Soil Drainage Systems That Function

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One can oversimplify the definition of drainage by saying that it is simply ridding oneself of unwanted water. Were it only that simple for the person who must maintain a golf course, a school playfield, a football field, soccer field or park; were it only so simple for the budget-makers of golf courses, school districts or park departments. Drainage might better be defined as "If you haven't got it, you also do not have a playable surface". In the area west of the Cascades in particular, and to a lesser degree in the drier areas, year-round healthy and **un-saturated** sportsturf surface cannot exist without proper drainage.

Before we get into the specifics of curing the problems of drainage on turfed areas, be it golf, football, soccer or whatever is played on that surface, let us review what I prefer to call the "Simplistic Philosophy of Drainage". This over-simplified explanation is intended to help us rid ourselves of the old-wives tales, voodoo, witchcraft and guesswork that permeates our professions.

The Simplistic Philosophy of Drainage

Seldom, if ever, were golf courses, parks, playfields or school grounds ever sited because someone recognized the fantastic drainage capability of the underlying soils. Hence it is not uncommon for major drainage problems to crop up **after** the golf course, park or playfield has been constructed. One can understand why golf courses, with 90-150 acres of land are relegated to correcting many drainage problems afterwards. For parks and playfields the usual excuse for not correcting them at the time of construction is **budget!** This is our way of life.

After many of these sporting facilities have been built, the Maintenance Staff discovers that Mother Nature, through the medium of glacial action eons ago, dropped something less than beach sand at the site. More likely here on the west slopes of the Cascades, she dropped silt, clay or both, materials that may permit water to infiltrate and percolate, but **very slowly**. Add to this dilemma an overabundance of rainfall that seems to be present continuously from October through March or April (or June in 1984), and we find two natural conditions detrimental to quick dissipation of surface moisture ... **slow draining soil and an excess of water.** These are natural conditions for this area. Add to this a third, but indirect natural condition ... mild winter weather which encourages outdoor activity for twelve months of the year. The crowning touch occurs through a man-made ingredient; heavy traffic of golf shoes, golf hand carts, golf riding carts and maintenance equipment on golf courses and football players, soccer players, intermural athletics, adult leagues and maintenance equipment on playfields. All four of these conditions combine to create untenable playing conditions on turfed surfaces. Destruction occurs through the following action.

A. Water, being inherently lazy, migrates vertically through the soil because of gravity and will continue to do so as long as the soil is not saturated.

B. If the soil is fine textured, i.e. silty or clayey, the water moves through at a very slow pace. Hence, we find the problem with heavy rains running off of these soils rather than down into and through them. This may all be good

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except when the runoff simply moves from one part of a golf course to another, we have solved some of the problem in one place at the expense of an added problem at another place. On a flat sportfield, we simply form a lake until percolation or evaporation takes place. Even crowned fields, puddles and saturated surfaces are common.

C. When the pores of the soil are completely full of water, the material is in a saturated condition. Any activity which causes a disturbance of the material tends to change the soil characteristics and may destroy whatever natural drainage channels that might have existed. Additionally, organic material decays or rots on the surface, often causing surface sealing and slowing infiltration.

D. Old turf sometimes exhibits heavy layers of "Thatch", the longterm build-up of dead grass stems, leaves, etc. If not treated each year with appropriate equipment, water movement is further restricted.

It now can be seen that we have all of the ingredients that are necessary to slow or inhibit drainage. Take away any of the three primary ingredients, excess rain, fine textured soils, or excess traffic and you have no problem. The rain and soil are Nature's contribution; traffic is the gift of man. If we eliminate traffic, we have a nice-to-look-at-lawn but no golf course or playfield. We have no control over rain. The only variable that we can attack is the soil, its make-up or its surface. Now enters the science of corrective drainage.

Determine the Problem

Each site is unique unto itself. Only in places like Palm Springs where we can find thousands of acres of contiguous land of fast draining sand from the surface to 100 feet of depth, do we chance on land similarity. Here in the Pacific Northwest we must treat each fairway differently and we must read each playfield differently. We search out the vital characteristics of each individual site by ...

A. Visually identifying soil characteristic through test holes.
B. Conducting infiltration tests of the surface layers.
C. Conducting percolation tests of the underlying areas.
D. Mechanical analysis of the soil particles (sieve tests).
E. Reviewing top conditions, runoff, etc.

Once the foregoing practices have been applied, one can identify the seriousness of the drainage problem and make recommendations for the correction thereof. The first identification must be to determine the source of the excess water. Occasionally this excess derived from underground sources, i.e. springs. More often the problem is one in which the existing soils cannot pass rainfall sufficiently. Underground water can be handled quickly and simply by intercepting it in cut-off trenches. When we have identified the problem as slow-draining soils, the cure is much more complex and certainly much more expensive. The question now arises as how much cure (and money) is it necessary to throw at the problem to bring the site up to our desired standards.

