



GIS Mapping of Land Application Sites for Septage Management in Mahoning County, Ohio

AUTHORS

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ABSTRACT:

This paper describes efforts by the Mahoning County, Ohio, District Board of Health and Youngstown State University to identify the geographic boundaries of eight septage land application sites in farm fields in the county to help local septage operators to maintain compliance. Using a geographic information system (GIS) to map isolation distances is an excellent tool for regulators to determine available acreage and calculate loading limits for septage application, but it has limited value to the operator during actual field application. As a result, the Board of Health decided to convert mapped land application boundaries to global positioning system (GPS) coordinates and use these coordinates to locate application boundaries in the fields using hand-held GPS locators.

Septage is defined as liquid or solid material removed from a septic tank, cesspool, portable toilet, type III marine sanitation device or a similar system that receives only domestic septage (household, non-commercial, nonindustrial sewage) (Mahoning County, 2004). In 2004 the Mahoning County, Ohio, District Board of Health updated its *Regulation of Servicing and Disposal of Septage* to manage septic tank cleaning and the land application of septage. The rules were developed to address increasing public concern about the potential public health impact of allowing the application of hundreds of thousands of gallons of septage to farm fields in Mahoning County, while still allowing for a beneficial and economical method of disposing of septage.

In 2005 in Mahoning County, 2.8 million gallons of septage were pumped from household sewage treatment systems and a total of 927,226 gallons of septage was applied to eight Board-of-Health-approved land application sites; the remaining septage was either disposed of at a municipal wastewater treatment plant or land applied in another county. The significant increase in the amount of septage pumped since 1997 can be attributed to the Board of Health's implementation of a successful pumping tracking and reminder program for the nearly 18,000 residences serviced by septic systems, pumpings

which ultimately help to prevent the costly premature malfunction of septic systems but that also produce a larger volume of septage for disposal.

The Board of Health needed to provide tools to septage haulers to manage the additional septage in a manner that would be economical for the resident and hauler, and be beneficial to the community. Land application meets the needs of the community by providing for economical disposal in rural locations far from treatment plants, and it makes available a nutrient-rich soil building product to landowners.

The eight land application sites are operated and monitored in accordance with the 2004 Board of Health regulation, which requires site compliance with federal regulations governing land application of sewage sludge and septage, following guidance from the Ohio State University Extension (Ohio EPA, 1999, and OSU Extension, 1995). In an effort to assist the site operators in maintaining compliance, the Board of Health partnered with Youngstown State University (YSU) to identify the geographic boundaries of septage application in farm fields. Using a Geographic Information System (GIS) to map isolation distances is an excellent tool for regulators to determine available acreage and calculate loading limits for septage application, but this tool has limited value to the operator



during actual field application. As a result, the Board of Health decided to convert mapped land application boundaries to Global Positioning System (GPS) coordinates and use these coordinates to locate application boundaries in the fields using hand-held GPS locators.

Methods

Aerial photographs outlining the boundaries of the land application areas in Mahoning County and a list of their corresponding GPS coordinates were provided to the Board of Health by the Center for Urban and Regional Studies at YSU using the Mahoning County GIS. These maps depict the proper isolation distances that land appliers must maintain from homes, streams, ponds, wells and property lines (Table 1).

Copies of the maps were then provided by the Board of Health to each site operator to assist them in locating the boundaries of land application on their sites. The sites marked during this project varied in size. The smallest site was 5.9 acres, which was permitted to apply 101,025 gallons per year, and the largest site was 34.8 acres, which can apply up to 834,232 gallons per year, depending on the expected crop rotation (Table 2).

The land application operators were first contacted and informed that the Board of Health would be visiting their sites to field locate the limits of septage land application in conjunction with the routine annual inspection. The site operators were requested to be present during the site visit to discuss the importance of the land application boundaries and the isolation distances. The site visit also allowed for an exchange of ideas for the best management practices to be implemented at each site.

The land application boundaries were field located by the Board of Health and the site operator using the Trimble GEO XT (Trimble Navigation Limited, Sunnyvale, CA) and the GPS coordinates provided by Youngstown State University's Center for Urban and Regional Studies. These coordinates were obtained using ArcView GIS, version 3.3 (ESRI, Redlands, California) to overlay parcel boundaries,

Table 1

Isolation Distances for Land Application of Septage—Mahoning County General Health District.

- Field drainage swales, wet weather and intermittent streams – 33 feet
- Lakes, ponds, rivers, creeks – 500 feet
- Occupied dwellings – 500 feet
- Wells and cisterns – 500 feet
- Property lines, road – 50 feet

