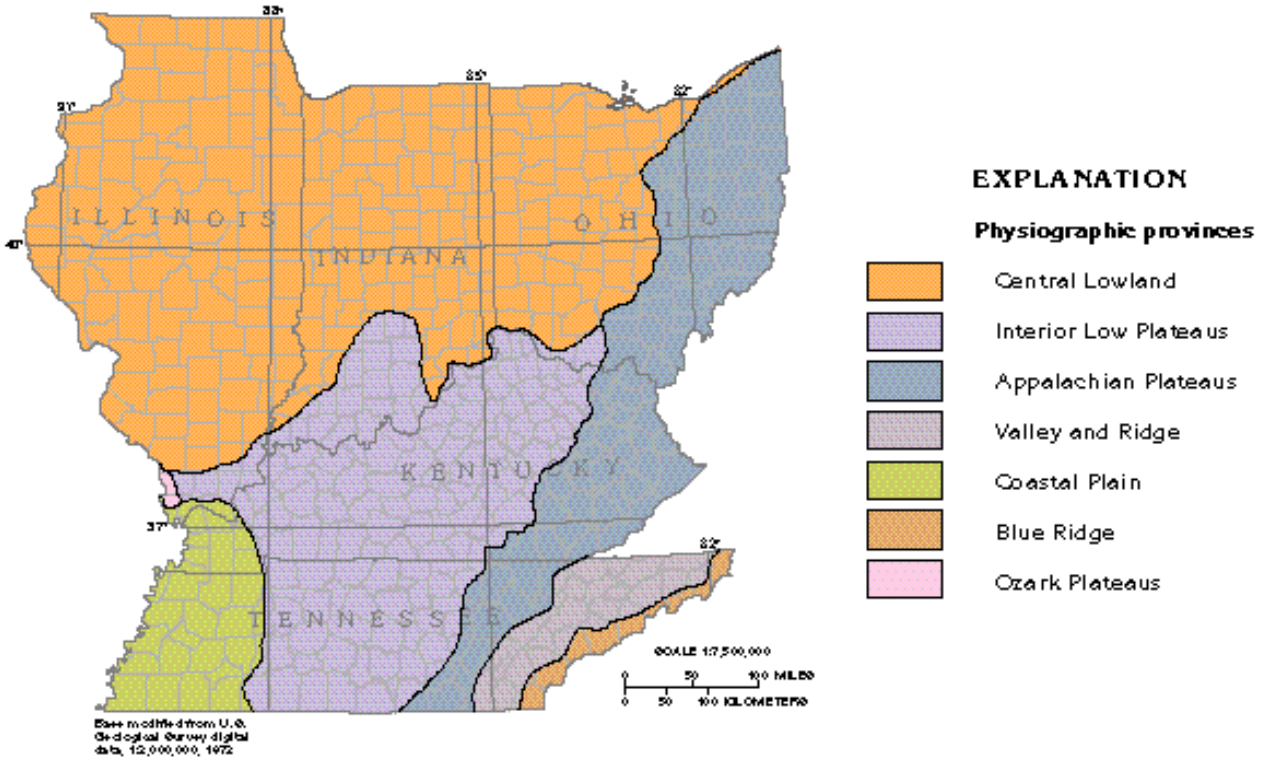


Figure 1. Parts of seven physiographic provinces, each with unique hydrogeologic characteristics, compose Segment 10.

Modified from Fenneman, N.M., and Johnson, D.W., 1946, Physical divisions of the United States: U.S. Geological Survey, 1 sheet, scale 1:7,000,000.

