

USGA Greens: 58 Years of Innovation and Counting

A storied commitment to research and collaboration sets the USGA Recommendations apart from all other methods of putting green construction.

BY ELLIOTT DOWLING AND BOB VAVREK



University research and frequent testing underpin the USGA Recommendations for a Method of Putting Green Construction.

The USGA Recommendations for a Method of Putting Green Construction are the most researched, discussed, and used construction recommendations in golf. When properly built and maintained, putting greens constructed according to the USGA Recommendations have consistently provided excellent results in a wide variety of environments for many years. Around the world, thousands of putting greens have been successfully built using the USGA Recommendations. But getting where we are today required years of experimentation, field observations and university research.

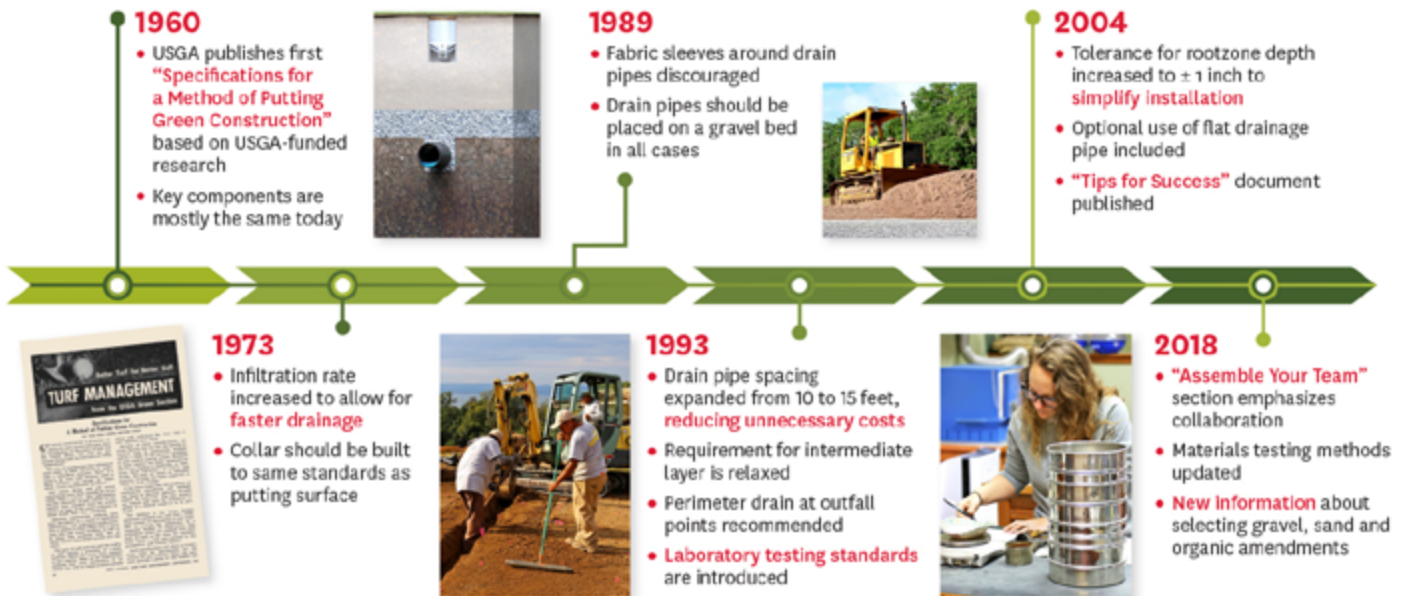
HISTORY

The earliest putting greens were primarily constructed of native soil. Sometimes clay, sand, and organic matter were blended into native soil in an effort to improve growing conditions. Early turf managers understood that moisture retention was of utmost importance because turf survival was dependent on natural rainfall. Having recognized the value of proper irrigation and drainage, early architects such as C. B. Macdonald and Donald Ross started to incorporate subsurface irrigation and drainage into the soil profiles of their putting green designs. The process of developing a consistent

method of putting green construction that ensured adequate drainage and moisture retention had been born. Some early putting green profile drawings even closely resemble those depicted in the current USGA Recommendations.

