



*Almouj Golf – The Wave Muscat – Oman*

# *Your* **Soil Structure** *Guide*

# PROFILE GOLF™:

## Experts in Soil Solutions

Profile Golf™ is a comprehensive program designed to advance long-term turf health and deliver more cost-effective turf establishment. Profile Golf is the first and only program of its kind—one that helps golf course architects, builders

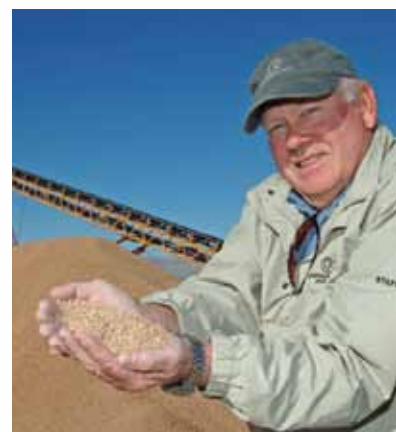
and superintendents realize greater synergy in finding soil solutions. Our commitment to support conservation practices and the environment is evidenced by our charter membership in Audubon International's Conservation Country Club.

### *Solutions for your Environment™*

Profile Products delivers proven solutions for many different environments—all with an eye toward being friendly to the environment. From erosion control and vegetative establishment to golf course construction and maintenance, Profile® brings knowledgeable people, purpose-driven products and groundbreaking technology on-site for you. Our system of innovative technologies and consultation make turf establishment a sure thing, ongoing maintenance less of a chore, and soil erosion a thing of the past.

Profile works to understand customer objectives—then leverages its expertise in soil science to provide the highest performing root zones and most complete seed germination. Over 3,500 golf courses around the world utilize Profile's products and services throughout the course. Count on the world-class performance of Profile Products for your course.

*For more information, visit [www.profilegolf.com](http://www.profilegolf.com).*



*The Bay Club, Mattapoisett, MA*

# Agronomic Consultation

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Profile's ability to offer the world innovative soil solutions is unparalleled. We have assembled a support team with over 120 years of golf course experience, which provides agronomic expertise and leadership for your project.

Whether you are renovating your greens or working with new construction, our Project Management team will help. We meet with key individuals, architects and builders. We help you select sands, perform root zone tests and recommend the final root zone mix. We also offer quality testing and ongoing support.

The support team of Profile® Project Managers will assist and guide you through the *four main areas* of project management. The Profile team will help you achieve outstanding results through our products, people and services.

## 1. Pre-Construction Management

- Establishing Project Objectives & Priorities
- Testing of Selected Raw Material
- Root Zone Formulation Worksheets
- Sourcing Raw Material
- Developing Root Zone Mix Specifications
- Conducting Pre-Project Instruction Meeting(s)

## 2. Construction Management

- Securing Raw Materials
- Coordinating Blended Root Zone Delivery
- Scheduling Project Tours
- Contracting with Material & Blending Services
- Pre-Blending Quality Control Testing
- Testing Quality Control During Blending
- Responding to Project Site Emergencies (if needed)

## 3. Post-Construction Management

- Grow-in Guidelines
- Quality Control Test Result Copies
- Maintenance Recommendations

## 4. Ongoing Support

- Annual Site Tour
- Profile Mailing & Research Updates
- Technical Support/Recommendation as Needed

Profile's team of consultants and agronomists are specially trained in root zone development, erosion control and turf establishment and are available to assist you with your new construction or renovation project. Contact your local Profile Distributor or call Profile Products at **1-800-508-8681** to request a free project consultation.

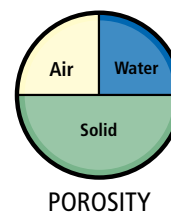
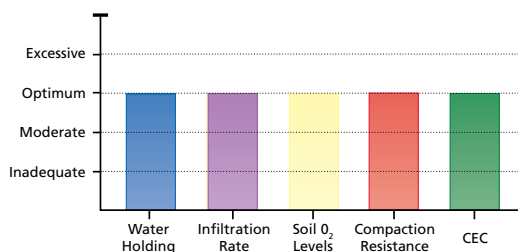
# The Hidden Foundation of Healthy Turf

## What Causes Turf Problems

To solve turf problems on your course, it's important to understand how soil itself can impact the issue. Let's examine the causes of common problems in sand-based root zones, along with the ideal soil composition.

