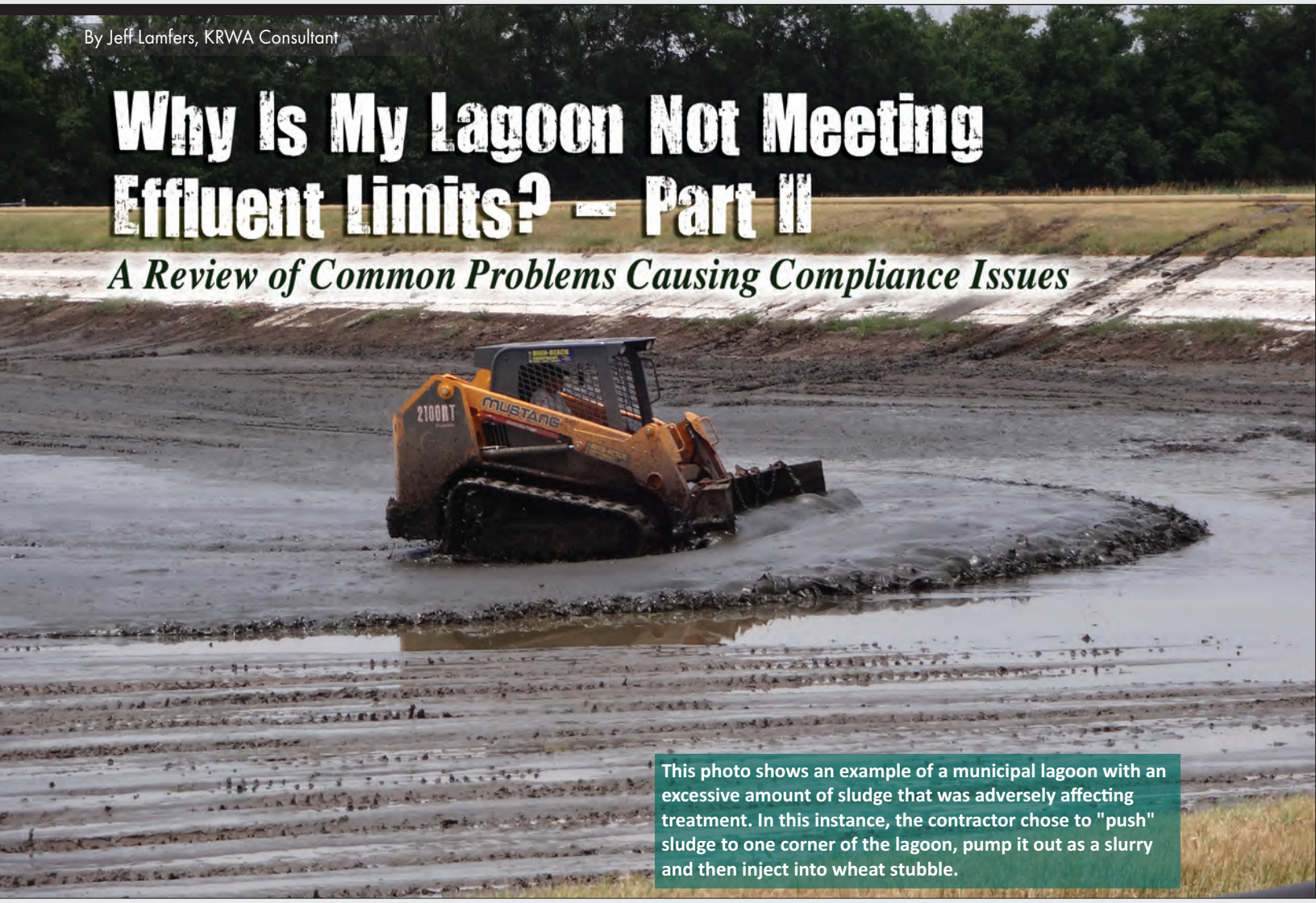
By Jeff Lamfers, KRWA Consultant

# Why Is My Lagoon Not Meeting Effluent Limits? – Part II

## *A Review of Common Problems Causing Compliance Issues*




This photo shows an example of a municipal lagoon with an excessive amount of sludge that was adversely affecting treatment. In this instance, the contractor chose to "push" sludge to one corner of the lagoon, pump it out as a slurry and then inject into wheat stubble.

