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Closing Abandoned Livestock Lagoons Effectively to Utilize Nutrients and Avoid Environmental Problems

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Closing Abandoned Livestock Lagoons Effectively to Utilize Nutrients and Avoid Environmental Problems

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Purpose

In Nebraska alone, nearly 400 earthen manure storage structures are in operation; approximately four dozen requests to cease operation of permitted lagoons were received by the Nebraska Department of Environmental Quality in the prior decade with many more non-permitted storage structures being in need of proper closure. Abandoned livestock lagoons, earthen manure storage basins, and other manure storages (e.g. concrete pits) need to be decommissioned in a manner that controls potential environmental risk and makes economical use of accumulated nutrients. Currently, limited guidance is available to support lagoon closure planning and implementation and few professionals who support livestock producers have experience planning or participating in the manure storage closure process. The main focus of this project was to produce two videos that document the processes for planning and executing a lagoon closure.

What did we do?

The University of Nebraska Haskell Ag Laboratory, located near Concord, NE, had an anaerobic lagoon that was operated for over 20 years, but has not received swine manure additions since 2009 when the swine unit was depopulated. The decommissioning of this storage structure was proposed in 2014 and provided our team an opportunity to plan, implement and document the procedures necessary to properly close this structure. When we went to find material on how to accomplish this properly, we did not find suitable material. Two grants were secured in 2016 from the U.S. Pork Center of Excellence (USPCE) to fund our team efforts to document the closure process – from planning to completion – with two separate videos. The first video is focused on the planning activities necessary to prepare for removal and utilization of stored liquid and sludge. The second is focused on the liquid and sludge removal and utilization

activities, decommissioning of conveyance structures, and deconstruction of the lagoon berm to return the site to a natural grade.

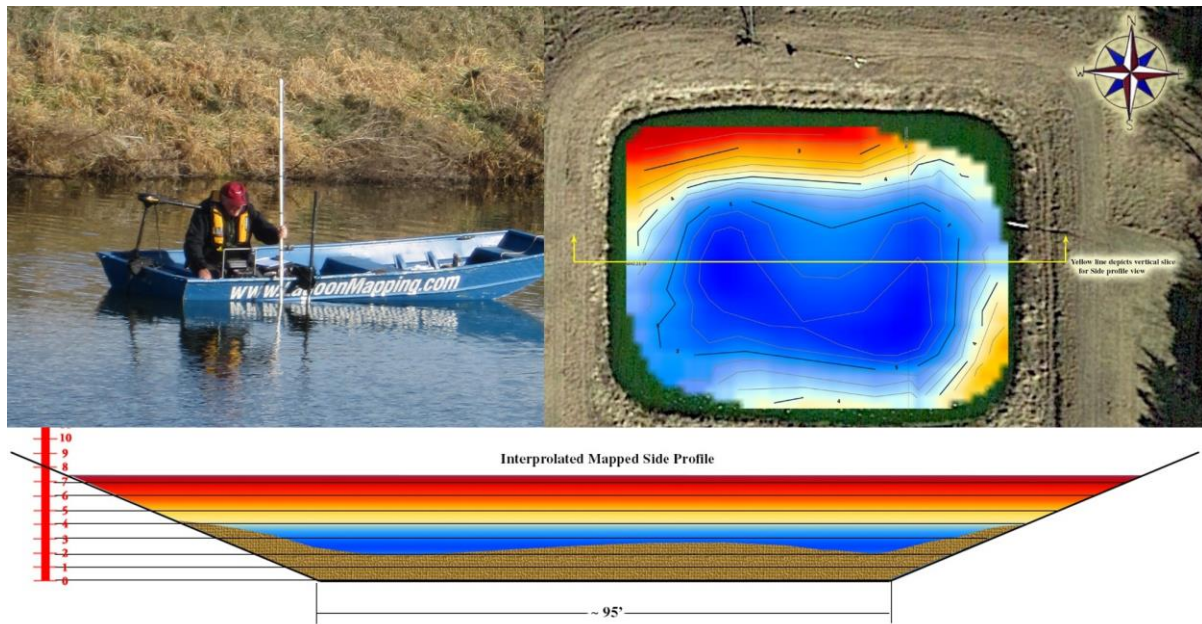


Figure 1. Sonar sludge mapping.

Activities conducted to execute the lagoon closure have included:

- 1) Mapping of sludge levels with sonar and analyzing sludge samples to estimate volume and nutrient content of sludge, which enabled development of a land application plan for utilizing the products
- 2) De-watering the lagoon (effluent used for sprinkler irrigation and flood irrigation)
- 3) Hosting a demonstration event during which participants:
 - a. observed sludge removal and land application processes,
 - b. participated in a manure spreader calibration,
 - c. inspected the soil beneath the lagoon liner,
 - d. viewed the abandoned production buildings and heard about options for eliminating conveyance of liquid from the building to the lagoon,
 - e. explored alternative sludge removal methods, and

f. participated in a classroom session where presenters shared details of the closure planning process, cost-share opportunities for closure of manure storage structures, and expectations for re-grading and re-seeding the site following removal of sludge.



Figure 2. Participants learned about planning land application of the sludge.