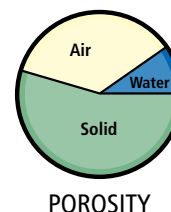
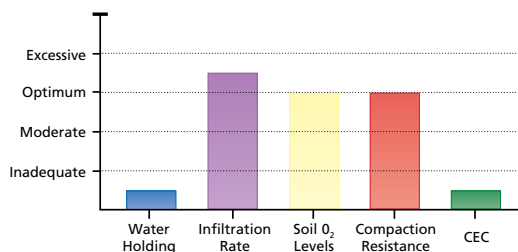
### IDEAL SOIL

Ideal soil contains 50% solid and 50% pore space. The 50% pore space should be 1/2 capillary (water holding) and 1/2 non-capillary (air holding and drainage).



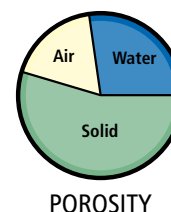
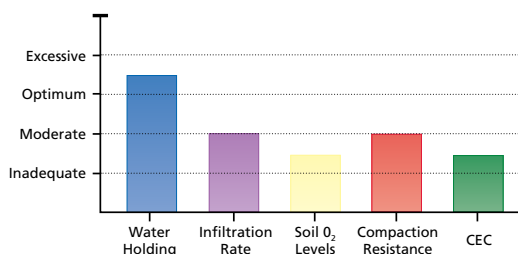
### SAND-BASED ROOT ZONE

Sand soils resist compaction, but have little water and nutrient holding ability.



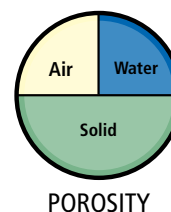
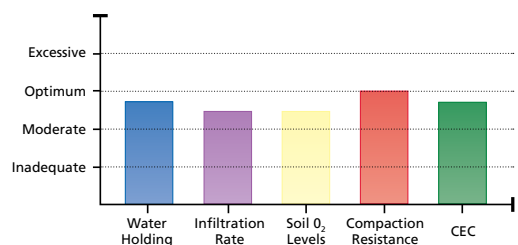
### SAND/PEAT MIX

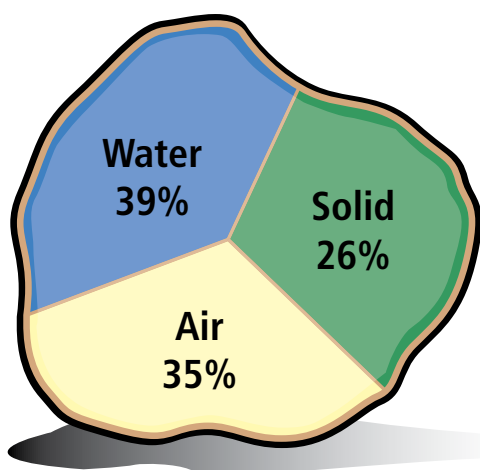
Peat is added to sand-based soils to improve water and nutrient holding. However, peat slows drainage, changes over time and decreases the air space in the soil. It also reduces non-capillary pore space.



### SAND/PROFILE MIX

Profile brings sand back to ideal soil conditions by balancing pore space and providing excellent air space. It also increases moisture and nutrient retention.





## Profile® Porous Ceramic

- High Total Porosity 74%
- Balanced Pore Space  
Air-Holding 35%  
Water-Holding 39%
- High Stability (3% degradation in 20 years)
- CEC 33 meq./100g (Profile base mineral was clay)

### The components of Profile Porous Ceramic include:

- Illite clay (clay has CEC to hold nutrients)
- Opal CT (provides air- and water-pore space)
- Quartz (provides durable, stable long lasting particle)

