Review of Conservation Drainage Practices and Designs:
Results from Focus Groups with Drainage Professionals around Minnesota

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A critical point in time

Agricultural drainage systems in Minnesota developed over the past 100 years. As these aging systems are updated or replaced, there is a window of opportunity to incorporate new designs and practices that improve the balance between water quality and agricultural productivity. To effectively take advantage of this opportunity, we wanted to learn from the people who are responsible for implementing drainage infrastructure.

What is conservation drainage?

A set of drainage practices and designs intended to support the needs of agricultural production while addressing impacts on water quality and flow. It is the **act of preventing or mitigating** the unwanted effects of artificial drainage.

What we did

Focus groups: In January and February 2010, we ran structured in-depth discussions with small homogeneous groups to understand how people think about conservation drainage. We asked questions that helped us explore the potential for various practices and designs, and understand the barriers to their implementation.

Locations:

Crookston – Mainly surface drainage; tile is new and a growing interest. Flooding is primary concern. Drainage authority is mostly watershed districts.

Mankato – Rolling and flat landscapes. Most areas have subsurface systems, though many are intensifying. Drainage authority is mostly counties.

Montevideo – Similar to the Mankato area. Some experience with road impoundments.

Participants: People most actively involved in designing, installing, and regulating drainage.

Engineers and agency employees – Technical assistance providers, especially private drainage engineers, and DNR and BWSR hydrologists. Other agricultural drainage technical specialists were included from PCA, MDA, USFWS, an NGO, and NRCS.

Contractors and farmers – The "front line" people who actually install and use farm-scale drainage technology, including tiling contractors, farmers, agronomic consultants, Certified Crop Advisors, and farm managers.

Drainage authorities – The watershed district managers and administrators and county commissioners and engineers who are responsible for permitting and maintaining drainage systems and thus help regulate, influence, manage, and plan county- and watershed-scale drainage systems.

What participants said

People are key.
Communication is critical.
Building positive relationships is essential.

"If you want these projects to happen, staff cuts at the local offices are the worst thing you can do. (Drainage authority)

"It's the one-on-one approach. It's not the meeting, or the flyer. . . . For a farmer, they want to talk about a project over a cup of coffee, with the understanding that he may not do anything for two, three years." (Drainage authority)

"If we can show that certain techniques are appropriate for certain areas, we can make that decision much better than any authority can make it for us." (Farmer/contractor)

"If there are two families with a long-standing feud, 90% chance it has to do with somebody dumping water on somebody else. " (Farmer/contractor)

"All it takes is one person standing in the way to prevent a project, you can put hours and hours into a project, it's often not the dollar amounts, but personal beliefs or family ideas that pose problems in moving projects forward." (Drainage authority)

Regarding redetermination: *"Once things have been done successfully, they're going to catch on. . . ." "But it takes a commissioner with guts to do it."* (Drainage authority)

"Given the funding climate, the economic climate we live in, we can't settle for a one-win solution. We can't settle for just flood control; we can't settle for just water quality; we

can't settle for just wildlife. We need to figure out solutions that provide wins for all the parties involved. And that's going to require communication not just among agencies and farmers." (Drainage authority)

"We all know we have issues. Problem is, we have to figure out how to work together to fix some of these issues. I'm really glad that this discussion is starting." (Drainage authority)

"We fight the perception of the public who has never seen a combine before." (Farmer/contractor)

Responsibility and fairness are important

"Farmers aren't expected to produce food just because they have the land and give it to us out of the goodness of their heart. . . . They could produce more water quality, more wildlife, but I don't think they buy into the notion that they're obligated to do that because they own land." (Engineer/agency)

Several emphasized the importance of maintaining objectivity and applying rules fairly – between landowners, across counties, and between landowners and agencies.

Impacts of agricultural drainage are complex

Drainage increases peak flow – except tile compared to surface drainage

"Surface drainage would increase the peak flows, but subsurface is actually a longer drainage period. . . compared to surface." (Engineer/agency)

Drainage increases total volume of flow – maybe

"Drainage increases annual water yield. Consistently, you get more water out of whatever outlet you're looking at wherever you have a drained landscape." (Engineer/agency)

"If the field level of water is this high and its flooding in Fargo, our tiling lines ain't doing nothing for that. Water in tile lines aren't even flowing." (Farmer/contractor)

"We have more volume coming out of the whole system than we used to. . . . At some scales, rate control might help, but on a bigger scale, volume may the biggest driver of problems". (Engineer/agency)

Regarding flow changes from controlled drainage: *"I don't know about total flows so much as the peaks, the concentration. It'll meter it out slower; it will save more so it's available when we need it."* (Engineer/agency)

"If we can take land that we're growing 120-150 bushels/acre and grow corn up to 200-250 [by tile draining it], we're using a lot more water. In the long-run you're going to have less water coming off land." (Farmer/contractor)

We need to talk about what were the conditions before the rainfall occurred. Later in summer, I agree that a drained field will act like a sponge and generate less runoff. But it's early in the year, before the crops are up, when soils are wetter that we're seeing the problem." (Engineer/agency)

Will conservation drainage practices make enough of a difference?

