## Saturated Buffer Situations

## Season 1, Episode 4

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**John McMaine:** Thanks for joining us on streamlines, your source for water knowledge. I’m your host John McMaine with South Dakota State University Extension. This is episode 4.

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**John McMaine:** Well, hello everyone again. This is John McMaine

**Anthony Bly:** And Anthony Bly.

**John McMaine:** And today’s topic, Anthony, is saturated buffers.

**Anthony Bly:** Well, that sounds like a good one, John.

**John McMaine:** It is a good one. It’s one of my favorite conservation practices. Although I would say probably that they’re all my favorite conservation practices. But saturated buffers I feel like do have a lot of advantages over other conservation practices.

**Anthony Bly:** Sure.

**John McMaine:** And we’re going to get into those today. But let’s start out kind of just getting people thinking about saturated buffers. What do you think about when you think about a saturated buffer?

**Anthony Bly:** Well, I think of it as a water quality management tool for drain tile.

**John McMaine:** And that is exactly what it is! And I think of them a lot of times kind of in conjunction with bioreactors because they use a lot of the same mechanisms as a bioreactor. So, you have denitrification in a bioreactor, you have denitrification in saturated buffers, but one major difference is you are not bringing in new material for saturated buffer, you’re using what is already there. Which is a really nice benefit, doesn’t cost as much, doesn’t require as much input.

**Anthony Bly:** And vegetation as well.

**John McMaine:** And vegetation as well. That is an excellent point, Anthony.

**Anthony Bly:** Right.

**John McMaine:** And you have more utilization of the space for the saturated buffer than you maybe would with a bioreactor. And you get some nutrient reduction because of that vegetation. So, to tell our story about saturated buffers today, we got in touch with my good friend Dr. Jeppe Kjaersgaard. He is with the Minnesota Department of Agriculture. We will let him introduce himself.

**Jeppe Kjaersgaard:** My name is Jeppe Kjaersgaard. I work as a research scientist with the Minnesota Department of Agriculture.

**John McMaine:** Jeppe has worked on saturated buffers for probably close to 10 years now. Some of you may or may not know that he was in South Dakota before he was in Minnesota. And actually, put in some of the first research saturated buffers in South Dakota. And so, his background goes back quiet a way, but he also has some pretty exciting current projects he is working on.

**Jeppe Kjaersgaard:** A primary one is a research demonstration project; we have near Breckenridge in Northwest Central Minnesota. It is about 30 miles Northeast of Rosholt in Roberts County, South Dakota. And at this location, we installed a set a saturated buffer back in 2016 and we have been monitoring it ever since. And we are finding that that buffer removes about 90% of the nitrate of the drainage water that we are routing through it. Now we do have a bypass installed on it to route excess water around the saturated buffer when there’s more water coming through the tiles than what the capacity of the buffer to handle is. And so, if we factor that water in, we are removing over 75% of the total amount of nitrate that is coming on.

**John McMaine:** So, treatment efficiency of 90%. Total load reduction of 75%.

**Anthony Bly:** That’s pretty impressive!

**John McMaine:** That’s pretty impressive, yeah. And especially for a system that again, is completely working on the natural conditions of what’s there. It is not like they had to spike the system with any, you know, special micros or anything like that. They’re putting tile in the ground at a certain orientation forcing water a certain way and it is doing its thing which is nice. So, there’s been a fair amount of research on saturated buffers and the research so far shows that it’s a kind of viable and cost-effective practice. But that was another question asked Jeppe was ‘what is kind of the motivation for farmers to put in a saturated buffer?’

**Jeppe Kjaersgaard:** So, if a landowner has concerns about the nitrate losses from a field, a saturated buffer is certainly a very viable option. We also often see in situations where a downstream landowner has concerns about their tile installation and in some cases that concern relates to nitrate that is coming off in the drainage water. And so, in those situations, a saturated buffer could be a very good option also. And it comes back to, you know, environmental stewardship as well. That you certainly want to have a profitable agricultural production and at the same time there are concerns about the negative environmental impacts. And we are starting to see that in some states, and even at the federal level, discussions about potential regulation. Now there’s still active research taking place, among other things, that characterize well what a sum of under which conditions might saturated be most effective. But I think the research we have seen so far is that it is a very viable practice and very cost-effective practice. And we are starting to see installations among individual landowners that are doing it either on their own account or with cost share either with the NRCS or a local soil conservation district.

