



Figure 7. Plastic corrugated tile used widely for providing internal golf green drainage.

plastic. Two to 4-inch diameter corrugated, flexible, plastic tile with slits is widely used today due to its ease of installation and relatively low cost (Fig. 7). Slits of the plastic tile should always be laid facedown on the gravel bed to prevent clogging of lines by soil migrating downward. Nylon-netted filter drain sleeves which wrap the tile line are available. However, if silt and clay content from the topsoil exceeds 5 to 10 percent total, these may plug up.

Trenches in which drainage lines are laid should be dug 6 inches deep into the subgrade and be 5 to 6 inches wide (Figs. 3, 4, and 5). Up to 12-inch wide trenches are sometimes used, however, this wider cut necessitates more gravel, thus higher costs, to fill the trench. Normally, the trench width and depth should be no greater than twice the size of the drain line. A 5 to 6-inch wide box-shaped trench will allow a 0.5 to 1 inch gravel bed below, above, and on either side of a 4-inch drain line. The soil from digging the trenches should either be removed or placed between drainage lines to provide a slight crown and compacted.

Before trenching, the area should be surveyed and staked with proper labeling for the desired depth of cut. Tile should not be placed deeper than is necessary to obtain the desired amount of slope. Grade stakes should be placed to give tile lines a minimum downward slope (fall) of 0.5 percent (1 ft in 200 ft), ideal of 1 to 2 percent (1 ft in 100 ft or 1 ft in 50 ft) and a maximum slope of 3 to 4 percent (1 ft in 33 ft to 1 ft in 25 ft). Slopes less than 0.5 percent are difficult to properly install and maintain and also drain much slower than steeper ones. Slopes greater than 3 to 4 percent will loose

lateral drainage capability, require greater elevation changes within the drain line, and a deeper outlet point. Care must be taken to ensure that the trench and tile are always sloping downward so pockets of standing water do not develop. These lines should be placed diagonally to the slope of the green and not at right angles. All main and lateral lines should be double checked with a level prior to backfilling to insure that the grade provides desired drainage. Tile joint tops should be covered with asphalt paper, fiberglass composition or with plastic spacers or covers to prevent gravel and sand from entering the line.

It is recommended that the main drainage line, into which the lateral (feed) lines flow, have its upper end extended to the soil surface and properly capped. In the future, if this line becomes contaminated (clogged) with soil, the cap can be removed and the line flushed. This greatly extends the useful life of the drainage system without need of disturbing the playing surface to clean the tile lines.

After tile installation, the surveyor should place grade stakes into the subgrade throughout the putting green site (Fig. 8). With allowance for the depth needed to drive the stakes into the ground, each stake should be marked at 4 inches, 6 to 8 inches, and 18 to 20 inches above the subgrade. These markings correspond to the intended depth of the gravel, coarse sand layer (this layer is optional, see below for further details) and root zone layer required in the green profile. Stakes should be placed at frequent spacing throughout the putting green site to indicate any changes in elevation or contouring of the surface.



Figure 8. Grade stakes placed into the subgrade to mark the intended depth of the green's gravel and root zone layers.