This article (Part II) is a continuation of my article in the November 2016 issue of *The Kansas Lifeline*. Part I dealt with a variety of issues than can cause compliance problems in lagoons. These included problems with misdirected flow patterns, short-circuiting, insufficient detention time caused by excessive infiltration and inflow (I&I) and organic overloading caused by high-strength discharges from commercial and industrial customers. In this article, I will review a few more common problems found in lagoons across Kansas that are not meeting effluent limits.

### Excessive sludge accumulation

An excessive amount of sludge in a lagoon can present a problem as it can reduce detention time. For example, if your primary cell has a total water depth of 5.0 feet and there are 2.0 feet of sludge on the bottom of the cell, then the cell has lost about 40 percent of its original capacity. But that is not entirely true as all lagoon cells have some sludge on the bottom; it just depends how much. While most cells that have problems with excessive sludge have usually been in service for many years, it's not always a problem just because a lagoon cell has been in service for 30 or even 35 years. Many lagoons in Kansas that have been in operation since the 1970's do not currently have a problem with excessive sludge and may never require sludge removal. In theory, sludge on the bottom of lagoons undergoes anaerobic decomposition which helps turn some of the sludge into liquids and gases that are released, thereby maintaining a constant sludge depth.

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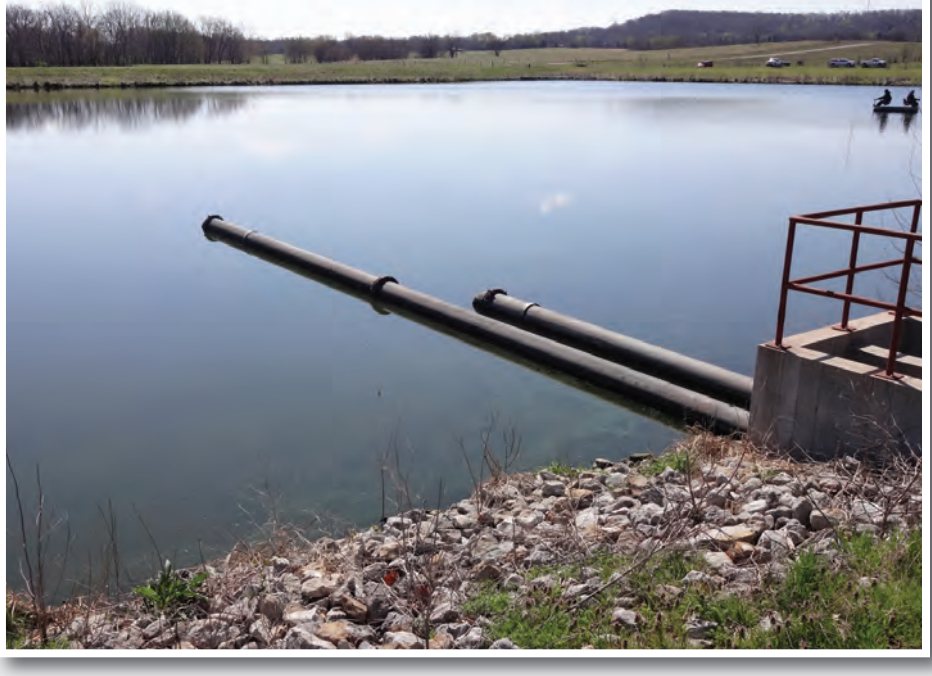
Also of importance is the consistency of the sludge. When checking sludge depths in lagoons, KRWA Wastewater Tech Charlie Schwindamann records what he refers to as "heavy sludge". He will also note any lighter sludge that makes up the blanket on the bottom of a cell. He is able to distinguish between the two by using a sludge judge and years of experience

checking sludge depths. When he uses the term "heavy sludge" he is referring to that part of the sludge blanket that is made up of inorganic material such as grit, sand, etc. that does not decompose. Once such material enters a lagoon, it will never break down and will remain until removed. However any lighter sludge that is present is sludge that is composed of organic material in the sewage that will decompose. So, if a given cell has an excessive amount of "heavy sludge", it most likely is reducing detention time and the only option is to remove it if the lagoon is experiencing compliance problems. It should be noted also that the organic component of any sludge blanket likely varies in depth during the year. With colder water temperatures during the winter months, the sludge blanket may actually increase slightly. But with the return of warmer water temperatures during summer, that same blanket depth should decrease slightly. If your lagoon is having problems consistently meeting limits and you feel excessive sludge is a problem, please feel free to contact me to discuss the issue. KRWA is available to check sludge depths at no charge, and provide recommendations.