**John McMaine:** So, as a farmer, and as someone who works with farmers a lot, Anthony, I guess maybe put yourself in a farmer’s shoes. How would you view a saturated buffer from that perspective?

**Anthony Bly:** I think if you got the right situation to put on it, I think it would be very compelling to do that. A lot of the outlets I know, prior to that outlet, there may be some low ground or some area that we could set up, set up the buffer in.

**John McMaine:** Yeah. And that is kind of an ideal situation. Because one thing we haven’t gotten into yet, but saturated buffers, the way they work, on your main. You put in a control structure and run laterals parallel to the stream or ditch from that control structure, so the water is able to run through the buffer, rather than out letting directly into the stream or ditch.

**Anthony Bly:** Right.

**John McMaine:** And so, because you have that control structure, if you don’t have kind of a drop as you get closer to the stream, you could potentially back water up into the field and lose your drainage advantage. But if you have that drop, then you don’t have to worry about that. You aren’t backing water up into the field at all, you’re instead backing it up into the buffer pretty much exclusively and then it is able to work as that saturated buffer so.

**Anthony Bly:** It is just an artificial wetland. In a way.

**John McMaine:** In some ways, it is, yeah. It is kind of a subsurface flow artificial wetland. You don’t have saturated conditions at the top which you have a lower layer that is saturated and so, exactly, you get the microbial communities you would see in a subsurface flow artificial wetland. Even can get some similar vegetation and microbial interaction kind of the biogeochemical reaction. Which is the one that drives the nitrate reduction in that situation. So, like I mentioned at the top of the episode, in my opinion, saturated buffers have a fair number of advantages over some other conservation drainage practices. I mentioned this to Jeppe, and he thought the same thing too. And so, I’ll let him give his take on what some of those advantages are.

**Jeppe Kjaersgaard:** Different conservation practices have different circumstances where they may work or there may be other situations where they do not work. And it typically depends on both the specific location or the landform or land available or preferences of the landowner, as well as cost. Some of the advantages that saturated buffers have is they are very effective in removing nitrate and they utilize an existing buffer. So, they are utilizing land that is typically acts as a buffer strip along a stream. So, in many cases, you do not need to take additional land out of production to install a buffer. And another advantage is it can be combined with other conservation practices. For example, control drainage. In which case, you are not only removing nitrate from the drainage water, but you are also adding addition agronomic benefits. It is also fairly inexpensive to install and has low maintenance. One of the ones I am currently working with costs about $2,000 to install, and about half of that was cost shared by our local water conservation district. So, compared to other practices, it is a relatively inexpensive practice to install. It is also simple to install. You are using a regular tile plow and tile pipe. You do need a control structure, but everything else you are using is really something that is a part of your regular tile install. And then, another advantage is also that the buffer itself can be utilized for other activities such as a person could hay it or graze it if they wish. We have seen on the one we have; we have seen an increase on biomass just because there is more water available throughout the growing season. Also, the separated buffer we have our collaborator landowner has installed a pollinator habitat on part of it. So, there is kind of additional benefits that way.

**John McMaine:** So, they’re a good practice. They got a lot going for them.

**Anthony Bly:** Yeah. Effective.

**John McMaine:** Yup.

**Anthony Bly:** Relatively cheap.

**John McMaine:** Yup. There’s some co-benefits potentially. I mean, you know, vegetation, you can use that land, pollinator habitat as we heard. So, a lot of the reasons someone wouldn’t install a conservation drainage practice could be cost, could be maintenance, could be loss of the use of the land. Really all of those are taken care of in a saturated buffer. I mean there are still some costs, but it’s relatively minimal if you are looking, you know, $100,000 drainage installation project. $2,000-$3,000 is a very low percentage. I mean, that’s error basically.