Determine the Remedy

Often one can tell why a soil is slow draining by little more than visually identifying the clays or silts. However, until the filtration tests, perc tests and mechanical analysis tests are conducted, the degree of correction action cannot be properly deter-

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mined. Corrective treatments for golf courses or parks or playfields may require little more than frequent sand topdressing after a prior vigorous program of verticutting and aerifying. It may be that it is necessary to strip the existing sod and overlay the area with 3 to 4 inches of clean, carefully screened sand. Or, it may require a very expensive removal of the existing soil, underdraining the area and then replacing the void with carefully selected permeables, principally sand. The depth of excavation (and sand replacement) will vary depending upon the findings obtained from the perc tests and sieve analysis.

It can be seen that there are numerous options available, all with differing price tags. **However, there is usually only one correct remedy for a given site, be it fairway, playfield or park.** This is not to say that you cannot use any of the aforementioned solutions at any site; what we are saying that there is usually only one right way to provide you with the results you want on a permanent basis. Since budgets are the nemesis of all turf caretakers, it is important that we spend absolutely no more than necessary on a site to improve the drainage. This is where the perc tests, infiltration tests, the mechanical analysis and visual soil identification through test holes pay for themselves for these tests may well provide us with the data which would permit a resolution other than a complete underdrained and reconstructed area.

Let us look at some sample problems and their resolutions.

Example A

Playfield with dirt surface to be rebuilt and made playable for soccer. Soil sieve analysis reveals 10 to 15% of the soil material passing the No. 200 sieve and perc tests which indicate average perc of 10 minutes per inch.

Solution: Grade the area, break up the base material and overlay with 4 inches of sand. No drain tile required. Seed, fertilize and irrigate. Cost per acre equals $20,000*.

Example B

Playfield to be rebuilt. Underlying materials are mostly silts and clays with upwards of 50% passing the No. 200 sieve and perc tests averaging 90 minutes per inch. Field to be used for soccer and football.

Solution: Remove 14 inches of subgrade and dispose of same. Underdrain with 4-inch corrugated perforated polyethylene at 20-foot on center and cover with 14 inches of selected sand. Seed, fertilize and irrigate. Cost per acre equals $50,000*.

Example C

Golf course fairway with same material and perc rates as Example B. Constantly saturated during winter.

Solution: The option is always open to completely rebuild the fairway at $50,00 per acre. Since this is likely to be quite impractical, an alternate method of improving the playability is desired. Start a program of selected sand topdressing at the rate of 1 inch per year for a three-year period. Regrade fairway to slope if possible prior to the sanding program. Install occasional drains after the sanding program has been completed. While this remedy will not give you the results of Example B, it will improve the playability and drainage. Cost per acre equals $8,000*.

Example D

Playfield with base materials of sandy nature, no more than 10% passing the No. 200 sieve and perc rates of 15 minutes

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per inch. Surface is constantly saturated and soft in the winter soccer/football playing periods.

Solution: The problem was determined to be a dense and impenetrable 2-inch layer of thatch that had built up over some 20 years. Field was verticut with a commercial thatcher until the surface sealing thatch was removed. Field drains well without use of drain tile, reconstruction or sanding. Cost per acre equals $750*.

*These cost estimates are general in nature and will vary greatly depending upon availability and most of permeable materials. Seek professional assistance before budgeting for a drainage project.

Summary

Every turfed area that is subject to heavy winter play, be it a playfield, golf course, park or school yard, must be able to cope with the destructive nature of heavy traffic and excess moisture. Either nature provided the site with natural drainage or we must be expected to do so in some artificial manner. The degree of corrective drainage required is a function of the soils of each individual park, playfield or fairway. Before you spend dollars for treatments that may harm the drainage as much as help it (or not really help it at all), take the time to find out what types of soils you have, how they perc or how they infiltrate and then decide on a course of action. It is a well known fact that there are more dry drain tiles than functioning drain tiles in heavy soiled athletic areas. So often maintenance personnel are under pressure to "Do something about the drainage!" And so, "Something" is done whether it is drainage-effective or cost-effective or not. Take the time to learn about what you have in the way of soils on each of your parks, on each of your playfields and each of your fairways. Then and only the will you be able to address the proper remedies to your drainage problems.

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Book Review

by Dave Blomquist, Naperville Country Club

Interested Superintendents should pick up a copy of the book "Trashing the Planet." Author Dixy Lee Ray provides fascinating and timely insight about everything from pesticides to acid rain. This book provides information for superintendent's operating in "environmentally sensitive" areas.

These are some outtakes from the book:

- "Pesticides have reduced America's food costs 33% by controlling weeds, insects, mold and rot in vegetables and fruits. They have helped to keep our food and our homes clean by controlling ants, rats, mice and cockroaches. Through the use of wood preservatives in pressure treated lumber, we have saved a forest of trees two times the size of New England."
- "The most important fallout from the decision to ban DDT was that it gave credibilty to **pseudoscience.** It created an atmosphere in which scientific evidence can be pushed aside by emotion, hysteria and political pressure."

I found it interesting to read a different point of view. This book debunks every "environmental crisis" and forces the reader to use common sense, or review legitimate scientific data vs. emotional knee jerk pressure.