Table 2

Eight Sites Approved for Land Application of Septage in Mahoning County

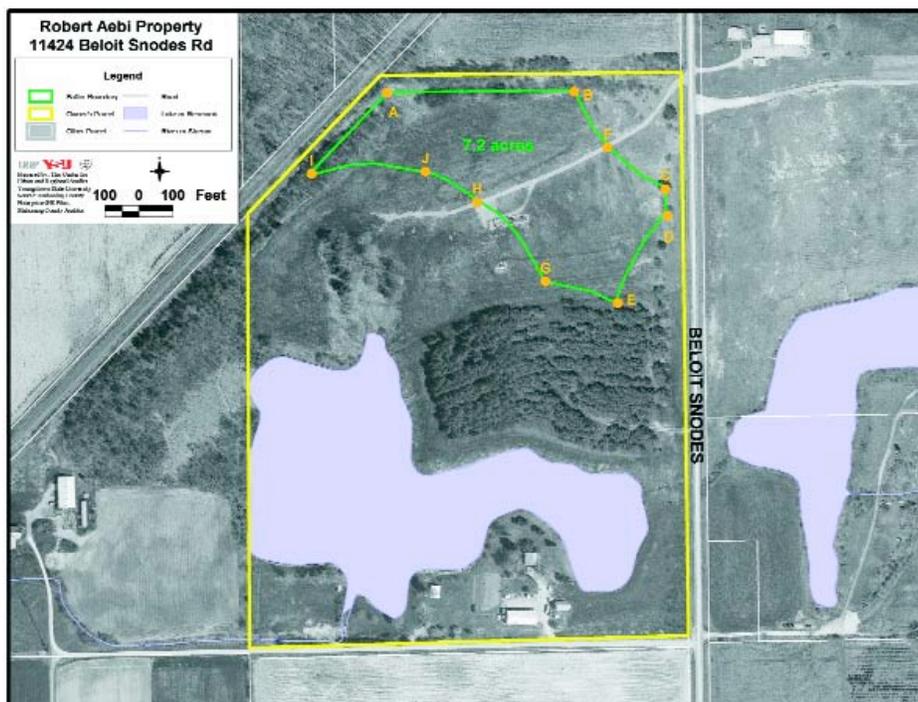
Site	Acres	2004 Crop	Gallons of Septage Allowed
A	16.9	Hay (back)	289,379
B	19.6	Corn/(front)Barley	671,221
C	32.8	Hay	561,634
D	34.8	Corn	834,232
E	6.8	Hay	116,436
F	5.9	Hay	101,025
G	7.2	Hay	123,285
H	21.6	Hay	369,857

roads and water features with digital aerial photographs provided by the Mahoning County GIS. The Board of Health provided isolation distances from occupied dwellings, water, roads, and other sensitive features from its regulation to create maps of areas at each site where application of septage would be suitable.

To assist the Board of Health and the site operator in field locating the boundaries, points were mapped at several locations along the land application boundaries. Since the layers in each map were created using a State Plane projection to overlay the digital aeri- als, the coordinates of each point were converted to decimal degrees and

given a letter for identification purposes. The decimal degree coordinates were then converted to degrees-minutes-seconds, a suitable format for the Trimble GEO XT, and entered into a spreadsheet. The acreage of each suitable location was also calculated using ArcView GIS to determine the allowable amount of septage applied at each site. Fieldwork was subsequently completed by the Board of Health and the site operator. Figure 1 contains an example of one mapped site.

Each boundary point with corresponding GPS coordinates indicated on the map was marked in the field with survey lath and ribbon. Isolation distances due to sensitive areas



Below: Sanitarian Dan Hutton locates a point using GPS.



Figure 1 Land Application Site Map (Youngstown State University) Indicating Limits of Application

such as homes, streams, ponds, and lakes received additional field staking. The marked boundaries clearly defined a visual limit of application to the operator, which assists them during actual septage application. Every field-located point was stored on the hand-held GPS locator for future reference. The stored coordinates make it possible to navigate to marked boundary points very quickly and reestablish a visual limit of application.

During the visits, the regulators and operators can visually identify the application limits of their site and discuss best practices for land application within these limits. Disposing of septage using land application is an economical method, which has many benefits for generating productive soils that are capable of producing various crops. The crops grown on the Mahoning County sites include hay, corn, barley, wheat, and soy beans.

Results

The GIS data generated by YSU and field located by the Board of Health assisted five operators in visually locating the limits of septage application at eight sites. The

marked boundary limits help ensure the proper application of the nearly 900,000 gallons of septage within the boundaries established by the isolation distances. The defined limits of application help regulators address occasional community concerns about the safety of this practice and provide an opportunity to discuss management practices with the operator. The marked limits of application have also provided the operator information necessary to maintain compliance while land applying septage.

Conclusions

We have used this GIS and GPS technology to assist a local company and group of concerned citizens living near a proposed site come to an agreement that the site did not have adequate acreage for economical land application, thereby saving the company from making a significant financial investment in order to acquire the site. GIS and GPS technology can help regulators to calculate accurate septage loading limits for land application sites and provide site operators with visual boundaries to safely and effectively land apply septage without

causing unnecessary environmental hazards that may result in a threat to public health. Site visits by regulators provide an opportunity to discuss many land application issues with operators, including the importance of isolation distances and their corresponding limits of application.

References

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has served as a registered sanitarian/health inspector for the Mahoning County District Board of Health since 2004. He works in the environmental division and performs various sewage-related inspections/evaluations and is part of a five-member sewage staff. He also assisted the Mahoning County District Board of Health with integrating their GPS information into the Mahoning County Geographical Information (GIS) Web site. Prior to his employment at the Mahoning County Board of Health, he was employed as a registered sanitarian at the Columbiana County General Health District, where he also served as the rabies grant coordinator for the county along with performing various environmental inspections. He received his bachelor's in science and technology from Kent State University.



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John D. Bralich is the research associate II/senior GIS analyst at the Center for Urban and Regional Studies at Youngstown State University. He received his bachelor's in geography at YSU and has worked for the center for the past seven years. John, in addition to providing technical assistance to the Mahoning County General Health District and a myriad of other local government entities, has provided GIS analysis for numerous major projects, including the city of Youngstown's 2010 comprehensive plan and a series of watershed action plans. He can be contacted at jdbralich@ysu.edu.



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has served as health commissioner of the Mahoning County General Health District since 1988. As chief executive officer of the Mahoning County District Board of Health, he leads a public health agency with a staff of 65 providing services to the 250,000 residents of the county townships and villages and (through contracts and agreements) to three cities in the county. He received his public health degree from the Johns Hopkins University and is an alumnus of the U.S. Centers for Disease Control and Prevention and Ohio Public Health Leadership Institutes. He is a faculty member in the Division of Community Health Sciences at the Northeastern Ohio Universities College of Medicine and is active in professional and civic associations.