



Turf & Soil Diagnostics

November 29, 2016

Paul Hagy
Texas Sports Sands
702 Easy Street
Garland, TX 75042

TSD File #16110081

The Arkansas White Bunker Sand sample was tested as received. This sample was evaluated for use in sand bunkers. These results are being compared to published guidelines for bunker sands.

To measure the potential of a sand to produce fried egg lies or buried balls, we measure the resistance of the sand to ball penetration using a penetrometer. Values between 1.8 and 2.4 kg/cm² are considered acceptable with values above 2.4 kg/cm² considered desirable. The sample has a penetrometer value of 3.7 kg/cm², which suggests a very low tendency to bury the ball.

The crusting and setup values suggest that bunkers with this sand in place may not require significant raking after rainfall or irrigation events.

The infiltration rate of this sample is 32.9 in/hr, which meets the recommended minimum infiltration rate for a well-drained bunker sand. This suggests that bunkers built with this sand should initially exhibit good internal drainage.

It is desirable for a bunker sand used in green side bunkers to be compatible with the rootzone to reduce the risk of layering on the greens. The particle size results indicate the sample meets the bunker sand guidelines. The sample is slightly finer than USGA particle size recommendations for greens, which suggests a potential risk of layering from sand splashed from green-side bunkers onto nearby USGA style greens.

Despite this testing, bunker sand selection is highly subjective. Aside from playability, factors such as color and aesthetics are often weighed in the decision process. We recommend that golf course superintendents, pros, greens committee chairs, and any other interested parties visit a club with the sand in use or build a test bunker. Play into and out of it to see how they like it.

If you have any questions or are in need of further assistance, please do not hesitate to contact us. Samples are generally kept on the premises for 45 days after report date. Thank you for using Turf & Soil Diagnostics, Inc.

Sincerely,

Duane K. Otto
Vice President



Turf & Soil Diagnostics

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 Paul Hagy
 702 Easy Street
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Date received Nov-21-2016
Date Reported Nov-29-2016
Facility Product Development

Bunker Sand Evaluation

Lab ID#	Sample Name	Dry Color	Wet Color	Penetrometer Value kg/cm ²
16110081-1	Arkansas White Bunker Sand	White w/Black Specks	10YR 8/1 White w/Black Specks	3.7

Lab ID#	Sample Name	Shape Angularity	Shape Sphericity	Crusting	Set-Up
16110081-1	Arkansas White Bunker Sand	Angular to Sub-Angular	Medium to Low	None	None

Bunker SOP

Samples were tested as received and comments pertain only to the samples shown.
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 Sample condition upon receipt was normal.
 Samples were received without a transmittal letter.



Photomicrograph of Lab ID 16110081-1 Arkansas White Bunker Sand.

Reviewed by Duane K. Otto



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Particle Size Evaluation*

Lab ID#	Sample Name	% Retained mm (US sieve)										
		% Sand 2.0 - 0.05 mm	% Silt 0.05-0.002mm	% Clay < 0.002mm	Gravel 4.0 (5)	Gravel 2.0 (10)	V. Coarse 1.0 (18)	Coarse 0.5 (35)	Medium 0.25 (60)	Fine 0.15 (100)	Fine 0.10 (140)	V. Fine 0.05 (270)
16110081-1	Arkansas White Bunker Sand	97.9	< 1.0	< 1.0	0.1	1.0	3.6	31.8	34.3	19.0	6.6	2.5
USGA Recommendations for Greens		≥ 92%	≤ 5% Silt	≤ 3% Clay	≤ 3% Gravel ≤ 10% Combined		≥ 60% Combined		≤ 20%	≤ 5%***		
Bunker Sand Guidelines ¹			≤ 3%		≤ 2%	≤ 15%	78 - 100%				≤ 5%	

¹ From Golf Course Management 54:64-70, 1986

² From USGA Green Section Record 36:9-12, 1998

Lab ID#	Sample Name	Uniformity Coefficient Cu	D15 mm	D50 mm	D85 mm	Shape Angularity	Shape Sphericity	USDA Textural Classification	Acid Reaction	Infiltration Rate** in/hr	Infiltration Rate** cm/hr	Bulk Density g/cc
16110081-1	Arkansas White Bunker Sand	3.1	0.17	0.38	0.80	Angular to Sub-Angular	Medium to Low	Sand	None	32.9	83.7	1.51
Bunker Sand Guidelines ²		-	-	-	-	-	-	-	-	> 20	> 50	-

*ASTM F1632 Method A & Determination of Size Factors SOP

***Maximum of 10% combined on Very Fine Sand, Silt, and Clay fractions.

**ASTM F1815 30 cm Tension

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