NORTHWEST CROPS & SOILS PROGRAM

TILE DRAINAGE IN VERMONT: EDGE OF FIELD TILE MANAGEMENT

Factsheet No. 7

Introduction

Proper drainage design and field based best management practices will minimize nutrients that reach the tile. End of tile treatment can be used to help further minimize potential for nutrients to reach surface water.

End of tile nutrient management falls into two general categories: drainage water management and nutrient treatment practices.

Controlled Drainage Management

The amount of water flowing through the tiles can be controlled with water level control structures. *Water level control structures,* like stoplogs or weirs, keep the water table elevation at a desired level throughout the year (Figure 1). Raising the gates during the non-growing season, typically between November and April 1st, to about 15 cm below the surface, can slow water and thus, nutrient release. Controlled drainage also allows for adaptive management of water flow. For example, raised gates can conserve water during drought conditions and lowered gates early in the spring can reduce excess moisture during the busy planting season. Controlled drainage structures typically accommodate flow from 20 acres, depending on slope. With a cost of $500-$1,000 per 20 acres and a lifespan of 40 years, it may be a worthwhile investment.

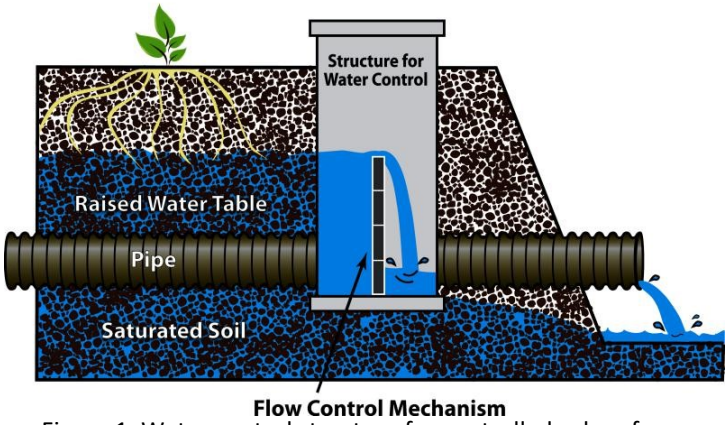

Figure 1. Water control structure for controlled subsurface drainage. (Illustration courtesy of Purdue University and USDA NRCS)

Controlled drainage can present many challenges. First, controlled drainage requires a slope of <1% to function properly and therefore is not suitable for all field sites. Second, if maintenance is a concern, remote control is possible, but costly. Controlled drainage requires maintenance and monitoring to ensure that the retained water is at the desired level. For example, the surface level of the water should be managed so that the water does not get high enough to pose a risk as surface run-off or be too high as to inhibit cover crop root growth.

Nutrient Removal Structures

End of tile nutrient removal structures are systems that absorb or otherwise filter nutrients before the tile discharge reaches surface water. In-field management, including proper manure application should be the first line of defense to keep nutrients from water flow. End of tile treatments can further assist in keeping nutrients from reaching surface waters. End of tile nutrient removal structures include end of tile filter treatments, edge of field treatments, and ditch design.

End of Tile Nutrient Treatments use an intermediary to capture nutrients. Filters can be installed at the end of pipes to remove nutrients from the flow of water. Additionally, absorptive materials can be inserted into the tiles to retain nutrients. For example, lining ditches with gypsum has also had some success in retaining nutrients. Biofilters are also installed before the outflow to treat incoming flow. Nutrient removal systems that focus specifically on phosphorus removal is a new technology being tested in Vermont. These systems use a tank or excavated trench to capture tile water and filter it through media. Refer to a consultant or engineer for a design and media that can work for your site. These methods generally have a limited lifespan and need to be maintained and replaced when no longer functioning properly.

Edge of Field Treatments capture nutrients before they reach surface water. One edge of field treatment is saturated buffer which uses a box to divert outflow from the ditch to a buffer. Constructed wetlands, bioreactors, and phosphorus removal beds are examples of other edge of field treatments (Figure 2). They provide a filter for the water before it reaches surface water. Saturated buffers, constructed wetlands, and bioreactors are less effective in the cold and will eventually become saturated, slowly losing effectiveness overtime. Reservoirs or retention ponds store drainage discharge and nutrients which reduces water and nutrients into surface water. This adds another nutrient storage facility to manage. Edge of field practices often occupy more land than other practices.

Figure 2. Installation of a phosphorus removal bed. (Photo courtesy of Blanchard River Demonstration Farms Network)

Ditch Design can impact the flow of nutrients and sediment settling time. Narrow channels in a trapezoidal design are common to move water from the edge of the field. Two-stage ditches have a deep narrow channel to move water during periods of low flow and wide vegetated benches to move water during high flow (Figure 3). The vegetation reduces velocity of the water allowing sediment to settle.

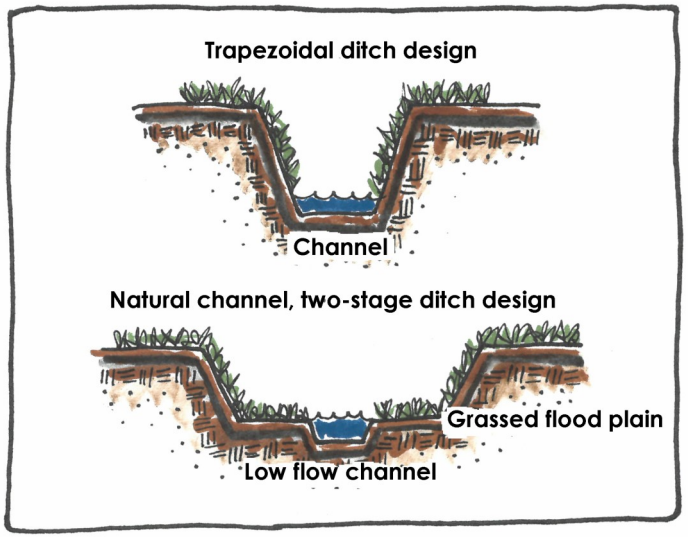

Figure 3. Trapezoidal ditch design and two-stage ditch design. (Illustration courtesy of Amanda Gervais)

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