RE: FarmLinks/Pursell Farms

## PHYSICAL ANALYSIS



100% SAND  
SAND/PROFILE BLEND  
SAND/PEAT BLEND

MIXES ANALYZED (% by Volume)			SATURATED HYDRAULIC CONDUCTIVITY in/hr (mm/hr)	POROSITY (%)		
AMENDMENT Profile	SAND Superior 102 Fine	AMENDMENT Sphagnum Peat		NON-CAPILLARY (large)	CAPILLARY (small)	TOTAL
0	100	0	30.9 (784.9mm)	27.9	16.9	44.8
15	85	0	37.4 (949.9mm)	30.5	19.4	49.9
0	85	15	17.0 (431.8mm)	25.8	22.1	47.9
USGA® Recommendations for Root Zone Mix:			Normal Range: 6-12 Accelerated Range: 12-24	15-30	15-25	35-55

### SAND/PROFILE vs. 100% SAND

18% increase in Drainage  
9% increase in Non-Capillary (air pore space)  
13% increase in Capillary Pore Space (water-holding space)  
18% increase in Total Porosity

### SAND/PEAT vs. 100% SAND

45% *decrease* in Drainage  
8% *decrease* in Non-Capillary (air pore space)  
24% increase in Capillary Pore Space (water-holding space)  
6% increase in Total Porosity

## THE PROBLEM-SOLVING POTENTIAL OF PROFILE®

Profile can be used to remedy a wide variety of common turf problems. Some examples:

- Localized dry spots
- Organic buildup in the top four inches of old greens
- Shallow rooting
- Salt buildup from poor quality irrigation water
- Sand that doesn't meet USGA® guidelines
- Greens that don't hold enough moisture or nutrients
- Soggy greens
- Greens with algae buildup
- Wet wilt in the summer months
- Compaction in high-traffic areas such as tees
- Dessication of bunker banks and lips



# Profile Golf™ Products:

## Changing Your Course for the Better

### PROFILE® POROUS CERAMIC: PROVIDING BALANCE FOR YOUR ROOT ZONES

The inorganic soil amendments are mined and processed at our facilities located in northern Mississippi. The mineral is kiln-fired in a computer-controlled process that changes it into a dust-free porous ceramic particle with uniform particle size and the ability to withstand intense traffic. Profile Porous Ceramic mixes meet the specifications outlined in the USGA's *Recommendations for a Method of Putting Green Construction* and are used on courses throughout the world.

Profile Porous Ceramic is used to replace peat and permanently improves the air/water balance and nutrient holding ability of sand root zones. It has been proven on thousands of golf courses and major turfgrass universities around the world—from public links to PGA tournament sites. Real world success and years of independent university studies leave no doubt that Profile is more effective than peat or other inorganic amendments at balancing air and water pore space and enhancing nutrient uptake over the lifespan of your greens.



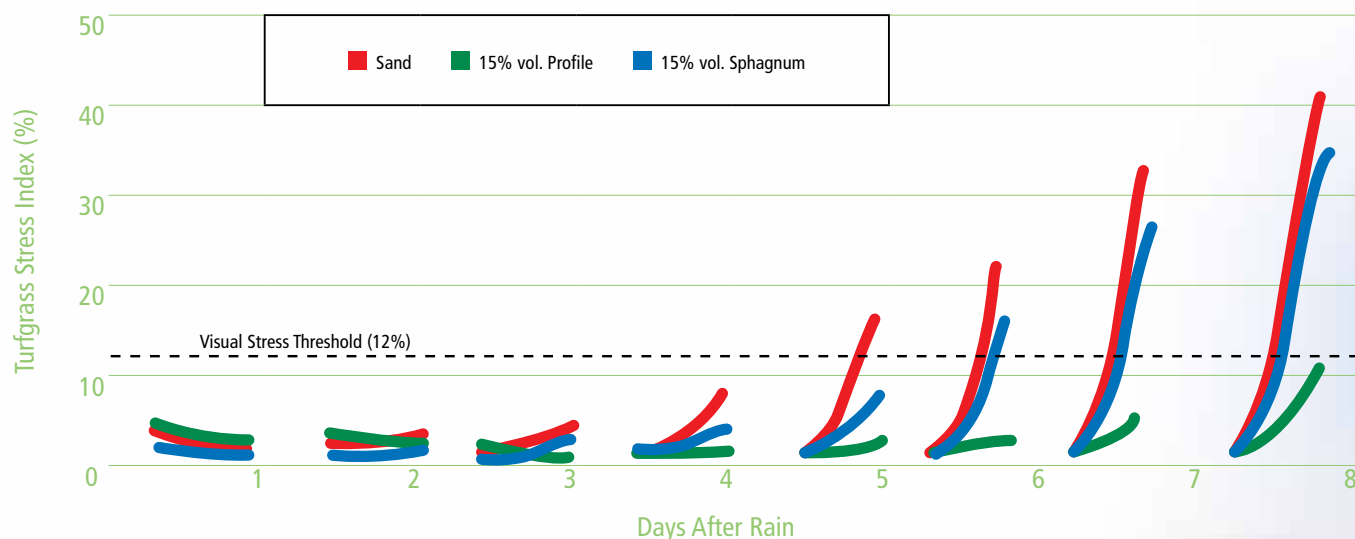
#### Profile Porous Ceramic for Sand-Based Root Zones