**The discharge structure on the final cell of this lagoon was designed to draw effluent from two different depths in order to avoid algae near the surface. Typically the lower pipe is used during the summer and the upper one during the winter.**

## High effluent Total Suspended Solids (TSS) due to algae

Increases in Total Suspended Solids (TSS) is a frequent problem with many lagoons in Kansas, especially during the summer. The main cause is excessive algae in the effluent. Without the presence of algae in lagoons, adequate treatment would not be possible. It is the algae that produce oxygen used by the facultative bacteria to break down incoming sewage. But during the summer with longer days and lots of sunlight and warm water temperatures, algae growth in lagoons can become excessive. When also factoring in the presence of nutrients like nitrogen and phosphorous, the environment is perfect for lots of algae growth.

Once way to avoid excessive algae in the effluent of a lagoon is to draw the effluent from below the water's surface of the last cell. Since algae require sunlight to grow and reproduce, they are typically found near the water's surface. Algae are less concentrated at 18 to 24 inches below the water surface. That is why many newer lagoons are built with discharge structures that allow for drawing effluent from various depths. Final cells are also often designed to be deeper cells to allow more flexibility of where the effluent is drawn. A typical final cell today is often designed and built to be 10 to 12 feet deep and have three draw-off pipes, drawing effluent from various depths. The upper pipe may be two feet below the water surface, the middle one four feet below surface and the lower draw-off at six feet below surface. This setup allows the operator to draw samples from each of the draw-off pipes to see which one produces

an effluent that is visually less green with algae and of better quality. Typically, the middle or lower pipes are used during the summer and the middle or upper pipes used during winter months. Should your system want to modify your discharge structure as previously described, KDHE requires retaining a Kansas-licensed engineer to submit plans.

## Proper effluent sample collection procedures

Finally, KRWA staff occasionally find that effluent samples may indicate compliance problems, but are not due to poor effluent quality. Instead, the way in which effluent samples are collected may contribute to samples exceeding limits and samples that are not truly representative of the lagoon effluent. The two most common situations are when lagoons may stop discharging during dry summer months. The other is when the lagoon continues to discharge during dry months, but at such low flows it makes collecting a representative effluent sample very difficult. The following are typical scenarios that often occur during dry summer months:

**This V-notch has been cut into the top of the metal weir plate to allow for easier and more representative effluent sample collection. Note the biological growth, etc. on the plate that may have ended up in the sample prior to cutting the V-notch.**

- The lagoon is permitted as a discharging lagoon and quarterly monitoring is required. However due to hot dry weather, the lagoon does not discharge during the third quarter (July – September). Is sampling required in this situation? No! The system must still submit a Discharge Monitoring Report for the third quarter, but simply print "No Discharge This Quarter" on the form. In this situation, never collect samples off the surface of the final cell or from behind the stop plate in the discharge box. First, such samples are not required as the lagoon is not discharging. Second, they likely will be of poor quality (high in BOD and/or TSS) and KDHE staff will assume the lagoon was discharging and out of compliance.
- The lagoon is barely discharging at a very low flow over the top of the weir in the discharge box. However the flow is so low, collecting an effluent sample becomes very, very difficult. The likelihood of scraping solids, algae growth, etc. off the weir and into the sample bottle is high. What should an operator do in such a situation? KRWA recommends that a shallow V-notch be cut into the top of the wood or metal weir plate, allowing flow at a single point with enough force that it now flows out, away from the plate. This should make collecting a representative samples free of scraped solids, etc. much easier. The V-notch itself does not have to be that large, approximately 1-inch deep by two to three inches wide. (See the photo above.)

It is critical that care be taken when collecting effluent samples to make sure they are not "contaminated" during the collection process with foreign matter found within the discharge box itself. Since major decisions are made with regard to compliance, such samples must truly represent the quality of wastewater being discharged.

Hopefully the compliance problems discussed in these two articles will help systems determine a cause for any problems they may be experiencing and apply effective solutions to correct the situation. If I can be of further assistance, please feel free to contact me at either jeff@krwa.net or 913-850-8822.

## Conference sessions

I also want to take this opportunity to invite readers to the 2017 Annual Conference & Exhibition, March 28 - 30 at Century II Convention Center in Wichita. The program is reprinted in this issue and is also online at www.krwa.net/training/conference. There are many sessions designed for wastewater utilities and there are scores of exhibits that would be of interest.

*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.*