"Are we really conserving enough nutrients that it's going to make a big difference in the end, if this is something to appease people who say agriculture is the cause of the hypoxic zone, for example? Is it going to make enough of a difference to put that cost into it?" (Farmer/contractor)

Watershed scale planning

The impacts of drainage practices accumulate at the watershed scale – especially water storage practices such as ponds or culvert sizing. Yet, watershed-scale planning of drainage activities is difficult and spotty around the state. (Examples of watershed scale planning would be reviewing culvert sizing or water storage options across the whole watershed, or establishing a county or district-wide schedule for redetermination of benefits so landowners feel that ditches are being managed fairly and with appropriate priorities.)

"The broader issue of drainage is certainly being addressed in those [water] plans but often at a high level. We know we have to store water, we know it's a problem, but it's hard to get at the specifics that lay out a CD 57-type project. Those seem so complex to put together – beyond what a typical government entity planning process can do." (Drainage authority)

"Those were beautiful ditches on the lower reaches. Thirty-some years ago they channelized the upper end of it; and I've got hundreds of pictures of the lower end of it is paying for it." (Drainage authority)

Regarding culvert sizing: "You have to design on a system basis, not on every one individually." "Yes, start at the top of a watershed and work your way down." (Engineers/agencies)

Institutional concerns

Many participants from all three regions felt the three-to-five years required for the wetland mitigation process was a substantial barrier.

"If the process was easy, people would do it. It's not a money issue. Farmers are wasting money on FWs [farmed wetlands] every year, so that would pay back fast." (Farmer/contractor)

Conservation drainage practices

Every group resisted when pushed to prioritize the various approaches to conservation drainage. Each water management effort is a site-specific endeavor with site-specific priorities. Promoting a single practice across the state at the expense of other practices will limit the number of areas that can be improved.

Appropriate sizing of field systems

"Appropriate sizing of drainage systems is based on economics. You put in as big of a main as you can justify, but I don't know anyone who went way overboard on a main – just because it's so expensive. You don't see people overdoing it on the mains, do you?" [Another participant:] "*No, usually they're two sizes too small."* (Contractors)

"Tile is not a science, everything is trial and error." (Contractor)

"With a two year payback on 60 ft spacing, you can bet I'm going to start doing 30 foot spacing. Appropriate sizing is as much as you can show will economically work; I truly believe we are improving the environment with these systems." (Contractor)

Controlled drainage

"It's a waffle plan underground, that's what it is." (Engineer)

"You start looking at the cost factor, the topography, and the amount of micromanaging you're going to have to do, in addition to the initial costs – then you weigh out the benefits of increased yield, potentially. Are we really conserving enough nutrients? Is it going to make enough of a difference to put that cost into it? I wouldn't think so." (Contractor)

Participants in all regions felt that the greatest potential was in the Red River Basin. In other regions, much of the land is either too steep, pocked with potholes, or already tiled. Some participants, especially in Crookston, were quite concerned about leaving the water table high over the winter and eliminating the soil storage that could reduce spring floods. The other concern with winter storage (in all regions) was the potential for frost to break tile lines.

Bioreactors

Bioreactors were appealing to some people because they are a quick fix to treat nitrate and they can be attached to any existing tile system without taking land out of production. Several people questioned whether they were practical and effective enough to justify the cost. Most people wanted to see more demonstrations.

Side inlets

"I chose side inlets as the number one practice, because there's at least some opportunity in all drainage systems for these." (Engineer)

One of the groups observed that some counties perceive inlets as improvements, while the law treats them as repairs.

"Public drainage system allows the system to pay for erosion control structures, but it's a question of whether or not the landowners believe they're really needed." (Engineer/agency)

Ditch buffers

"If redetermining benefits, two points are no brainers: buffers and side inlets." (Drainage authority)

"To some of the public and legislators, buffers are seen as a panacea. That's such a simplistic view of things." (Engineer)

A few people mentioned the public relations value of buffers – the public can see the grasses and the wildlife.

