By Jeff Lamfers, KRWA Consultant

How to Seal a Leaking Lagoon

Example of a lagoon cell that leaks excessively. Minimum water depths cannot be achieved in order to provide adequate treatment and prevent offensive odors from developing. Another concern can be the potential contamination of groundwater in the area.

Waste stabilization ponds are an excellent sewage treatment option for small communities in Kansas. Not only are they usually cheaper to construct and operate than mechanical plants, they also provide a treatment solution for many, many years. But like all treatment facilities, they have their share of maintenance issues. One problem that shows up occasionally is excessive seepage. Excessive seepage can have several causes including allowing deep-rooted plants such as cattails and trees to develop. Such vegetation can penetrate the pond bottom and compromise the clay or bentonite seal that helps control seepage. This can result in a lagoon cell that barely holds water and is essentially a swamp or marsh. This can then result in several additional problems including poor treatment, offensive odors due to inadequate cover over anaerobic solids on the pond bottom and possible contamination of groundwater.

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Such was the case with the city of Dorrance's two-cell lagoon system when I was contacted in March 2012. The north cell, which has a surface area of 1.25 acres, was not holding water. The purpose of this article is to provide guidance on how to properly seal an existing lagoon cell that leaks excessively.

Before proceeding with sealing any lagoon cell, it is advisable to contact the Kansas Department of Health and Environment (KDHE), either the Topeka office or respective district office, to discuss the need for resealing the cell in question and the procedure that will be followed. KDHE considers resealing an existing lagoon cell a maintenance issue, so retaining a consulting engineer is not required. But it is also a good idea to keep KDHE staff updated on how the system intends to proceed.

The process

The first step is to dry out the cell to be resealed. If the cell is not in service, this should not be necessary. However if the cell is in service, then all flow must be diverted to other lagoon cells so that the cell to be resealed can be isolated and allowed to dry. KDHE most definitely needs to be notified if taking a cell out of service will result in the remaining cells discharging to a receiving stream. This is especially important if the system has a non-discharging permit.

The next step is to remove all foreign debris that may be on the bottom or inner dikes of the cell. This includes any dried sludge left behind and/or dead vegetation. In the case of the city of Dorrance, cleaning also included a considerable amount of wind-blown soil that had accumulated over the years. These materials do not compact very well and will be detrimental when attempting to obtain optimum compaction during resealing. A road grader or maintainer is usually used to remove such material. Dorrance contacted the Russell County highway department for assistance with removing debris from the city's north cell once it had dried. The county provided a grader, front-end loader and two dump trucks to remove more than 70 loads of dried debris. This process required one and a half days to complete; costs to the city were approximately $3,400. While most of the material removed was dried sludge and/or soil, there was also evidence of a considerable amount of vegetation that had

grown in this north cell and was likely contributing to the seepage problem.

Before removing any debris, it should be determined from system records whether or not bentonite was used to seal the cell originally. If so, this material should obviously not be removed. In the case of Dorrance, city records were unclear as to whether or not bentonite was used when the lagoon was constructed in 1964. Consequently during debris removal, city staff were on the alert to see if any bentonite was present, but is was never positively confirmed. Soil testing is another way to determine the clay content of soil on the bottom of a lagoon cell and whether it might contain bentonite. Such soil tests are almost always needed if bentonite is to be used when resealing. Soil test results allow calculating the desired bentonite application rate.

After debris is gathered into piles by grader, a front-end load is used to load materials onto dump trucks. Most of this debris consists of minor amounts of dried sludge, dead vegetation and wind-blown soil. Such material must be removed as it does not compact well.

Disc and compact

The next step is to lightly disc the pond bottom and inner dikes in order to loosen up the soil and provide a more uniform soil mixture to allow for better compaction. Dorrance chose to disc the pond bottom to a depth of approximately eight inches, going both north/south and then east/west to break up soil satisfactorily so that it would compact well later. The city was able carry out this work with their own equipment and labor.

The next step is to compact soil on the pond bottom and inner dikes. It is recommended that a smooth-type roller be used as opposed to a sheepsfoot roller. If bentonite is present, the feet on a sheepsfoot roller will not keep the bentonite seal at a uniform depth. Some of the bentonite will be pushed too deep, while some will remain at the original depth. The city of Dorrance was able to rent a smooth roller from a contractor at a cost of $2,300 which included delivery from Salina. The rental was for two days.

Water must usually be added to achieve optimum compaction. When Dorrance staff began to compact soils in the north cell, they added some water but learned very quickly that merely wetting the surface was not nearly enough. It should also be noted that the city conducted this work in late June when the temperature sometimes exceeded 110 degrees. At first, the water only made soil stick to the roller. Eventually city staff figured out that applying a lot of water and then allowing it to be absorbed by the loose soil worked best. While the soil had to be worked repeatedly in order to achieve a moist, clay-like consistency, the city was finally able to compact the bottom into a hard surface. In total, the city hauled more than 20,000 gallons of water to help with compacting soils in the north

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Completed north lagoon cell at Dorrance once resealed and raw flow again diverted to cell. This cell is now approaching a 3-foot water depth and holding tight. Also note the green color (algae) that developed quickly once wastewater was reintroduced to the cell.

cell. This was accomplished using a 3,400-gallon water truck rented from the Russell County highway department.

The city installed a new influent pipe and staff gauge for monitoring water depths before raw flow was again diverted to the north cell. It was soon evident that the newly sealed cell was holding water. Within a couple of weeks, this cell already had more than a foot of water and was holding tight. Again, all this work was completed during high temperatures and high evaporation rates. It is most important that a minimum water depth of 2.5 to 3.0 feet be achieved rather quickly to prevent unwanted weed growth from developing on the pond bottom. Soil sterilants can also be applied before filling the cell to prevent weed growth. While Dorrance did not conduct a seepage test, systems might also consider running such tests after resealing, taking into account the rate of evaporation, rainfall and the incoming flow of sewage.

During my last visit to the Dorrance lagoon in late August 2012, the average water depth in the north cell was approaching three feet. Algae were also present in the wastewater as evidenced by the green color throughout the cell. The project appears to be a success and hopefully will provide the city with sufficient lagoon capacity for many years. At least now the city has a lagoon cell that should eventually reach the desired five feet of water depth and provide treatment as intended.

If anyone representing a wastewater system ever has a similar problem with excessive seepage, please contact KRWA Wastewater Tech Charlie Schwindamann or me for assistance. We would be pleased to provide whatever assistance we can.

Jeff Lamfers began work for KRWA in November 2008. Jeff has more than thirty years of regulatory experience in the oversight and operation of water and wastewater systems with the Kansas Department of Health and Environment. He is a graduate of the University of Kansas with a degree in Environmental Studies with an emphasis in aquatic biology.