Profile's computer-controlled manufacturing process provides consistent particle sizing that falls within the medium to coarse particle range of the USGA® guidelines, which is .25 mm to 1 mm. Our Emerald particles are ideal for masking worn areas of your greens. The Profile team can meet with you to discuss your needs and particular situation, develop the best root zone mix recommendations and then help obtain the mix ingredients—all at no extra charge.

# Proven Performance

## Greater Drought Resistance

Recent computer modeling studies, completed by Dr. Ed McCoy with The Ohio State University, examined differences in watering frequency of three different mixes in sand-based soils. The studies were completed using a validated simulation of water flow and turfgrass stress within a USGA putting green. These studies addressed root zone water retention, hydraulic conductivity, turfgrass stress and root zone aeration in three root zone samples: unamended sand, a 15 percent by volume Profile Porous Ceramic, and a 15 percent by volume sphagnum peat.



*The lines show increasing drought stress during the daylight hours.*

The Profile-amended root zone increases oxygen levels to allow for deeper rooting and better utilization of water throughout the root zone. Comparing the curves from days 4 to 7 shows that the Profile amended root zone delayed the onset of drought stress by about 3 days relative to un-amended sand and by about 2 days compared to sphagnum peat amendment.

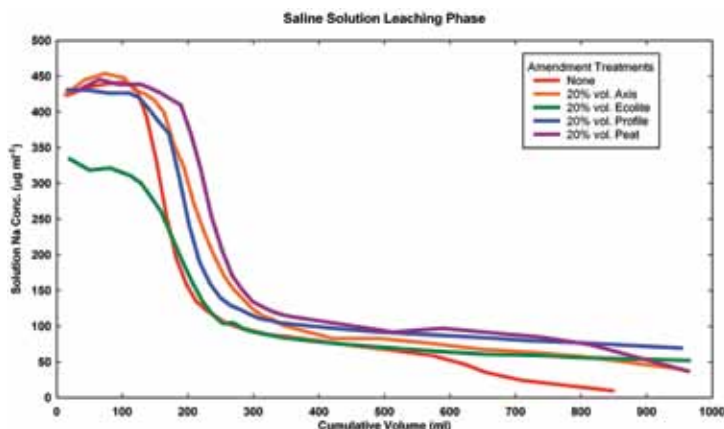
# Proven Performance

## Managing Salinity

### RESEARCH PROVES NO SALINITY HAZARDS USING INORGANIC AMENDMENTS

Inorganic amendments such as Profile® Porous Ceramic are used to increase water and nutrient retention in sand-based root zones. However, there has been a perception that root zones containing these amendments may lead to salt retention within the root zone.

A column leaching experiment was conducted at The Ohio State University by Ed McCoy, Ph.D. and Keith Diedrick, Ph.D., to determine if the presence of inorganic amendments within the root zone had an influence on the leaching of salts from a putting green soil profile. Comparisons were made between an unamended sand root zone, and root zones containing Profile, Axis®, Ecolite® and sphagnum peat.



This chart shows that the breakthrough curves for Na were all similar. There was no significant difference in leaching among the inorganic amendments. The organic peat was found to be the most delayed for salt leaching. Additionally, any leaching differences were related to the water contents of the columns prior to leaching.

This experiment did not find any kind of salinity hazard from the use of high rates of inorganic amendments within turfgrass root zones. The diffusive salt exchange between the leachable, inter-particle porosity and the non-leachable, internal porosity was sufficiently rapid, indicating that a typical irrigation cycle should displace accumulated salts.

