A guide to Sportsturf Drainage Techniques for Golf Courses
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Golf Course Drainage

The advanced Shelton drainage techniques available today can be installed speedily with little disruption to the playing surface, such that ‘drain today, play tomorrow’ becomes a reality. Cost effectiveness is uppermost in our minds, also. But the timing of the drainage works needs to be selected with care for optimum results – some drainage techniques are best undertaken when soils are relatively dry, others when soil moisture levels are relatively high. Plan long-term to get the backing of the players and create minimum disruption to the course.

The first step is to try and identify the reasons for the excessively wet area. Perhaps it is naturally slow draining clay soil, maybe substantial rainfall over a short period, possibly soil water rising from below, or run-off from adjoining higher ground. It may be caused by excessive thatch or capping of usually well draining soil by heavy pedestrian or mechanical traffic. Is it a broken land drain or a damaged irrigation pipe? Until the reasons for the problem are identified the best and most cost-effective solution cannot be formulated.

Some clubs choose to let their own green keepers rectify the problem; a significant number of them have been trained in basic techniques of land drainage. But can they be spared from other duties for a few days or weeks and have they the specialist up to date equipment that will allow them to undertake the work quickly and without substantial disruption of the playing schedule? Do they know the best layout of the primary drainage system and when a secondary drainage scheme may be advantageous and save money?

Fairway Drainage being installed
Drainage of Fairways - Primary Drainage

Fairways are usually drained by a system of land drainage pipes. The herringbone layout is no longer fashionable as it causes major upheaval down the centre of the fairway where the lateral drains connect with the main drain. The majority of piped systems today would be installed with the main drain to the side of the fairway with laterals spaced at 5, 7, or 10 metres apart running across the fairway. Laser guided equipment would ensure an even fall on these pipes.

Pipe spacing will determine the cost of the installation hence it needs to be accurately calculated. But pipe sizes and consequently trench width are major cost considerations also. Big diameter pipes do not necessarily give the best results. The smaller the pipe, the faster the flow, which helps keep them running clear.

Also, the larger the pipe, the wider the trench, and hence larger quantities of aggregate are required to backfill the trenches. Narrower trenches also heal quicker. Main drains would typically be 100mm in a 118mm trench, laterals being 60mm in a 78mm trench or 80mm in a 97mm trench.

Aggregates

The selection of these aggregates needs to be understood. Spherical materials are the preferred choice as they leave air spaces for water to flow through. Angular gravels tend to run together over time leaving no such spaces. Materials with lots of fines should also be avoided to prevent pipes from becoming blocked.
A crushed 8-10mm gravel may be inexpensive but a product such as Lytag – pulverised fuel ash – could drain up to ten times faster and carries no Government Aggregate Tax. The advantages of using Lytag are many, including faster drainage, the ability to retain water in dry conditions which reduces the striping that can occur when gravel is used. It is half the weight of gravel per volume, which reduces the weight of material being carted across the site. It also shatters on contact with mowers, where gravel will not. The latter could be the more cost-effective material to use; it will depend on your circumstances.

**Secondary Drainage (see also table in Appendix 1)**

The network of land drainage pipes is often referred to as the primary system. Depending on a number of factors a secondary system may be superimposed over them to speed up the flow of excess soil water to the piped drains. There are four techniques offered by Shelton.

**Sand Slitting**

One of the commonest systems has been sand slitting or slit trench drainage. This consists of 50mm wide gravel / sand filled trenches spaced one to two metres apart. They are typically 250mm deep, backfilled with 150mm of gravel, and topped off with 100mm of coarse sand. These are best installed in dry conditions.

**Gravel Banding Drainage**

This consists of closely spaced gravel bands each 20-25mm wide. Bands of aggregate are injected into the surface by a vibrating channel opener and as no soil is removed, surface disturbance is minimal. This allows play to resume immediately.
System 25

System 25™ is a trenching technique where 25mm wide trenches are dug by a high speed wheel. The arisings are conveyed into a trailer running alongside and simultaneously gravel or Lytag is vibrated into the open trench in a one pass operation.

Lightening Drain

Lightening Drain™ is very similar to System 25™ except the trenches are dug 35mm wide and a 25mm perforated land drainage pipe is installed prior to backfilling with Lytag.

Avoiding damage to the golf course.

Some advisors and contractors advocate working on boards when draining fine turf such as on greens. But unless they continue the boarded runs across to the soil tipping locations, the fairways may get damaged by the wheels or tracks of the tractors and trailers. We believe in selecting very wide specialist grassland tyres that can be run at low ground pressures for our tractors.

Our High Lift and Dump trailers are fitted with four wheels in line which are also fitted with ultra-low ground pressure grassland tyres. Backfilling equipment should also be fitted with these. We would advise you to take this route when you are next buying equipment.
Golf Greens (see also table in Appendix 1)

The majority of golf courses constructed in the last 30 years have greens built to USGA standards and consequently they should drain well. In practice they were not all constructed with materials of the precise specification and improvement to their drainage may be necessary. By far the larger number of greens were 'push-up' using surrounding topsoil. A drainage system was rarely installed in that era as golf was infrequently played in the wetter winter months.

To rebuild an old-style green to USGA specification can cost in excess of £25,000. On top of this is the major disruption to the course lasting weeks, sometimes months. There are now three Shelton techniques available for draining established golf greens, some of which are the same as for secondary drainage. Using these techniques greens may be re-opened for play in a matter of hours or days depending on circumstances.

Gravel Band Drainage

Closely spaced gravel bands each 20-25mm wide leading to a piped drain situated just off the green. Bands of aggregate are injected into the green by a vibrating channel opener and as no soil is removed any surface undulations can be minimised by hollow tining prior to the installation.
System 25

System 25™ is a trenching technique where 25mm wide trenches are dug by a high speed wheel. The arisings are conveyed into a trailer running alongside and simultaneously Lytag is vibrated into the open trench in a one pass operation. The gravel-filled trenches lead to a piped drain just off the green.