Figure 2.1: Surficial Aquifer System

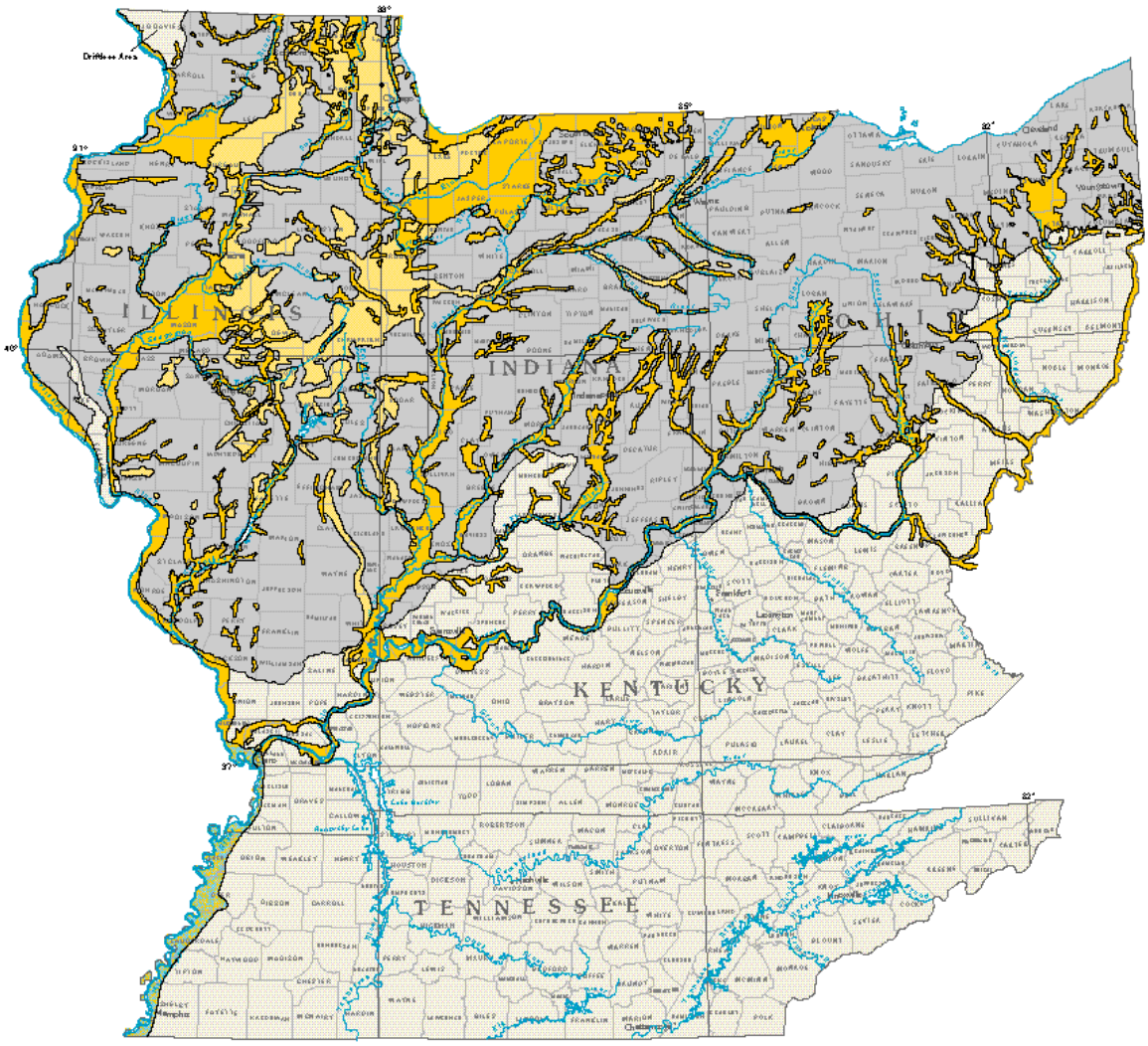


Figure 4. Aquifers in unconsolidated sand and gravel deposits overlie aquifers in semiconsolidated and consolidated rocks in large parts of Segment 10. Most of the sand and gravel aquifers are north of Kentucky. The most productive aquifers in the unconsolidated deposits consist of coarse, well-sorted, stratified glacial deposits.

ATTACHMENT C
REFERENCES

References

OEPA 1998. *PRS 322 Dayton Unit III Soil Screening Results Interim Report*, Ohio Environmental Protection Agency, February, 1998.

USAF 1997. *Radiological Scoping Survey of Former Monsanto Facilities (Unit III and Warehouse), Dayton, Ohio*, Radiation Safety Branch, Office of Environmental Management, 88th Air Base Wing, U.S. Department of the Air Force, 4 September, 1997.

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DOE 1998. *FUSRAP Authority Review for Former Dayton Plant, Units III and IV, Dayton Ohio*, Department of Energy, November 11, 1998.

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Topographic Map, http://www.topozone.com/map.asp?lat=39.7508&lon=-84.2148&s=25&size=s