For a detailed explanation of this experiment, visit [www.profileevs.com/dissolved-salts](http://www.profileevs.com/dissolved-salts).

*"Working with Profile is not just about quality products. The knowledgeable Profile staff and the company itself made our reconstruction a great experience. Our decision to use Profile Porous Ceramic Greens Grade was the right choice to replace peat. It dramatically improved the percolation rate and the nutrient-holding ability of our sand-based root zone."*

Shawn Emerson,  
Director of Agronomy, Desert Mountain



# Solving Common Problems: Profile® Field & Fairway™

## Help Turf Survive with Profile Field & Fairway

FIELD & FAIRWAY

Profile® Field & Fairway™ is a larger particle size than Profile Porous Ceramic. It helps turf in native soils survive under intense traffic. When you incorporate it into the root zone, it adds porosity to prevent compaction in high traffic areas. Profile Field & Fairway will hold moisture, nutrients and provide a permanent balance of air and water pore space to increase drainage and prevent muddy conditions that destroy turf.

### NATIVE SOIL ROOT ZONE

Native soils are comprised of sand, silt and clay particles combined to form aggregates of larger particles. Typically they have some organic content. These soils tend to compact easily creating an imbalance of non-capillary pores (air holding pores) and capillary (water holding pores). This imbalance of too much water and not enough air results in shallow root zones and unhealthy turf.



### Profile Field & Fairway Granules

Profile Field & Fairway dramatically improves the oxygen, moisture and nutrient holding ability of native soil root zones. Field and Fairway can also be used to conceal worn areas of your course and prevent mud and damage in walkways and heavy traffic areas. For additional cosmetic benefit, try our Field & Fairway Emerald particles.

# Profile Golf™ Products:

## Working It Into Your Soils



### TOPDRESSING WITH PROFILE®

Topdressing with a sand/Profile blend as part of your regular maintenance program is an ideal way to solve current problems and prevent future problems. An ideal way to incorporate the product is by backfilling aerification holes. The porous ceramic particle wicks and holds moisture in its capillary pore space, while the non-capillary pore space allows quick drainage of excess moisture which in turn draws oxygen back into the soil.



### AERATE OR USE DRYJECT® SERVICE WITH PROFILE

Aerate or use the DryJect service to simultaneously aerate, topdress and amend with Profile. DryJect's high-speed, water-based injection system blasts aeration holes through the root zone while simultaneously filling with large amounts of amendment (up to 8 cubic yards per acre/15.3 cubic meters per hectare), leaving the surface smooth and ready for play.



Construction of Whisper Rock Golf Club, Scottsdale, AZ

### GREENS RENOVATION AND CONSTRUCTION WITH PROFILE POROUS CERAMIC

You only get one chance to build your greens right. The Profile team will help you source the best root zone material, assist in testing mixes, identify erosion-prone areas and follow through with quality control testing and monitoring to make sure it's done right. Including Profile Porous Ceramic in your root zone ensures long-lasting air- and water-holding capacity, effective nutrient retention, and improved drainage for your greens.

# The Supporting Facts

## Research

### **LOCALIZED DRY SPOT**

**University of Florida**  
**Profile® Porous Ceramic**  
**1995-present**

Dr. Grady Miller reports, "The statistical trend indicates Profile-amended plots to be the highest in quality and with the least L.D.S. symptoms."

**Tifton Physical Soil Labs**  
**Profile Porous Ceramic**  
**1992-present**

Powell Gaines reports, "In every sand tested, Profile always increases water retention without sacrificing percolation rates."

**University of Missouri**  
**Profile Porous Ceramic**  
**1992-1995**

Dr. Dave Minner concludes, "After three years of research, plots topdressed with Profile significantly improved turf quality and reduced localized dry spot injury."

**Penn State University**  
**Profile Porous Ceramic**  
**1995-present**

Dr. Charles Mancino says, "Plots topdressed with Profile had higher overall quality than plots topdressed with sand during drought stress. The 100% Profile topdressed plots exhibited higher quality and lower drought stress than wetting agent-treated plots."