In 1908, Dr. Charles V. Piper and his colleague, Dr. Russell A. Oakley, were asked by C. B. Macdonald for help establishing turfgrass on the sand dunes of eastern Long Island. Piper and Oakley's input was put to good use as Macdonald finished arguably his finest creation — National Golf Links of America. Later, Piper and Oakley, who were working for the

Evolution of USGA Recommendations for Putting Green Construction



Years of research, observation, and experience have led to the current USGA Recommendations for a Method of Putting Green Construction.

United States Department of Agriculture, were asked by the USGA for help identifying solutions to common turf-grass problems in the United States. This led to the creation of the Arlington Turf Gardens in Arlington, Virginia, the first research facility dedicated to studying golf course turfgrass issues. The site was eventually requisitioned by the United States government and is now home to the Pentagon.

In 1922, Piper and Oakley published [The Essentials of Construction and Maintenance of Grass Putting Greens](#) in the *Bulletin of the Green Section* of the USGA. This was the first documented description of putting green construction published by the USGA. Although basic compared to today's recommendations, this early description laid the foundation for future research and development.

In the decades to follow, the need for university testing became obvious. The goal was to establish a method of putting green construction that was dependable and repeatable around the world. Work continued on the putting green recommendations throughout the '40s and '50s before

the [Specifications for a Method of Putting Green Construction](#) was published by the USGA in 1960. In 1963, Dr. Marvin Ferguson, professor at Texas A&M University, started the first university laboratory specializing in testing rootzone materials for use on golf courses. Dr. Ferguson reinforced the importance of rootzone mix selection and testing, both of which remain fundamental aspects of the USGA Recommendations.

The USGA Recommendations for a Method of Putting Green Construction are periodically reviewed by leaders in academia, soil-testing professionals, golf course architects, builders, superintendents, and USGA agronomists. The review process keeps the USGA Recommendations up to date with current research, construction methods, and materials, ensuring that they remain the best and most trusted putting green construction recommendations in the industry.

CONSISTENT RESULTS

The earliest recommendations set out to create a written standard that could be followed when constructing putting

greens in a wide variety of environments. If the standards in the Recommendations are met, the results should be consistent. Frequent quality control testing — a cornerstones of the USGA Recommendations — is necessary to deliver consistent performance. The only way to ensure consistency among every putting green being constructed is through vigilant testing and strict standards for quality control. To maintain high standards for quality, the USGA Recommendations state that all laboratory testing should take place at a lab accredited by the [American Association for Laboratory Accreditation](#).

DRAINAGE AND THE PERCHED WATER TABLE

Most superintendents consider adequate drainage and sufficient pore space for rooting as critical factors for maintaining high-performance putting green turf. Two foundational elements of the USGA Recommendations are water infiltration standards for optimal drainage and a range for particle size uniformity that optimizes pore space. Ranges are set for both parameters to

ensure suppliers can blend rootzone mixes that consistently conform to the USGA Recommendations.

The layered design is another beneficial aspect of USGA putting greens. This design creates a perched water table at the interface of the gravel and rootzone mix. The perched water table helps maintain sufficient moisture for healthy turf in the rootzone mixture. This feature is especially important during dry periods and in regions that receive little rainfall, when the water reserve helps reduce moisture stress between irrigation or rainfall events.

A critical aspect of putting green moisture management is rootzone selection prior to construction. The rootzone mix plays a key role in determining how much moisture is available for turf roots and how quickly excess water drains from the rootzone. Because of its importance, the USGA relies on rigorous scientific research when recommending the characteristics

of an acceptable rootzone mix. Refinements are periodically made to the USGA Recommendations to ensure that they remain up to date with current scientific understanding.

MANAGING USGA PUTTING GREENS

Constructing putting greens according to the USGA Recommendations provides many advantages — e.g., optimal drainage, resistance to traffic, and the perched water table. However, superintendents may experience an initial learning curve with nutrient, organic matter, and water management when old putting greens are reconstructed to meet the USGA Recommendations.

NUTRIENTS

New sand-based putting greens have relatively low cation exchange capacity and a limited ability to retain nutrients compared to soil-based putting greens, especially during the first few years

after construction. A weak, thin putting surface and an inability to quickly recover from wear caused by foot traffic and maintenance equipment can be symptoms of inadequate fertilizer inputs or pushing an immature turf stand too hard. Light and frequent applications of fertilizer are advised during and after grow-in until organic matter levels in the rootzone stabilize. Use soil test recommendations along with observations of turf color and clipping yield to guide fertilizer inputs.