Water storage

Most participants were not familiar with the full range of water storage options. Some of the features of water storage that needed clarification were:

- ***Goal:*** Wildlife habitat, flood mitigation, or water quality.
- ***Time scale:*** Permanent water storage in a wetland versus medium-term storage during a wet period versus short-term (e.g. 24 hour) storage after a storm.
- ***Spatial scale:*** Dispersed storage in the soil profile versus field-edge storage in small depressions versus moderate-sized impoundments versus massive impoundments over hundreds of acres.
- ***Mechanism:*** E.g., tile systems to create storage in the soil profile, down-sizing of culverts to temporarily hold water behind roads, down-sizing of inlets to temporarily hold water behind a ditch berm, breaking tiles to restore wetlands. A few people included agronomic and other practices that increase infiltration or evapotransporation.
- ***Land use while storing water:*** E.g., land could be: permanent water storage, wetland habitat, in-ditch storage, farmable after temporary early-spring flooding, farmable except after a large storm, or farmable with crops that can tolerate brief inundation.

"A tiled field will yield you as much storage as anything. More, because you have more acres [to store water in, compared to a pond]." (Farmer/contractors)

"That's one of the things I'm hoping you can help convince people: that it won't harm you in terms of productivity [to have water backed up for 24 hours] and it will help with water quality." (Engineer/agency)

"Broadly distributed storage, which culvert sizing does, is the key. An inch of storage runoff is about what you can store behind road grades in the Red River Valley. . . . that's about the storage you could provide if you implemented culvert sizing over the whole basin - about 1 inch of runoff - which is huge." (Engineers/agencies)

The permanency of easements and potentially huge costs were significant barriers.

"It sounds like a no-lose situation, to get compensated when you lose a crop. But people are not willing to admit defeat." (Farmer/contractor)

"After farmers have seen it work in a few places, some farmers would volunteer to have it done. The demonstration of it is important." (Drainage authority)

Two-stage ditches

Many participants had little awareness of the design and goals of a two-stage ditch and were not familiar with research or demonstration results. However, most groups were interested in discussing them, especially those in Crookston. Cost was intimidating.

"I'm not sure it's better to pass [sediment] downstream so we don't have to clean it out close to the source. I want to see a debate on whether that's appropriate." (Engineer/agency)

Dispersed practices

"If this waffle thing were implemented in the Red River Valley, we wouldn't be talking about building a billion dollar ditch around Fargo-Morehead." (Drainage authority)

If we have a one percent gain of water quality on 100 acres, is that more of a net gain than when we have a 20% gain in water quality once it hits the open ditch? Which is a better bang for the buck? Sometimes things that we do on the landscape – whether its conservation tillage or whatever – a small gain over a big acreage might have a net effect that's much bigger than a bigger percentage gain once we hit the main channels." (Farmer/contractor)

Several people in both engineer and contractor groups saw appropriate sizing of field systems as a more practical way to achieve dispersed water storage compared to controlled drainage or setting aside land dedicated to holding water.

Agronomic practices and drainage

"We're sending the river much cleaner water than is sent there with the overland flooding that occurs without drainage. It allows us to farm properly, without as much moldboard plowing." (Farmer/contractor)

All of the farmer/contractor groups (and one of the engineer/agency groups) observed that agronomic practices were not on our list of conservation practices, yet should be a high priority – especially nutrient management.

Guidelines for Action

Support long-term relationships and the individuals who are skilled at building and maintaining productive relationships. "Win-win" options are available, but they can only be implemented with the help of people who can build the necessary trust and collaborations.

Be part of the conversation. Make goals explicit (ag production, water quality, flood/flow mitigation, habitat). Help build shared understanding of the complexity of hydrology and drainage. Be precise in defining terms and be explicit about assumptions when discussing impacts of drainage. Communication is needed both within and between stakeholder groups, including the non-farming public.

Clarify the roles and responsibilities of the various state and local agencies to reduce perceptions of inequities, inconsistencies, or inefficiencies.

Discuss who (landowner or society) is responsible *for costs of managing or mitigating upstream contributions to drainage systems.*

Examine options for water storage on the landscape.

Promote watershed-scale views for planning and managing drainage.

Continue research and demonstrations, especially full-scale demonstrations and analyses of costs and benefits. Before landowners will adopt a new design, they need to see how it works and that it is effective for meeting production goals and environmental goals. Use demonstrations to communicate with both farm and non-farm audiences.

Address regional differences. The Red River Basin is particularly distinctive, but other regions also have unique physical and institutional features that impact water management.

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