## Conservation Drainage Complexities Part 1

## Season 1, Episode 1

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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 1.

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**John McMaine:** Well, hey everyone again, I’m John McMaine.

**Anthony Bly:** Yeah, hello my name is Anthony Bly.

**John McMaine:** Well Anthony this is our first full official episode of the first series of streamlines.

**Anthony Bly:** Wow that’s exciting John!

**John McMaine:** I’m excited! You know this is something I’ve actually been working on for about the last year.

**Anthony Bly:** Takes a long time, don’t it?

**John McMaine:** Apparently it does.

[Anthony laughs]

**John McMaine:** I thought it would be out sooner than this but hey, we’re getting this off the ground, getting out of the gate, and I’m excited to just start flowing downhill. So, we’re kicking off this season with a discussion of our theme. Our theme for this season is of course conservation drainage and when you think about conservation drainage, what comes to your mind Anthony?

**Anthony Bly:** You know I think about drainage as getting rid of excess water and conservation is the opposite of that. So, retaining some of that maybe for later usage or, you know, maybe in some regards, conservation is related to putting it back the way you found it. Cleaning the water up in a sense, I think we got to talk about that now. It’s kind of perceived as a negative thing in ag[riculture] groups, but I really think we got to talk about it.

**John McMaine:** I agree, and it’s interesting. So, we had a conservation drainage workshop back in 2018 and one of the comments from someone, they wanted to attend because they didn’t know how you could have conservation and drainage in the same sentence. So, I think there’s a perception, I mean drainage is a very divisive issue I feel like, and so, there’s a perception that you can’t have both, you can’t improve water quality, and you can’t have drainage, but I think you really can and so, I’m excited to really get into the tools we can use and how we can manage water, but also improve water quality and all the benefits that come with drainage. To start with, we need to talk about tile drainage in general. What’s good? What’s bad? What do we think about when we think about tile drainage? You know, I’m kind of privileged in my position as the extension state specialist for water management in South Dakota, that I get to work with many of the experts and leaders in this field from across the regions, across the country, and we’re going to hear from a lot of them during this season, different research and outreach, and demonstration projects we’re working on, but for this discussion, to kind of kick this off, we interviewed Dr. Chris Hay and I’ll let him introduce himself.

**Chris Hay:** I’m Chris Hay, I’m a research scientist with the Iowa soybean association.

**John McMaine:** “Dr Hay, Chris has a very long career looking at many aspects of water management. He was in South Dakota for 7 or 8 years and really did a lot of work in South Dakota to get practices in the ground and really raise the level of awareness about tile drainage in general and then about conservation drainage. And so, the place I started with him was just asking him what are the pros and cons of tile drainage? So, Chris goes into some detail here about the 2 main benefits specific to tile drainage.”

**Chris Hay:** 2 Main benefits of drainage are; getting rid of excess water out of the root zone, one that creates better trafficable conditions and so you get more, good work days where you can get in the field a little earlier, you can get things planted, you’re not hung up by two wet of conditions, you’re not compacting the soil because the soil is too wet when you’re trying to get in and have to mud in a crop. So that’s one of the big benefits, now the other one then is getting that excess water out of there, your crops need to get both air and water out of the soil so if they can’t get enough oxygen out of the soil, unless it’s rice, they can’t take it from the air and so they need a good, aerated root zone as well. So that benefits good root growth, good early crop development, so that crop gets off to a better start, you’ll have a more robust crop as you head later into the season.

**John McMaine:** So, we get an earlier start, we get a better start, and we get, kind of, more consistent root growth.

**Anthony Bly:** God I hate that mudding in the crop part.

[“yeah” simultaneously]

**Anthony Bly:** If we can get rid of that part, that’s really beneficial.

**John McMaine:** That term really stuck out to me. And that has a lot of implications for your soil quality.

**Anthony Bly:** Absolutely! I mean porosity and you know soil compaction is negative, and yeah, it just really sets up a good situation.

**John McMaine:** And so, since I’ve been in SD, there’s a very distinct split between people that are always very much for tile drainage, or very much against tile drainage.

**Anthony Bly:** I’ve witnessed that.

**John McMaine:** So, tile does have you know significant benefits agronomically, can reduce erosion, particulate phosphorous loss, but like you mentioned earlier Anthony, I think it is important that we acknowledge and discuss the potential negative impacts because then we can do something about those.