### **HIGH-TRAFFIC AREAS**

**Iowa State University**  
**Profile® Field & Fairway™**  
**Three-Year Study**

1- and 2-ton rates per 1,000 square feet of Profile Field & Fairway were tilled into intense traffic sports fields with native soil. Results of the study showed that the plots revealed significant reductions in bulk density with the 1- and 2-ton rates, indicating more favorable bulk density and less compaction.

### **POOR DRAINAGE AND OXYGEN IN THE ROOT ZONE**

**University of Missouri**  
**Profile Porous Ceramic**

It was found that all the greens constructed with Profile (as compared to peat root zone) had significantly higher water infiltration. After four years of topdressing with Profile, it was found that Profile doesn't produce the negative effects of layering.

**University of Florida**  
**Profile Porous Ceramic**

It was reported that hydraulic conductivity increased with an addition of Profile.

**Pennsylvania State University**  
**Profile Porous Ceramic**

A field study conducted showed that no physical obstruction (such as layering) occurred using Profile.

### **CONSTRUCTION AND REBUILDS**

**University of Missouri**  
**Profile Porous Ceramic**

Greens constructed with sand and Profile versus sand and peat ALWAYS had higher infiltration and perc rates. Also, when Profile was used in a 15% to 30% construction mix, root branching and root volume increased as the amount of Profile in the mix increased.

### **TOPDRESSING NUTRIENT RETENTION**

**North Carolina State University**  
**Profile Porous Ceramic**

Profile blended into organic potting mixes, reduced leaching of potassium and made more potassium available to the plant.

**University of Missouri**  
**Profile Porous Ceramic**

The top three inches of soil topdressed with Profile had more potassium than the plots topdressed with sand.

**Ohio State University**  
**Profile Porous Ceramic**

Increased Profile percentages resulted in a uniform increase in CEC for all sand and sand/peat blends. Profile has the ability to reduce potassium leaching and make potassium available to the plant.

**University of Florida**  
**Profile Porous Ceramic**

Adding 10% Profile to the sand increased potassium concentration 256% in tiftwarf bermuda tissues. Diatomaceous earth and peat are not adequate in retaining potassium compared to Profile.

### **REDUCED DROUGHT STRESS**

**The Ohio State University**  
**2010 - Present**

Computer modeling studies, completed by Dr. Ed McCoy confirmed that a root zone amended with 15% Profile can delay the onset of visual drought stress by up to 3 days relative to un-amended sand and by about 2 days compared to a sphagnum peat amended root zone.

### **DISSOLVED SALTS**

**The Ohio State University**  
**2011 - Present**

A non-equilibrium sorption experiment, completed by Dr. Ed McCoy and Dr. Keith Diedrick, cited that no salinity hazard exists using Profile inorganic amendments.



# Comprehensive, Sustainable Solutions for your Environment



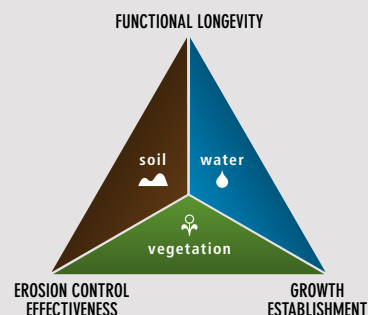
## GREEN DESIGN ENGINEERING™

EARTH-FRIENDLY SOLUTIONS  
FOR SUSTAINABLE RESULTS™

Profile® offers environmentally sound, site-specific solutions for your environment. These solutions include soil modification, erosion control and plant establishment. Many of today's industry standards were innovations developed and introduced by Profile, incorporating Green Design Engineering™.

This holistic approach combines environmentally beneficial project design with products that are ecologically responsible to help you maximize erosion control and vegetation establishment on slopes, channels, shorelines, fine turf areas and environmentally sensitive sites. The utilization of Green Design Engineering technologies assures you are contributing to today's most effective, cost-efficient and earth-friendly erosion control solutions for your environment.

## Green Design Triangle



We strive to promote healthy vegetation by balancing *natural variables* and *product benefits* to create the best environment for the plants.



Solutions for your Environment™



A MAJOR PARTNER  
IN EDUCATION



**CENTAUR**  
ASIA PACIFIC

Hong Kong | Singapore | Malaysia | Australia

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[www.profileproducts.com](http://www.profileproducts.com)

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