Drainage

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During a recent tour of British golf courses, I was told, "You Yanks take a well man and make him sick!" That was their picturesque way of saying we use too much irrigation water, make the grass sick, and then we apply pesticides and even more water.

Irrigation has been a favourite topic of the golf course maintenance industry during the last 20 years. Applying water to the golf course is the conspicuous, perceptible part of turf maintenance. But the other side of that coin is drainage — getting water off the golf course. Drainage is the hard job, the thankless job, the job nobody wants to talk about.

Drainage is not only crucial to quality turf maintenance, it also affects the playability of a golf course. A properly designed and installed drainage system keeps the golf course dry and playable, providing more playing time than a non-drained course. A drained course has the added advantage that it can be played more often with carts — no small consideration.

Rx for Turf Health

Ideally, the combination of drainage and irrigation achieve a soil condition agricultural engineers call "field capacity." This is the ideal level of moisture that, when balanced with air, enables aerobic bacteria in the soil to complete the nitrogen life cycle, thereby supplying nutrients to the grass.

Drainage can lower the water table, allowing the top part of the soil to dry out. This fosters grass root development, especially during the spring when the water table is normally near the soil surface. The deeper roots break up the subsoil and help develop good soil structure. Drained soils also warm more quickly during the spring season, promoting turf growth and speeding winter recovery. Conversely, drained soil is less apt to suffer from freezing damage.

In parts of the United States where soils contain a large amount of salt, sufficient irrigation is needed to flush the salts from the turf root zone. Drainage is especially important in these soils to allow this maintenance practice to occur. Adding fertilisers, which are basically salts, can create a similar situation if inadequate drainage exists.

System Components

There are a variety of drain types available, including tile drains, French drains, and open ditch drains, as well as storm sewer systems.

The least expensive to install is the open ditch drain. This type is frequently used in Great Britain, even at the exclusive Sunningdale Golf Club near London. In the United States, open ditches often are used on land of low value, such as swamps and forests, where more sophisticated drainage systems would not be cost effective.

Open ditches are relatively inexpensive to construct, but they do require long-term maintenance, including the removal of weeds and sediment. They are difficult to mow, and maintaining the slopes without the sides collapsing can

Shhh! It's a job nobody wants to talk about

be a problem. Also, there is the need to dispose of the excavated soil during construction. Although open ditches are not the optimum drainage solution for a golf course, there are occasions when physical conditions do not provide adequate slope or cover for drain pipes, and an open ditch may be the only reasonable option.

A variation on the open ditch drain is the French drain, consisting of a narrow open ditch drain filled with gravel. A disadvantage is the tendency for the upper portion to become sealed with dust and surface soils, which eventually clog the drain. To alleviate the problem, a geotextile fabric can be used to line the bottom and sides of the trench. When the gravel is in place, the fabric edges are overlapped over the top of the gravel. The fabric holds the gravel in place and, in unstable soils, prevents soil fines from entering and clogging the drain. The top can be cleaned off periodically or simply sealed off with a layer of porous soil or sand. Today, French drains are rarely recommended.

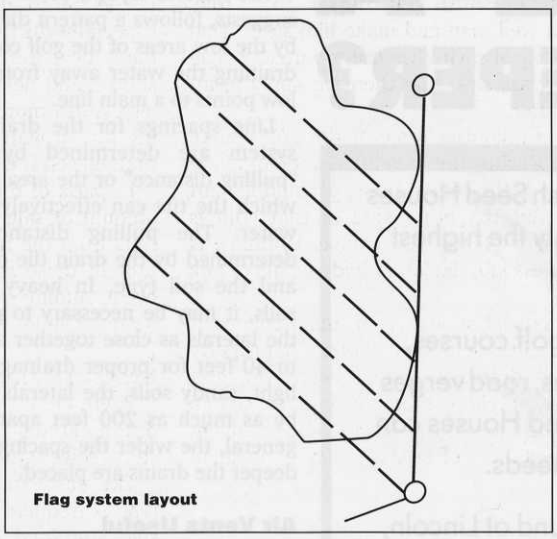
Historically, tile drains were constructed with 4 inch diameter, 12 inch long pieces of concrete or clay tile. Corrugated polyethylene plastic tubing, which is resistant to damage by acid soils and frost, is now a popular substitute for concrete or clay tile. The corrugations strengthen the tubing, which is manufactured in continuous lengths ranging from 500 feet for 2 inch diameter tubing, to 20 feet for 8 inch or larger tubes.

