Drainage for turf renovation

By Jeff Horan

It is routine for many sports turf managers to deal with saturated soil conditions throughout the wet season. Different types of drainage, drainage materials and drainage designs all have an application. Parking lots, cut off drains, and dry-wells each have a different design and material criteria. This article is a closer look at a drainage application for natural grass, native soil and/or amended soil sports fields. Sports turf managers can adopt this application to solve drainage problems at their own facilities.

Even though you may have drainage on a field, it doesn't eliminate the possibility of saturated soil conditions. Drainage that targets soil saturation will increase scheduled usage, increase maintainability, and reduce maintenance costs.

Surface drainage is essential and uses slopes, swales and catch basins to remove surface water from the field. Although good surface drainage can eliminate standing water it cannot reduce saturated soil conditions. Stand next to a storm inlet within a turf area during the wet season and you are experiencing complete soil saturation.

Subsurface drainage can be implemented as a solution to solve ground water problems and lower the water table. A perched water table is created with subsurface drainage because soils are layered. As water enters the soil profile each layer must reach capacity before water moves down to the next layer.

One analogy that helps visualize how water moves through a soil profile is to observe a kitchen sponge. Hold a kitchen sponge (soil)

in your hand and apply water (precipitation). The sponge will not drip water (drain) until reaching capacity. Layering soils produces the same results. In other words, soil saturation is a requirement for subsurface drainage to function. A perched water table is desirable when creating a complicated USGA golf green or possibly a sand-based sports field, but not so desirable with native soil or amended soil fields.

We call our drainage concept vertical column drainage. Drainage trenches are excavated and then a corrugated perforated pipe is installed with a continuous vertical column of permeable drainage material to the surface. One drainage material from top to bottom without layering is the key because collecting surface water before soil saturation occurs is our objective and, with this system, soil saturation is not a requirement for drainage to occur.

The best backfill material to reduce saturated soil conditions is sand. A logical thought pattern would automatically lead us to believe that increased permeability and a coarse drainage material like pea gravel will increase drainage rates and performance. Ironically, the most suitable permeable drainage material for vertical column turf drainage is sand.

Quality sports field topdressing sand or mason sand performs multiple functions in the turf drainage process. Sand is a permeable material that also supports a great environment for turf growth. Sand within the trench profile also bridges the adjacent soil and stops silts and sediments from contaminating the drainage system.

In this system, silts and fine particles from the soil do not migrate into the sand backfill. In addition, sand will continue draining the adjacent soil after surface water is no longer present. The finer texture of sand allows for better soil contact and increases drainage through capillary movement.

Turf drainage rates are limited by the rate in which water infiltrates through the surface. A larger aggregate material like pea gravel bedded around a drainpipe will not increase surface infiltration and the larger open spaces between the aggregate can allow fine particle migration.

Using a pipe in drainage is always more efficient. A drain pine installed within the profile is really just an open void in the ground that allows water to move laterally from the force of gravity. Lateral water movement is much slower within backfilled trenches that have no pipes, even with coarse gravel. Field drainage is much more efficient when water can move in a pipe unobstructed.

Many pipe configurations will work just fine. Waffle panels, narrow or tall pipes, and round pipe will all work well when installed correctly. More important is how the water gets into the pipe. As water enters the trench, gravity overcomes surface tension and moves water down to a less permeable layer (trench bottom). As this water table accumulates it enters the pipe from the bottom and then moves freely within the void. Installed drainpipes should be surrounded in an envelope of sand with no soil contact; this will ensure that no sediments are introduced as water enters the pipe.

When installing vertical column drainage with a sand backfill you should choose a pipe with a small slit (approx. 1mm X 10mm) or a pipe with a geo textile wrap (sock). A pipe with a small slit or a fabric sock will bridge the sand at the pipe and eliminates sand from

migrating into the pipe. The Greenshield Systems uses a 2-inch corrugated perforated pipe with small slits eliminating the need for a sock. A geotextile sock around a pipe works great if it does not have soil contact or become clogged with fine particles. A sock can be used to protect a pipe with larger perforations from sand migration and the sand backfill protects the sock by stopping the fine particles.

How far does your water travel?

The distance water travels over the surface or through the soil profile before intercepting a trench is directly related to drainage performance. Closer drain line spacing gives more dramatic drainage results. You will have better drainage performance with smaller pipes on closer spacing rather than large pipes on wide spacing. Smaller pipes and narrow trenches increase installation efficiency by reducing excavation and backfill quantities. Closer trench spacing is cost effective when installation efficiency is increased. Narrow trenches maintain a moisture balance with the adjacent soil and turf will not brown out under normal circumstances.

Drainage design and layout is just as important as the type of drainage you choose. Water should leave the site at the same rate in which it infiltrates through the trench profile. When starting a drainage project you will first need to locate a water outfall point lower than the target area to be drained. The outfall pipe can exit into an existing storm system catch basin or even daylight into a ditch or swale, but be prepared because water will exit this drainage.

After you have chosen your outfall point, the main collection pipe should run down the slope to the outfall point and the perforated drain lines which connect to the collection pipe should run across the slope. Perforated drain lines which run down the slope will not be effective if they do not intercept surface and sub surface water flow. The bottom of all drainage trenches should slope to the water outfalls point. When digging the trenches you will need to monitor and manage a depth, which gives slope to the trench bottom. The trench bottom should slope at least 6 inches per 100 feet of distance or .5 percent.

Install the drainpipe with the same accuracy in which the trench was excavated. The drainpipe should follow the slope of the trench and not be in contact with the adjacent soil. Before installing the pipe, lay down an inch of sand. Place the pipe, then backfill to the surface. Make sure to compact the sand to assure no settling.

The turf cover over the trenches should be as permeable as possible. I recommend establishing new turf over the trenches from seed or sprigs. If timing is an issue, sand grown sod may be used. Installing silt grown sod over a sand trench will limit the drainage performance.

Some typical problem areas that can easily be solved in house by a sports turf manager are; perimeter of infield within the turf, between the hash marks of football fields, goal mouths, and minor depressions. Plan a drainage project for a specific saturated area within your facility and you will be on your way to better turf management.■

Jeff Horan is co-owner for Greenshield Systems, Mt. Vernon, WA, jeff@greenshieldsystems.com.

The Greenshield System

The Greenshield Systems service concept is two-fold: 1) sports turf drainage that works; 2) effective and efficient specialized equipment. This patent pending trenching system elevates trench spoils into a material handler, while the pipe installation is performed with a hopper developed by the company, which lays the pipe as sand envelopes the pipe in a moving operation.

The trench excavation and pipe installation are two separate passes. Inspection of open trenches between the two passes allows checking for debris, irrigation breaks, and/or various infrastructures for a more precise drainage system. This technology enables the company to maintain the accuracy needed for good drainage performance and the efficiency to install up to 10,000 lineal feet of pipe per day.