**Anthony Bly:** Exactly

**John McMaine:** So here Chris talks about some of the potential cons of tile drainage.

Probably the biggest negative is the water quality issue. So as you move in that excess water and taking it out of the root zone, you’re also carrying with it nutrients that leach down below the root zone and they get carried out through the drains and so, the biggest one typically is, concern, is nitrate nitrogen, it’s easily dissolved in water and wants to move where the water goes and so it goes out with that drainage water and so nitrate loss from drainage is the big concern. There are other areas where dissolved phosphorous is also a concern coming through the drains. Phosphorous in a dissolved state can move again with that drainage water and that dissolved phosphorous is really highly bioavailable and so a little bit of dissolved phosphorous can be a big water quality concern.

**John McMaine:** So yeah, there are potential water quality impacts, downstream related to tile drainage, nitrate, orthophosphate, it’s one that we don’t think about as much.

**Anthony Bly:** Not as much, I know.

**John McMaine:** But it can be an issue especially like Chris mentions in the great lakes’ basin, Lake Erie.

**Anthony Bly:** Yes

**John McMaine:** And so, let’s just walk through, we have tile drainage, we have a lot of benefits related to tile drainage for agronomic perspectives and soil quality and workability and a whole range of things, but then there’s these potential water quality issues and so, enter conservation drainage and conservation drainage, then, is a way that we can address some of these potential issues related to water quality. Chris also expert in conservation drainage

**Chris Hay:** I guess my definition of Conservation Drainage is a set of practices that are designed to maintain the production benefits of drainage so, namely the timely field operations and then the healthy aerated root zone for the crop production. But then at the same time, address some of the environmental concerns of drainage, primarily water quality concerns

**John McMaine:** And there’s many different types of conservation drainage practices, I think one thing that people don’t always think about is that it’s not just edge of field practices, I mean we also have a thing about nutrient management in the field.

**Anthony Bly:** Absolutely

**John McMaine:** And that’s where people with your background and expertise really come in and help this equation.

**Anthony Bly:** Soil Testing, nutrient levels, yield goals are a big deal.

**John McMaine:** Yep, and so making sure what we put on matches what we get out so we’re not losing stuff downstream. And then there is this edge of field piece as well, so again let’s just check in with Chris and he’ll kind of go through the different conservation drainage practices that can help us address these water quality issues.

**Chris Hay:** Using that definition of Conservation Drainage, you know there’s a number of practices that meet that definition of maintaining production benefits but also addresses the water quality concerns and so that can include in-field practices like the 4 R’s of nutrient management, cover crops, extended rotations that either reduce the water leaving through the drains or tie in nutrients before they get to the drains, converting areas of row crop production to perennial production, and so again, that ties up nutrients before they get to the drains and also reduces some of the water leaving through the drains. And then probably what most folks think of when they think of conservation drainage would be the edge of field practices, some of the downfield practices that either manage the drainage water or actually treat the drainage water. So that includes things like controlled drainage, where we manage how much water leaves, and when the water leaves the drainage system. So that when hopefully we get both a production benefit as well as a downstream water quality benefit and then practices like denitrifying woodchip bioreactors, saturated buffers, wetlands, that treat the water and then the drainage water recycling kind of a newer idea for conservation drainage where we actually capture and store that drainage water and then reuse it for irrigation then looking downstream we can also look at two stage ditches where we have some vegetation in the ditch and that second stage we can slowly get some treatment of that water before it makes it out to the river or stream systems.

**Anthony Bly:** Certainly, sounds like a lot of options their John.

**John McMaine:** There are a lot of options, and the neat thing is they don’t all only have one benefit.

**Anthony Bly:** Right

**John McMaine:** Some like you know a bioreactor, it specifically targets for nitrate reduction and so you’re not going to get any yield benefits, or you know improve soil health from a bioreactor but, a lot of these, I mean it makes sense economically as well, that you’re reducing your input cost, you’re improving your soil quality, so you’re getting multiple benefits.

**Anthony Bly:** Right, there’s a lot of good tools there.

**John McMaine:** A lot of good tools

**Anthony Bly:** And they probably need to fit into the situation too.

**John McMaine:** I think that’s a big thing, and I think we’ll get into that somewhat, that not every practice is perfect, there’s no silver bullet.

