Revisiting Controlled Drainage: Is it Really New?

by Orr Construction, Inc. | www.OrrConstructionInc.com

WHY ALL OF THE INTEREST TODAY?

Had Mr. Van Winkle fell asleep in January of 2012 and woke up just after the season's harvest, he would have surely thought a new technology had been introduced.

Controlled drainage, however, has been in use and actively researched for at least a quarter of a century. So what transformed 30 acres of low-laying Luray and Fitchville soils in Eastern Wayne County into an overnight sensation?

We believe there are three main reasons. First and foremost is the 2012 drought, possibly the worst in over 50 years. In fact, "the Great Drought" damaged – and in many cases – decimated crop production on otherwise productive farmland throughout the Midwest. Despite these dry conditions, Louie Rehm recorded average soybean yields of 118 bushels per acre on land improved with controlled drainage structures. In contrast, Rehm's nearby tiled field netted an average of 80 bushels. According to Frankenberger etal. (2007), as published by Purdue Extension, increased yields of 5% are most plausible.

Secondly, Nitrate runoff and the adverse effect on water quality is a recognized environmental concern. Clearly, any process that reduces water flow during periods of greatest soil nitrate concentration is a win for farmers and the environment. Controlled drainage structures do just that.

Thirdly, the persistent sluggishness of the economy coupled with high energy prices have brought about a resurgence of thriftiness in farmers. Why buy a new pickup when one can simply tune up the old Ford in the shed? Or to paraphrase Louie Rehm, "It makes more sense to invest in drainage that makes me money than it does in fancy equipment." Definite words of wisdom.

HOW DOES CONTROLLED DRAINAGE WORK?

Water managed by controlled drainage is much like the old fashioned square hay bales. Farmers harvested and baled hay during the summer and fed the bales throughout the winter when pastures were dormant. Just as hay is stored in the barn, water is stored in subsurface drainage tile and the soil itself. While that's a simplified analogy, it accurately illustrates water flow via controlled drainage.

In new construction, control structures are installed in the tile main near the outlet. Often structures are added at 1' to 2' of elevation targeting consistent water table levels. Existing drainage systems can also be retrofitted with the control structures, though a system designed for controlled drainage tends to be more effective. The structures include multiple 6" blocks that stack (within vertical guides) from top to bottom within the structure. To raise the water table and withhold drainage, slide one or more blocks into

the guides until the desired height is reached. To lower the water table, simply remove one or more blocks.

A "blowout" of the structure is prevented because any water exceeding the table simply overflows the top block (within the structure) and continues through the drainage system.

In early spring and in preparation of planting, blocks can be removed to allow water to freely flow through the drainage system, thereby ensuring fields are adequately drained and ready to handle farm equipment. Once crops are in, blocks can be added back to the structure to (1) help store water for drier months and (2) reduce the flow of nitrates from the soil. Though higher subsurface water levels may increase the possibility of losing such nitrates to surface runoff, most fields with controlled drainage structures feature slopes of .2% or less (see below). After harvest, blocks can remain in place to maintain the water table as to prevent drainage and nitrate flow into nearby waterways during the fallow season. Nitrate outflow is also reduced by virtue of deeper seepage into surrounding soil while the higher water table is maintained.

WHERE DOES CONTROLLED DRAINAGE WORK?

With its diverse topography, Wayne County, Ohio offers limited areas that can benefit from controlled drainage. As mentioned above, the ideally suited farmland features slopes of .2% or less. And most often, these fields, or "bottom ground" as often called, are found near river bottoms or glacial plains.

To be technical, the Rehm farm included "Fitchville Silt Loam" (FcB) that tends to be nearly level and demonstrates somewhat poor natural drainage. The majority of the acreage, though, consisted of "Luray Silty Clay Loam" (Ly), also nearly level and very poorly drained. Other soil types with similar characteristics are also suitable for these structures. Western and southwestern Ohio and other Midwestern states offer prime farmland that could benefit from controlled drainage. Likewise, similar research has been conducted in southern states including those in the Lower Mississippi River Valley.

WHAT DOES INSTALLATION OF CONTROLLED DRAINAGE COST?

While a rough estimate of cost per (control) structure is $700, it does not include installation or the tiling. Overall costs vary from project to project and an actual estimate cannot be made until the farmland is surveyed using GPS-based technology and an optimal system is fully designed.

In general, the more level a field, the fewer control structures are required. And the fewer the control structures, the lower the cost. Conversely, the steeper the slope, the more costly the system. In fact, slope acts as a natural barrier to the feasibility of controlled drainage. Just as costs increase with the slope of the land, the functionality of such a system declines proportionately to the slope.

CAN EVERYONE EXPECT LOUIE REHM'S RESULTS?

Rehm's 30 acre tract was somewhat unusual in that it was tiled every 20' (rather than the standard 30' intervals). Additionally, some of the lines were tied directly into natural springs on the property, which helped supply moisture to the beans during the growing season. In fact, soil testing at the peak of the drought found moist soil conditions at a depth of 14".

Because every field is different, these results obviously cannot be promised across the board. However, we can safely say – as supported by Purdue Extension – that some increase in yield should be anticipated.

WHAT ARE OTHER CONSIDERATIONS OF CONTROLLED DRAINAGE?

According to Frankenberger etal. (2007) as published by Purdue Extension, there are additional considerations applicable to a controlled drainage system.

- Despite the reduction in nitrate outflow via water flow, application of nitrogen fertilizer will still be necessary because of nitrogen seepage into surrounding soils (i.e., "denitrification").
- Application of manure during springtime, or while the controlled drainage structure is set to allow maximum flow, is cautioned as to prevent nitrate and waste outflow.
- Neighboring farmland, upstream of the drainage main, may be adversely affected. Accordingly, managing a shared outlet is not advised unless the upstream farmland is 2 to 4 feet higher than the managed outlet.
- Studies are largely inconclusive regarding the impact of controlled drainage on earthworms. However, it is recognized that earthworms do not like excessively wet soil. As a result, controlled drainage may impact earthworm populations within the controlled area.

WHAT'S NEXT FOR CONTROLLED DRAINAGE?

Cost sharing through the Natural Resources Conservation Service (NRCS) has been available, though it is unclear how many funds have been disbursed. More farmers are likely to seek cost sharing in coming years.

Additionally, Larry Orr of Orr Construction, Inc. recently became certified as a Technical Service Provider (TSP) through NRSC. With this designation, Larry will be authorized on behalf of NRSC to design, install, and inspect controlled draining structures.

To get started in this area, contact Larry or Brian Orr at Orr Construction, Inc. for an initial consultation.

ADDITIONAL INFORMATION

For additional information, farmers may visit www.admcoalition.com or directly access these NRCS practice standards:

Drainage Water Management
ftp://ftp-fc.sc.egov.usda.gov/NHQ/practice-standards/standards/554.pdf

Structure for Water Control
ftp://ftp-fc.sc.egov.usda.gov/NHQ/practice-standards/standards/587.pdf

Subsurface Drainage
ftp://ftp-fc.sc.egov.usda.gov/NHQ/practice-standards/standards/606.pdf

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Frankenberger, Jane; Kladivko, Eileen; Sands, Gary; Jaynes, Dan; Fausey, Norm; Helmers, Matt; Cooke, Richard; Strock, Jeff; Nelson, Kelly; and Brown, Larry. December, 2007. *Questions and Answers About Drainage Water Management for the Midwest.* Purdue Extension Publication WQ-44.