ORGANIC MATTER

The natural accumulation of organic matter in a rootzone that meets the USGA Recommendations is a double-edged sword. Overzealous sand topdressing programs and insufficient fertility hinders organic matter accumulation and delays the development of a thin, desirable mat layer. Organic matter also increases cation exchange capacity in a mix,



Selecting and installing the rootzone mixture according to the USGA Recommendations is critical for effective moisture management. The physical properties of the rootzone mix ensure adequate water retention and sufficient drainage.



The drainage principles of the USGA putting green are one of the features that sets it apart from other construction methods.

which aids nutrient retention and provides some stability to the putting surface, giving it the resiliency required to handle maintenance and golfer traffic.

In contrast, excessive nitrogen inputs, inadequate topdressing, and overwatering cause a rapid accumulation of organic matter in the upper rootzone that can clog the pore space that allows water to drain quickly through a putting green profile. The unfortunate result is a putting green that remains soft and wet for extended periods after irrigation or rainfall. This makes the putting green vulnerable to a variety of turf health and playability issues, such as deep, pitted ball marks and inconsistent green speed.

The best way of walking the fine line between too much and too little organic matter is to monitor and measure upper-rootzone soil properties at appropriate intervals starting during grow-in. Frequent visual assessments of organic matter accumulation are

helpful, but looks can be deceiving. Send samples of the upper rootzone to an accredited soil physical testing lab to determine baseline levels of organic matter. Monitor changes from the baseline levels to fine tune a topdressing program and other maintenance practices.

USGA putting greens will benefit from timely applications of sand topdressing that dilute organic matter and help maintain a smooth, consistent surface. They will likely also require some form of hollow- or solid-tine aeration. Aeration requirements will be inversely proportional to the quality of the topdressing program — i.e., putting greens that are properly topdressed require relatively little aeration. Detailed information regarding organic matter management can be found in the USGA case study [Monitoring Organic Matter With Physical Soil Testing](#) and in the USGA Green Section Collection [Managing Soil Organic Matter](#).

IRRIGATION

A perched water table above the gravel layer of a USGA putting green helps superintendents utilize deep and infrequent watering schedules to maintain healthy turf. Tools such as handheld moisture meters and in-ground moisture sensors are taking much of the guesswork and mystery out of the perched water table. Measuring and monitoring water content in putting greens has become a standard maintenance practice at an increasing number of golf facilities. The ability to determine when water begins to release into the gravel layer provides valuable information that can be used to fine tune irrigation scheduling. Ultimately, golfers benefit when USGA putting greens are properly watered, because long dry-down cycles between irrigation events produce firm, consistent putting surfaces.

Salt accumulation in the rootzone of putting greens can be detrimental



The deep root system of improved creeping bentgrass varieties can take full advantage of the reservoir of water stored by the perched water table of putting greens built following the USGA Recommendations.

to turf health. This issue commonly occurs when recycled water is used to irrigate putting greens during extended periods of droughty weather. The USGA article [Flushing Greens: More](#)

[Than Just Heavy Watering](#) discusses implementing a sequence of maintenance practices that complement using high rates of irrigation to move excess salt accumulations beyond the

turfgrass rootzone. When needed, flushing excess salts from the rootzone will benefit turf grown on both putting greens built following the USGA Recommendations and those that were not.

ARE USGA PUTTING GREENS RIGHT FOR YOU?

The USGA Recommendations were designed to support the healthy growth of cool-season and warm-season grasses. Improved cultivars of creeping bentgrass and bermudagrass have deep, dense root systems that can take full advantage of a perched water table. The sand-based growing medium also resists compaction, allowing putting greens to accommodate a considerable amount of traffic while still providing a smooth, consistent putting surface. Superior drainage also means putting greens can be ready for play soon after heavy rainfall events.

Properly managed USGA putting greens have supported high-quality turf across a wide range of growing environments for many years. The USGA Recommendations are continually reviewed and updated to incorporate new scientific research, advances in technology, new construction methods, and field observations. When followed, these science-based recommendations for putting green construction provide a sound foundation for sustainable, high-quality putting surfaces.

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