**Anthony Bly:** Right. Just a little bit.

**John McMaine:** Yeah, and then as far as utilizing the land, especially if it’s kind of an acting buffer area. I mean, it is already out of use. Or, if it is being hayed or something like that, you can actually continue to use that land. I mean if it is a buffer, that can be used for habitat or pollinators or whatever the case would be.

**Anthony Bly:** Yeah, exactly.

**John McMaine:** It checks a lot of the boxes in my opinion of why we could put a conservation drainage practice in. It removes some of the barriers, I guess.

**Anthony Bly:** Yeah.

**John McMaine:** So, having said all that, saturated buffers are not perfect everywhere. As much as I love saturated buffers, you can’t put them in everywhere. There are situations better suited than others, and Jeppe talked some about that as far as ideal widths, situations where it wouldn’t be good to install a saturated buffer, and I’ll just let him discuss that.

**Jeppe Kjaersgaard:** So, there are certain criteria that has to be met to identify a location for where a saturated buffer will work. Now, typically it should be along, or located along a stream or waterway or drainage ditch or similar, that typically has some kind of certain width of buffer along it already. That buffer should be at a minimum of 30 feet wide. If it is 50 feet that is even better, that is kind of the typical width to have an efficient removal of nitrate. But it also requires to have… there should be stable banks along that waterway, because if they are too steep or if they are unstable, there could be issues with the bank sluffing when it becomes saturated; it could make the soil become less stable. On the other hand, the saturated buffer should be located at a place that’s lower in elevation than the rest of the field. If it is at the same elevation or higher, it might back up water or embrace the water table in the field, and that could cause some crop damage. There may also be concerns about the vegetation where the buffer is. If there is grass or other herb-type of vegetation, it may be fine. But if we start getting more into a woody, perennial vegetation, especially a species that seeks out saturated conditions such as weeping willow, cotton woods, and similar, we may see problems with root intrusion with the distribution line. Therefore, preferably the distribution line should be located a distance away from perennial, woody vegetation. Finally, the soil itself will need to be able to support this denitrification process, and so that means that it will need to have a certain amount of inorganic matter in it. Typically, we say about 1.2% organic, or more is preferable and by far, most conditions we do have that amount of organic matter in our soils, both in Minnesota and in South Dakota. So, that’s usually not a problem, especially if it is a natural water way and there is a riparian area along the stream of the water way there’s typically a build up of organic matter.

**John McMaine:** As Jeppe mentioned, not everywhere is ideal for saturated buffer, right? If it’s too high of slope or it’s too low of slope compared to the field, you don’t have enough organic matter, and sighting saturated buffers is one of the things… maybe one of the limitations, right?

**Anthony Bly:** Yeah

**John McMaine:** That maybe somebody will want to look at a system and they want to put in a saturated buffer, but they don’t know if it’s a good place for it or not. So, Iowa actually has a saturated buffer siting tool

**Anthony Bly:** Wow, that would be really handy.

**John McMaine:** It’s really a nice setup. It brings in different elevation data and things like that, and basically gives a color code of ‘is this full speed ahead?’ Green light, caution, or don’t put in a saturated buffer here.

**Anthony Bly:** We could use one of those in South Dakota.

**John McMaine:** We should do that! I think there’s a grant opportunity there.

**Anthony Bly:** Yeah definitely.

**John McMaine:** Then, again because they’re inexpensive and because they’re pretty high performing, wherever you have a place to put it, it makes sense to put it in.

**Anthony Bly:** It should be a common practice.

**John McMaine:** Absolutely

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**John McMaine:** So, we’ve covered a lot with saturated buffers today, again, they’re one of my favorite practices but they’re not perfect for everywhere. We brought up some of the challenges, but we’ll dig more into these in our next episode. This will be it for episode 1 and stay tuned for the next episode of saturated buffers.

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**John McMaine:** Thanks for joining us today on streamlines. We sure had a lot of fun, hope you did too. If you want to learn more about anything you heard today, head on over to the SDSU extension website, but for not I’m John McMaine…

**Anthony Bly:** … I’m Anthony Bly…

**John McMaine:** …and we’ll catch you next time.