Tile Drainage in Vermont: The Basics

Factsheet No. 1

Introduction

The Required Agricultural Practices (RAPs) define tile drainage as a conduit installed in cropland beneath the ground surface to collect and/or convey water to an outlet. Installing tile drainage on fields has the potential to pay for itself with more reliable and increased crop yield and improved quality. However, there are several factors to keep in mind that impact drainage efficiency or return on investment. Refer to the back of this sheet for a list of economic calculators.

Tile Drainage Components

Modern subsurface tile drainage consists of a specially designed framework of perforated plastic pipes. Lateral lines connect to mainlines, which connect to the tile outlet (Figure 1).

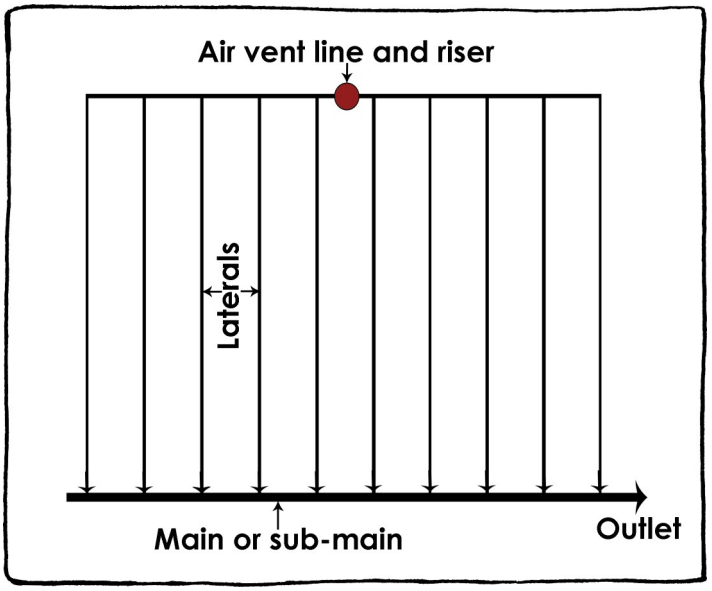

Figure 1. Overhead view of tile drainage system including vent. (Illustration courtesy of Amanda Gervais)

Tile Drainage Design

There are four basic tile drainage designs: parallel, herringbone, double main, and targeted (Figure 2). The design should allow for enough excess water to be removed within 24 hours to lower the water table to a level that will not cause crop injury, usually 6 inches the first day, down to a foot 48 hours later. Tile lines should be aligned with field contours not perpendicular to them.

The tile drain design should be created in such a manner to efficient and maximize resources. There are several factors that affect tile drainage including size of area to be tiled, slope, soil type, and crop type.

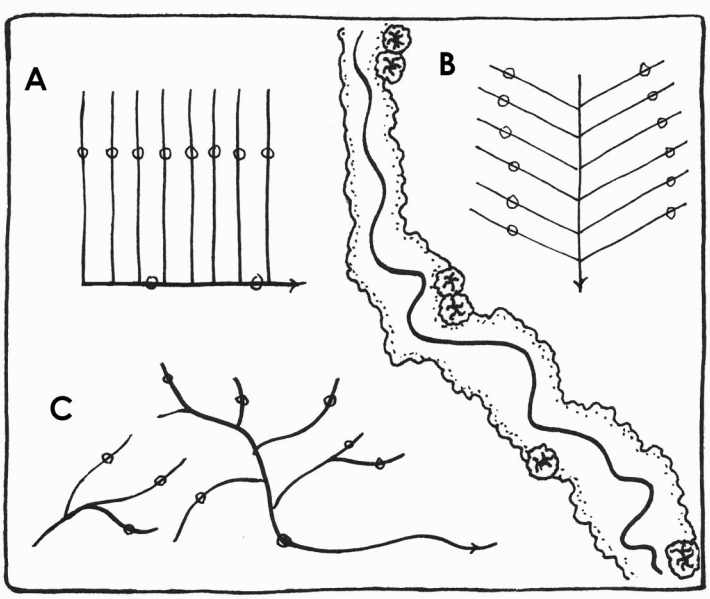

Figure 2. Various drainage layout alternatives. A -Parallel; B -Herringbone; C -Targeted. (Illustration courtesy of Amanda Gervais)

Materials

The size of the area to be drained impacts the amount of pipe and water structures e.g. outlets, water control structures, rodent guards, etc. In fields that have a seasonal high water table or lowland topography that lends to ponding, pump installation may be necessary by tile outlets to mitigate the effects of backflow: On soils with 20% or more clay, pipes with a drain envelope, 'sleeve' or 'filter sock,' may be necessary to keep unstable soil particles from entering tile. The 'filter sock' is a water-permeable barrier that slips over the pipe. Additional materials may be needed if modifying old tile.

Spacing

Tile spacing can range from 40' to 15' and depends on soil type, crop type, and value of crop. Tile may be spaced at 40' in gravel, 30' in clay, or closer depending on crop. Row crops on clay or high valued crops are typically spaced at 20'. Drainage coefficient or seasonal high water tables impact tile spacing needed to drain the field to a level that will not cause crop injury. Depth may be determined by frost layer or restrictive soil layer, which is usually 30-48 inches below.

Surface inlets, air vents, and outlets

Surface inlets, standpipes, or open drains are above ground structures that collect water before it filters through the soil and acts as a direct conduit to tile lines. Surface inlets typically drain low spots. To be in compliance with the Required Agricultural Practices, surface inlets must have a 25' vegetated perennial buffer where no manure can be spread (Image 1). Air vents are above ground structures designed to relieve pressure, increase pipe flow, and reduce potential for blowouts. As of November 2018, no new surface inlets may be installed within or adjacent to cropland. Outlets are where the tile daylights, allowing water to drain, and when properly installed, prevent erosion of the streambank. Outlets are typically installed 1 foot above normal ditch water and 3-5 feet below soil level.

Field Conditions to Consider

- Tree roots can damage tile lines. Install 15' or more away from tree lines to reduce likelihood of root damage.
- Ledge and rock can impact labor costs and tile effectiveness.
- Slope can impact design. Too little slope and a grading is necessary for proper flow. Too much slope increases velocity and increases chance of blow out. Variable slope, common to Vermont fields, requires pipe that suites all soil types, which can add to costs.

Image 1. Surface inlet with 25-foot buffer. (Photo courtesy of VAAFM)

Tile Drainage Install Records

Generally, it is highly recommended that a tile drainage plan be designed by a licensed contractor and include the following:

- Later spacing, size, depth, grade, footage, and material
- Main location, material, size, depth, grade, and capacity
- Details of any construction problems encountered during the installation
- Location of all outfalls, surface water inlets, and other structures
- Location of utilities, sand pockets, springs, etc., that may affect future maintenance.
- Date of construction
- Name of installer (i.e. contractor or landowner)
- Identification of any changes made during installation from the original plan.

Resources

VAAFM RAPs: https://agriculture.vermont.gov/rap

Drainage design calculators:

https://www.extension.umn.edu/agriculture/water/planning/

http://igrow.org/drainage-calculators/

https://www.extension.umn.edu/agriculture/water/planning/online-calculator/

https://www.extension.umn.edu/agriculture/water/planning/drainage-slide-rule/

https://www.prinsco.com/resources/drainage-calculator-by-acreage/

https://www.prinsco.com/resources/profitability-analysis-calculator/

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