Although tile drains are somewhat more expensive to construct, they provide a system that functions well over the long haul, with minimum maintenance. While it is true that soil fines and sand can enter the tile or tubing, the flow of water should carry the deposits along, preventing clogging of the system.

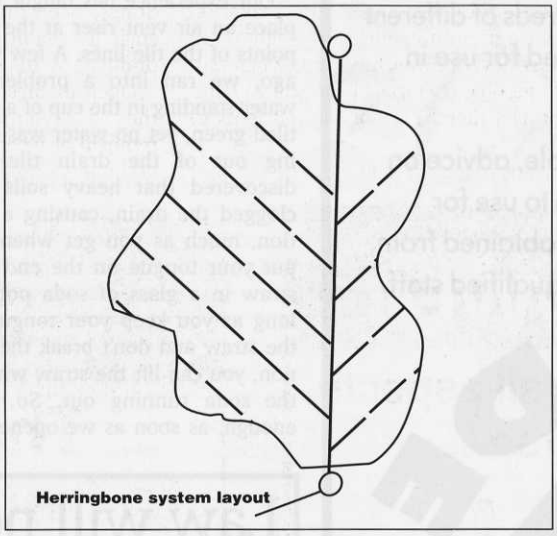
Although a variety of materials can be used as an "envelope" around sub-surface drains to prevent clogging, the most commonly used is gravel, sized 1/4 inch to 3/8 inch. The envelope material functions as a filter for fine sands and silts from the in-flowing water.

Interceptor Drains

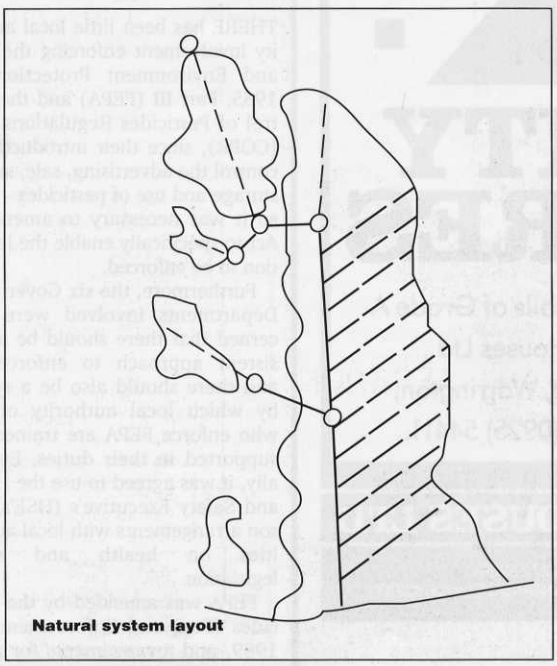
There are occasions when hillside surface water must be dealt with to prevent erosion and subsequent ponding in low areas. Hillside seepage occurs when previous surface soil is underlain with impervious soil that restricts vertical water movement. Hillside seepage also occurs when a water table exists at the soil surface, usually at the intersection of a hill and a flat valley. For example, seepage may occur where an elevated green meets the surrounding land. By locating a sub-surface interceptor drain uphill from the wet area, water can be intercepted and carried away.



Flag system layout



Herringbone system layout



Natural system layout

Storm Sewers – A Plus

The best outlet for a quality drainage system is a storm sewer system. While golf course drainage systems often do not tie into storm sewer systems, they should whenever possible. This should be a major consideration for a quality golf course drainage layout.

Storm sewers usually have two types of maintenance access: manholes and catch basins. Manholes should be placed at any point where a drain line changes direction, but no farther than 300 feet apart. Manholes have a covered top and a smooth bottom that matches the flow line of the drainage tile connected to it. The catch basin has an open, grated top to allow drainage to flow into it from the top, as well as from drain tile entering above the bottom of the basin. Since the flow is uninterrupted in a manhole, soil deposits do not accumulate. However, in the catch basin, the space between the tile and the basin bottom can fill up with drainage solids, so it must be cleaned out periodically. For easiest maintenance, it is best to run your drainage to a storm sewer system that features only manholes.