**Anthony Bly:** Right

**John McMaine:** But a lot of times people see a limitation or a flaw in a solution as a reason to not.

**Anthony Bly:** Discredit it

**John McMaine:** Discredit it, to not put that practice in, but we need to change the paradigm, change our mindset to seeing that flaw as the starting point for innovation.

**Anthony Bly:** Absolutely

**John McMaine:** So, we look at a practice, it has a limitation. Let’s not stop there, let’s use that as a starting point to figure out how to make it work for our situation.

**Anthony Bly:** Yeah, there’s all tools, all good tools, technology is moving forward.

**John McMaine:** It is. Research for the win.

**Anthony Bly:** That’s right!

**John McMaine:** Do you have any conservation drainage practices, in field or edge of field that you’ve personally worked on?

**Anthony Bly:** No, not that I’ve worked on, but I’ve visited several of them. They’re all very intriguing. I’m a soil scientist at my roots and physics, soil physics, so water is a big part of that. I guess that’s my interest.

**John McMaine:** So, I haven’t worked as extensively as Chris on a lot of these practices but it’s interesting because every practice that I pitch to, you know, a farmer or a contractor, there is always that hesitation. I think some of it is just unfamiliarity with the practice but then I think we really get into the social science side of what’s prompting people to change what’s holding them back, things like that, what are the drivers and barriers for people to implement these practices? And obviously it changes based on personality and a lot of different factors.

**Anthony Bly:** There’s a lot of you know, every farm is different and owning the land, and renting the land can be a factor, and land tenureship, and you know all of those things are interactions that come into play, so it’s good to just have a good toolbox full of tools and we have to be able to just give people the ability to pick the right one out.

**John McMaine:** Yeah, not prescribing things, but empowering people to figuring out what works best for them and then helping them make it work.

**Anthony Bly:** Absolutely! I mean these things aren’t going away, obviously you’ve seen all the trucks full of tile drain going up and down the interstate. It’s all about educating and understanding.

**John McMaine:** And I don’t think water quality issues will go away either, and so yeah, we don’t want to get to the point where it is a regulation situation where practices are prescribed so it’s important to get out ahead of these things as we’re doing more tiling or looking at tiling, we look at it in different way than we address. Not just agronomic benefits, but potential water quality concerns, improve water quantity, management of having enough in the summer, that type of thing.

**Anthony Bly:** Yeah, some sense I think there’s a race to get things done sometimes to get ahead of any perceived regulations that might come, but I think we can have it all, [laughs] you know? That’s what everybody wants in the end, so just knowing the tools and where to apply them I think is much more important.

**John McMaine:** So, it’s a good time for this podcast?

**Anthony Bly:** Oh, it’s a great time, awesome timing John.

[Laughs]

**John McMaine:** Yes! So, I pulled in another expert in the field, Dr. Jeppe Kjaersgaard.

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

**John McMaine:** And he has another really good perspective of why conservation drainage is useful and important, so I’ll let him share that here.

**Jeppe Kjaersgaard:** So, some of the conservation drainage practices have a crop yield benefit or agronomic benefits. Some of them might even have a positive impact that way, but they are primarily installed to reduce negative environmental impacts. They should be installed both out of environmental stewardship perspective, to show that agriculture, we’re doing our part in help minimizing nutrient losses from crop production and that might also help stave off potential regulation down the line and we are seeing some increasingly vocal voices talking about the challenges that comes with nutrient losses from agriculture. I think it’s very important for us working in the agricultural community to get out in front of that. And also, that many of these conservation drainage practices, there may be a cost share available, either from the NRCS or locally through soil conservation districts or other organizations that might be available or that might have cost share available to help foot some of the bill for what the cost might be.

**John McMaine:** So being proactive, I mean I think it’s important to think about that.

**Anthony Bly:** Oh yeah, absolutely

**John McMaine:** And there’s a lot of things we can do, there’s a lot of things that agriculture is doing, that we’re doing to manage water responsibly, effectively, considerate of what happens downstream. But I like how you said it Anthony, we can have it all.