Figure 3. Land application of the sludge and calibration of the manure spreader.

4) Removing the sludge and applying it to cropland following the demonstration event.

Documentation of all planning, demonstration, and closure execution activities have been captured via extensive video footage, still photos, and participant interviews. Production of the videos is in process with completion and release of videos anticipated in summer 2017.

What have we learned?

Although every manure storage closure process is expected to present its own unique challenges and opportunities for learning, the process documented during this project has provided a number of insights:

1) While this process involved pumping liquid from the lagoon prior to attempting sludge removal in order to observe the sludge layer and document the volume present, a more appropriate, and likely more effective, process is to agitate the storage prior to and during pumping activities to enable handling all of the material as a slurry;

2) Dewatered sludge volume (nearly 200,000 gallons) and nutrient content (44.2 lbs. TKN, 37.5 lbs. organic N, 89.3 lbs. P₂O₅ and 7.6 lbs. K₂O per 1,000 gallons) for this system yielded enough nutrients to apply to 80-100 acres, based on a phosphorus removal rate. It is unknown what the release of the organic N component of the sludge will be, but using just the phosphorus content, application of 1000 gallons per acre would provide enough phosphorus for what would be removed from 220 bushels of corn, which is worth approximately \$35 with winter 2017 prices.;

3) Given the high phosphorus content in the sludge and that the nearby fields at the Haskell Ag Lab were not in need of phosphorus, an appropriate application rate for the sludge was determined as 8-10 tons/acre;

4) Soil beneath the lagoon liner yielded a phosphorus concentration of 556 ppm, likely a result of an inadequate liner in the lagoon as originally constructed in the 1960s; and

5) Installation of a bentonite clay liner during renovation of the structure in 1992 appeared to be effective as the liner was fully intact when observed during closure activities.

Pre-post surveys completed by 33 attendees of the demonstration event revealed that attendees improved their confidence in performing six key tasks identified by the team as being impactful. Results are summarized in Figure 4.

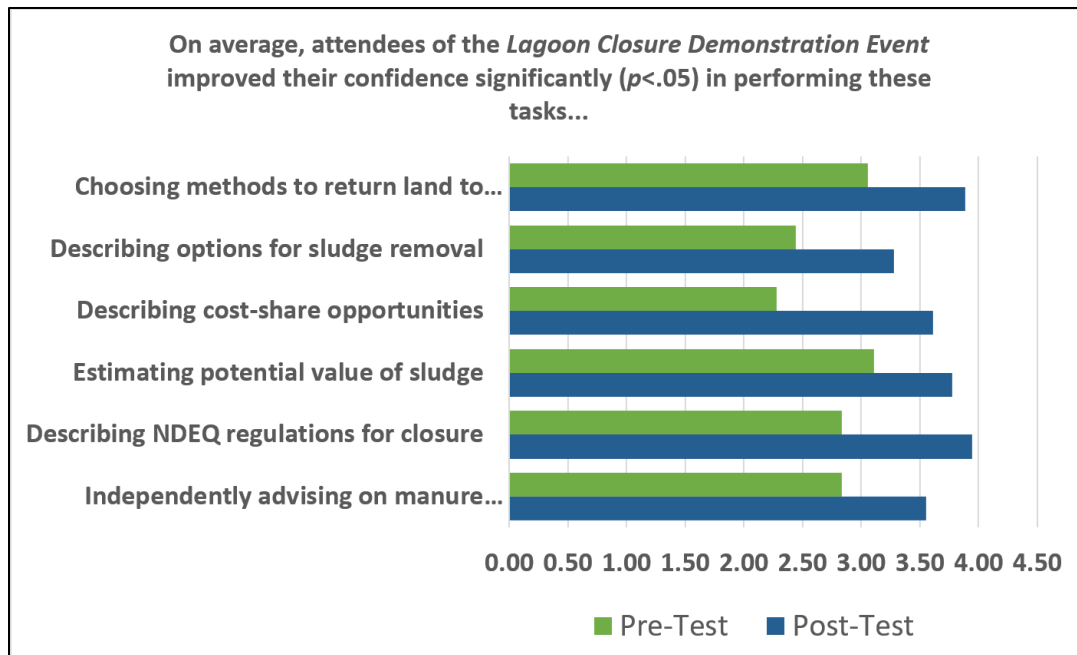


Figure 4. Impacts of the lagoon closure demonstration event.

Future Plans

We plan to continue the decommissioning process by:

- 1) Completing sludge removal and application to cropland;
- 2) Deconstructing the berms, leaving the liner intact, and returning the area to natural grade;
- 3) Seeding the area to establish ground cover and mitigate runoff and erosion; and
- 4) Plugging the inlet pipes in manure pits within the animal housing in lieu of removing buried conveyance pipes.

The two videos are in production and will be made available through the Pork Information Gateway (www.porkgateway.org) during summer 2017.

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Additional information

<https://water.unl.edu/article/animal-manure-management/lagoon-closure-and-your-environmental-responsibility>

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Online at <https://lpec.org/closing-abandoned-livestock-lagoons-effectively-to-utilize-nutrients-and-avoid-environmental-problems/>