There have been cases where drainage water has been recycled for use in the irrigation system. Pete Dye's design for the Old Marsh Golf Club in Florida is a case in point. There the water is recycled to avoid contaminating the natural ecosystem of the Everglades. The drainage water is collected and taken to sumps, where it is pumped into a storage lake until needed for irrigation.

Recycling is an expensive solution, but it is a viable answer. With recycled systems, the more the water is reused, the more concentrated the salts can become. Because of this, the water must occasionally be diluted.

Drainage System Layouts

Drainage systems are identified by their layout patterns.

The flag pattern, also known as the parallel system, is used to drain areas that have uniform slopes. A series of sub-branch lines, or laterals, run parallel to each other and drain into a main line. Drainage installers must do a good job of setting the lateral lines to an established pitch that must remain constant for the system to perform properly. Maintaining a constant pitch can be difficult if the terrain is uneven.

The herringbone system is used to drain swale areas. Water flows in the laterals ➠

toward the main line, located in the lowest part of the swale. This system is frequently used because of the ease of its installation.

The natural layout, as its name suggests, follows a pattern dictated by the low areas of the golf course, draining the water away from the low points to a main line.

Line spacings for the drainage system are determined by the "pulling distance" or the area from which the tile can effectively pull water. The pulling distance is determined by the drain tile depth and the soil type. In heavy clay soils, it may be necessary to place the laterals as close together as 30 to 40 feet for proper drainage. In light, sandy soils, the laterals may be as much as 200 feet apart. In general, the wider the spacing, the deeper the drains are placed.

Air Vents Useful

Our experience has taught us to place an air vent riser at the high points of the tile lines. A few years ago, we ran into a problem of water standing in the cup of a well-tiled green, yet no water was coming out of the drain tile. We discovered that heavy soils had clogged the drain, causing a suction, much as you get when you put your tongue on the end of a straw in a glass of soda pop. As long as you keep your tongue on the straw and don't break the suction, you can lift the straw without the soda running out. So, sure enough, as soon as we opened up the tile at the high point of the green, the water went gushing out of the tile. Since then, we have generally made it a practice to introduce an air vent at the high points of drainage lines.

The air vents accomplish three things. First, they prevent the suction from occurring. Second, they provide convenient places to introduce water into the system if flushing is needed to clear a blocked tile. And finally, the vents introduce air into the tile line, which helps to aerate the soil.

Common Sense and Drainage

Thinking about what it takes to achieve an outstanding and playable golf course, I am reminded of the story about the farmer who, every year, had the most outstanding crops in his area. His neighbours finally asked him to meet with them and share his secret. "Well," he replied, "the way I look at it, there's really not much to farming. It's about 90% drainage and about 10% common sense. If you don't have much common sense, put in more drainage!"

That story applies handily to golf courses. The secret of a great golf course is good turfgrass. One of the secrets for growing good turfgrass is good drainage. So if you want a great golf course, you'd better pay attention to your drainage!

● *This article first appeared in the USGA 'Green Section Record' and is reproduced with due acknowledgement and thanks.*

Law will now be enforced

THERE has been little local authority involvement enforcing the Food and Environment Protection Act 1985, Part III (FEPA) and the Control of Pesticides Regulations 1986 (COPR), since their introduction to control the advertising, sale, supply, storage and use of pesticides – to do so it was necessary to amend the Act to specifically enable the legislation to be enforced.

Furthermore, the six Government Departments involved were concerned that there should be a consistent approach to enforcement and there should also be a system by which local authority officers who enforce FEPA are trained and supported in their duties. Eventually, it was agreed to use the Health and Safety Executive's (HSE's) liaison arrangements with local authorities on health and safety legislation.

FEPA was amended by the Pesticides (Fees and Enforcement) Act 1989, and arrangements for a system of liaison and training were completed with a view to commencing enforcement on 1 April 1992.

Local Authorities will enforce all aspects of COPR, that is, from advertisement to use, on those premises where they now enforce the Health and Safety at Work etc. Act 1974. This includes all golf courses.

HSE Inspectors will continue to enforce all aspects of the pesticide legislation with the exception of advertising. This includes the effect of use on people and the environment in the area of agriculture, forestry, and horticulture, manufacturers premises, timber treatment works, construction sites, local authority premises, private dwellings when pesticides are used as part of a work activity.

A special section has been set up within the Local Authority Unit of HSE to ensure consistent standards of enforcement and to deal with pesticide matters.