**Anthony Bly:** Yeah, Absolutely

**John McMaine:** Just thinking about the tools and applying the tools, where do they need to go.

**Anthony Bly:** Well, if people want to continue to eat, we’ve got to be able to use our technology to increase productivity and expand usefulness of some of these soils. But at the same time, we have to take into account ecosystems and environments and things like that as well.

**John McMaine:** I mean tile drainage gives us the ability to not take other lands, or to not have to put other lands into production.

**Anthony Bly:** Correct

**John McMaine:** And so, I think that’s a consideration that we miss a lot of times. You know most of these areas are already farmed?

**Anthony Bly:** Yep, they are and that’s not going to go away.

**John McMaine:** So, it’s improving the yield and profitability of areas that are already farmed working lands, and I think that is an important consideration.

**Anthony Bly:** Yeah, I mean, it’s just a good win situation all around

**John McMaine:** Yeah

**Anthony Bly:** If we incorporate some of the conservation drainage practices, which I’m excited to hear about

**John McMaine:** So, let’s jump into some of the limitations or barriers and drivers of conservation drainage, I asked Jeppe about this and this is what he had to say.

**Jeppe Kjaersgaard:** We’ll start with some of the drivers, I think there is a lot of focus on conservation drainage practices. And also, we have seen that several states including Minnesota, but also Iowa, Wisconsin, Illinois, and other states. At the state level, have developed nutrient loss reduction strategies. And so that means at the state level, there are efforts under way to reduce nutrient losses from crop production, from non-point sources. But what we are seeing from research is that the most effective practices for removing nitrate are these conservation drainage practices. So therefor, there is a very strong interest in these practices because they are so effective. Some of the challenges are that unfortunately, while they do remove nitrogen from the tile water, it is being converted into, for most of the practices, for example saturated buffers and bioreactors, it’s been converted into nitrogen gas. So, it’s being taken out of the water and being released harmlessly into the atmosphere, but it does represent a loss for the farm that has to go out and buy nitrogen to replace what was lost. So, a challenge is to find ways to capture that nitrogen, and then bring it back onto the field. Now for a saturated buffer you could harvest the grass or hay it or something, and bring it back to the field, in that way you would bring some of the nitrogen phosphorous back up to the field. But again, most of it is lost to dinitrogen gas, to the atmosphere. So, I think while the practices we have now that they are well established, well documented that they work. I think the frontier we are beginning is to find ways to actually capture that nitrogen. So, we can reuse it. And that’s where practices such as, either control drainage, or drainage water recycling comes in, while you are capturing the water, and then you are bringing it back onto the field both, so you have the benefit of extra water if you are short of water later in the growing season, but also any nitrate that’s in the water is being brought back up to the field.

**John McMaine:** And I think that’s important to promote and maybe do more research on, and demonstrate, is these aren’t necessary one-trick-ponies.

**Anthony Bly:** No

**John McMaine:** And we can get additional, you know, multi-benefit from these practices.

**Anthony Bly:**  It’s a complicated system.

**John McMaine:** It is a complicated system, so yeah, I think it’s good, not just to talk about the systems, but why they work. Because then that helps the farmer have an understanding of where it works better or not.

**Anthony Bly:** Correct

**John McMaine:** And so that enables them to think about where to put these systems in and how they fit in their operation.

**Anthony Bly:** Yup, I think that’s important; education and awareness is big.

**John McMaine:** I definitely do not want to be the person that goes out and tells someone to put something in and not have a clue about how it fits in their operation.

**Anthony Bly:** Right

**John McMaine:** That doesn’t help anybody.

**Anthony Bly:** No, that’s just wrong. One size does not fit all.

**John McMaine:** I think that’s a good stopping place. So that will wrap up episode 1 of the conservation drainage season.

[music]

**John McMaine:** Conservation drainage, we have a lot to cover in this season, and I’m really excited to get into each practice. Today we kind of covered what conservation is, introduced some of the different practices of conservation drainage, discussed some of the challenges and benefits with implementing these practices, and then, kind of, what we need to think about regarding tile drainage in general. Next week you’ll be able to catch part 2, where we discuss other barriers keeping folks from implementing conservation drainage practices, how we can look to overcome these barriers, and what the future of conservation drainage looks like.

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**John McMaine:** Thanks for joining us today on streamlines, we sure had a lot of fun today, 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 now, I’m John McMaine.

**Anthony Bly:** I’m Anthony Bly

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