# Soil Drainage Principles and Procedures

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I have prepared this presentation on the assumption that you are now employed on a golf course that in wetter than normal years has drainage problems. It would be wonderful in this work IF before a tract of land was purchased for a golf course we could bring together the Golf Course Designer, the Soil Scientist and the Drainage Engineer who hopefully would have available soil classification information to make a decision from as to whether the site should be purchased. In making this statement, I am thinking of some of the tight phases of the Napanee in Michigan and the Rowe clay in Illinois. Tile drains can do very little in these soils in the way of removing the gravitational water. One could accomplish some drainage in the excavated trench by backfilling with coarser material; but this would not cause drainage of the soil mass outside of the trench.

To have a properly performing drainage system, we have to meet six requirements. They are:

1. Good Outlets
   a. Open ditch
   b. Large diameter tile
   c. Pump
2. Good Layout
   a. Proper location of the lines to correct the problem
3. Good Design
   a. Proper depth and spacing
   b. Proper grades and grading
   c. Proper sizes of tile or tubing
4. Good Construction
   a. Contractor who does a good job
   b. Contractor uses grades rather than "eye ball."
   c. Contractor who knows what to do when unanticipated circumstances develop
5. Good Materials
   a. Use ASTM specifications when purchasing tile or tubing
6. Good Maintenance
   a. Take care of this drainage system
   b. Repair holes quickly
   c. Keep debris off the surface inlets
   d. Clean out the sumps regularly
   e. Cooperate when the drainage outlet needs attention, i.e. brush removal and clean outs of open ditches
   f. Have an accurate drainage map (<u>as installed</u>) so that you can quickly locate any drain lines and also any other underground pipes and utilities

We will now turn to problems that I have observed on golf courses.

1. This golf course has a sloping area of 15 or 20 acres that drains to a green located in a pocket of organic soil. A tile drain of 8 inch diameter outlets into the ditch of a state highway. In a wet year, the green is frequently flooded. The flow out of the tile drain is slow which indicates a very low grade and the outlet is obstructed by the sediment that has accumulated over the years in the highway ditch.

   A. Possible solutions

      1. Approach the Highway Department about lowering the bottom of their ditch 3 feet. This will involve a ditch clean out of about 200 feet and the lowering of an existing culvert about 3 feet (we assume that the golf course owner will have to pay for this). We would then put in a new drain line - probably 12 inch and have its outlet about 12 inches above the bottom of the road ditch. In effect we have increased the fall or slope in our drain by about 2 feet. This however, removes only the surface water and we still have a saturated organic soil around our green.

      2. Install a pumping pit and pump on the edge of the green opposite the approach side. Run in an electric power line, install automatic controls on our pump so that it will operate as soon as surface runoff and/or tile drainage water arrives. Have tile drains installed about 4 to 5 feet deep in the organic soil around the greens and have these lines graded to the pump sump. Expect the surface of this organic soil to drop (subside) about 1 foot following tile drainage.

2. About 15 acres of a golf course drains to a low area, outflow is blocked by a road fill. A tile drain of doubtful condition carries the water slowly to a county drain about 1/4 mile away. The county drain was converted from an open ditch to a closed (tile) drain about 25 years ago. It turns out that while this move was more aesthetic, it was a mistake, the enclosed drain had a much reduced water carrying capacity and the neighbors had water in their basements when much runoff occurred that the closed drain could not handle. It appears that it would be very costly to install a new tile drain from our golf course to this outlet and to install a larger county drain with a second large diameter line.

   A. Possible solution

      1. A pump with a pressure discharge line is needed to take our water to a different and suitable outlet.

3. Water stands on our driving range and fairways for days during a wet year.

   A. Possible solution

      1. Experience with the same soil type in a nearby field in which tile drains were placed at 3 to 4 foot depth and a 50 ft. spacing of parallel drain lines, indicates that the same type of drainage installation should do the job.

4. Water accumulation in a pocket to a depth of 6 to 12 inches in wet years.

   A. Possible solution

      1. Place a tile drain 3 to 4 feet below the ground surface. Connect a surface inlet at the lowest point of the pond to the tile drain; or use a post hole (8 to 12 inch diameter) filled with peastone from the tile line up to the ground surface to have a blind inlet.

5. Soggy area on a hill side, tractors and carts get stuck.

   A. Possible solution

      1. We appear to have a seepage area. Take a few soil borings upslope from this wet area to see if there is a tight soil layer that directs underground seepage to our wet area; if so, run a tile drain into the area above the wet area. Have the drain put in just into the top of this tight layer to pick up in the seepage. We would like to have about 2 feet of cover as a minimum above our tile drains.

6. Water pond on a sloping area

   A. Possible solution

      1. Consider construction of a Vee channel possibly 1 to 2 feet deep and side slopes of 10 to 1. This would make for a very gentle side sloped waterway that carts and tractors would cross without difficulty.