Lightening Drain™

Lightening Drain™ is very similar to System 25™ except the trenches are dug 35mm wide and a 25mm perforated land drainage pipe is installed prior to backfilling with Lytag. We know of no faster land drainage system when the pipes are spaced at 500mm centres.
Options for getting the work done

Employing a contractor.

Golf course drainage calls for specialist skills and specialist machinery. Drainage techniques have advanced considerably in recent years and it is essential to employ only those who have the expertise and specialist equipment to work efficiently and effectively. It is likely to be the most expensive of the options considered here, but should ensure a high quality of workmanship.

Hiring in specialist equipment, trenchers, backfillers, and possibly tractors.

Consider – has the golf course got staff skilled in the operation of specialist equipment? Can it spare skilled staff for days possibly weeks, from their routine duties? Have we got detailed plans for the drainage works? If the answers are yes this option is worthy of an in-depth study.

Hiring in specialist equipment with trained operator(s)

This approach can show significant savings over using contractors. It is a form of partnership working. However the club must remember it is making the decisions, formulating the plans and directing the team of workers. It usually means there must be a senior member of the staff on site throughout the working day assisted by two or three skilled workers.
Purchasing new or rebuilt equipment.

If the club has a substantial amount of work to do, then purchasing new maybe an option. The equipment will also have a resale value at the end of the project. Pre-owned equipment may also be an option, this initially may be cheap but reliability may be compromised and it can be more expensive in the long run. Refurbished equipment is also worthy of consideration.

Some clubs have taken the middle route – having the primary drainage system installed by a contractor, and installing the secondary drainage system in-house. Each club will have their own preferred route to carrying out the works, which can depend upon many factors, including budget, existing labour and machinery resources.
# Appendix 1.

A comparison of secondary drainage systems:

<table>
<thead>
<tr>
<th>Shelton Gravel Band Drainage</th>
<th>Shelton System 25™</th>
<th>Slit trench drainage sand slitting</th>
<th>Shelton Lightening-drain™</th>
</tr>
</thead>
<tbody>
<tr>
<td>One pass operation</td>
<td>One pass operation</td>
<td>Two or three pass operation</td>
<td>One pass operation</td>
</tr>
<tr>
<td>Trench width 25mm</td>
<td>Trench width 25mm</td>
<td>Trench width 50mm</td>
<td>Trench width 35mm</td>
</tr>
<tr>
<td>Trench depth 300mm</td>
<td>Trench depth 350mm</td>
<td>Trench depth 250mm</td>
<td>Trench depth 450mm</td>
</tr>
<tr>
<td>Spacings usually 400mm to 1,000mm</td>
<td>Spacings usually 400mm to 1,000mm</td>
<td>Spacings usually 1,000mm to 2,000mm</td>
<td>Spacings usually 500mm to 1,000mm</td>
</tr>
<tr>
<td>Aggregate brought close to surface</td>
<td>Aggregate brought close to surface</td>
<td>Aggregate brought up to 2&quot; of surface, topped off with free draining sand</td>
<td>Aggregate brought close to surface</td>
</tr>
<tr>
<td>Cost per linear unit = x</td>
<td>Cost per linear unit = 2x</td>
<td>Cost per linear unit = 3x</td>
<td>Cost per linear unit = 4-5x</td>
</tr>
<tr>
<td>Negligible chance of trench opening-up in dry weather</td>
<td>Little chance of trench opening-up in dry weather</td>
<td>Moderate risk of trench opening-up in dry weather</td>
<td>Little chance of trench opening-up in dry weather</td>
</tr>
<tr>
<td>Safety: Excellent</td>
<td>Safety: Good</td>
<td>Safety: Some risks</td>
<td>Safety: Good</td>
</tr>
<tr>
<td>Must be undertaken when soils are moist to very moist</td>
<td>Best undertaken when soils are on the dry side</td>
<td>Best undertaken in dry conditions</td>
<td>Best undertaken when soils are on the dry side</td>
</tr>
<tr>
<td>Minimum labour requirement: one person</td>
<td>Minimum labour requirement: two persons, preferably three</td>
<td>Minimum labour requirement: two persons, preferably three</td>
<td>Minimum labour requirement: three persons</td>
</tr>
<tr>
<td>Output per day: circa 6000 metres</td>
<td>Output per day: circa 3000 metres</td>
<td>Output per day: circa 3000 metres</td>
<td>Output per day: circa 1500-2000 metres</td>
</tr>
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Important Points to Consider

- Remember to take precautions in the vicinity of trees and growing shrubs to prevent roots growing into land drainage pipes.
- One inch of rain on one acre is 22,610 gallons; can it be re-circulated.
- Rats and other vermin can block pipes; ensure vermin guards are fitted.
- To avoid damage to irrigation pipes and control wires mark all underground services in the vicinity of the drainage works with a white line.
- Check tyre pressures on tractors and trailers before commencing work to ensure they comply with manufacturer’s recommendations.
- Remember the risk assessment.

About Shelton

Shelton specialises only in the drainage of fine turf. We have over 50 years of experience in the drainage industry. Our equipment and techniques have been used to drain many prestigious sporting venues around the world.

We design, manufacture and sell the Shelton range of land-drainage machinery worldwide; new, used and refurbished. We have a contracting department operating throughout the U.K. We have equipment for hire – including tractors and operators.

Shelton can guide you as to which may be the best way to go to rectify your land drainage problems and indicate likely costs.

For more information please call us, or see our website: www.sheltonsdrainage.com