



April 20, 2022

Ian Freeman
Covia – Best Sand
11830 Ravenna Road
Chardon, OH 44024

TSD File #22040060

Enclosed are the results of the Signature 500 sample received by our laboratory on 4/14/2022 from Best Chardon. This sample was tested as received for potential use as bunker sand. Bunker sand criteria published in a 2020 issue of the USGA Green Section Record are referenced in this report.

The particle size test results indicate that the sample is uniformly graded sand with most of the particles in the medium and fine sand size fractions. The particle size results meet bunker sand guidelines, but the gradation is finer than the USGA putting green recommendations. The gradation suggests the sand may present a layering risk if splashed from green-side bunkers onto coarser graded greens.

The sand particle shape is angular to subrounded. Generally angular sands are preferred for bunkers.

There is no crusting of the sand after wetting and drying. This suggests that bunkers with this sand in place shouldn't require significant raking after rainfall or irrigation events.

A minimum infiltration rate of 30 inches per hour is generally recommended for bunker sand, though some construction methods may differ. The sand has infiltration rate that meets this minimum.

To measure the potential of a sand to produce fried egg lies or buried balls, resistance of the sand to ball penetration is measured with a penetrometer. The sample has a penetrometer reading of 2.0 kg/cm². While there are varying assessments of this test, results between 1.8 and 2.4 kg/cm² are generally considered acceptable, while values above 2.4 are more desirable as they suggest potential for fewer instances of buried lies.

The sample has an angle of repose of 30 degrees, with a straight pile shape.

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 interested parties visit a club with the sand in use, play into and out of it, and see how they like it.

If you have any questions or need further assistance, please contact us. Samples are generally kept on the premises for 45 days after report date. Thank you for using Turf & Soil Diagnostics, Inc.

Sam Ferro
President



Turf & Soil Diagnostics

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Date Received Apr-14-2022
 Date Reported Apr-20-2022
 Facility Best Chardon

Bunker Sand Evaluation*

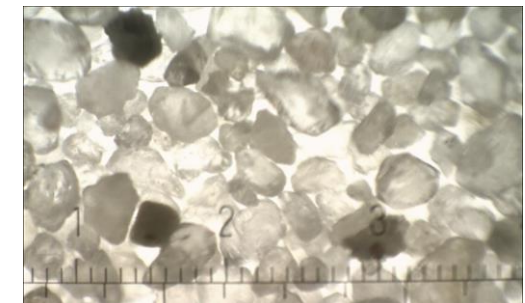
Lab ID#	Sample Name	% Sand 2.0 - 0.05 mm	% Silt 0.05-0.002mm	% Clay < 0.002mm	Gravel 4.0 (5)	Gravel 2.0 (10)	% Retained mm (US sieve)					
							V. Coarse 1.0 (18)	Coarse 0.5 (35)	Medium 0.25 (60)	Fine 0.15 (100)	Fine 0.10 (140)	V. Fine 0.05 (270)
22040060-1	Signature 500	98.6	< 1.0	< 1.0	0.0	0.8	4.5	12.0	53.6	25.1	2.7	0.6
Bunker Sand Guidelines ¹			≤ 3%		≤ 2%		≤ 15%	78 - 100%				≤ 5%
USGA Recommendations for Greens		≥ 92%	≤ 5% Silt	≤ 3% Clay	0%	≤ 3% Gravel ≤ 10% Combined	≥ 60% Combined		≤ 20%	≤ 5%***		

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
22040060-1	Signature 500	2.2	0.19	0.33	0.57	Angular to Sub-Rounded	Medium to High	Sand	None	36.2	92.0	1.55
Bunker Sand Guidelines ¹		2.0 - 5.0	-	-	-	-	-	-	-	> 30	> 75	-

USGA Rootzone Coefficient of Uniformity Recommendations: 1.8 to 3.5 for Mixes with Peat; 2.0 to 3.5 for Mixes with Inorganic Amendment or Pure Sand.

**ASTM F1815 30 cm Tension

Lab ID#	Sample Name	Dry Color	Crusting	Penetrometer Value kg/cm ²	Angle of Repose	
					Angle (°)	Shape of Pile
22040060-1	Signature 500	2.5Y 8/2 Pale Brown	None	2.0	30	Straight



Photomicrograph of Lab ID 22040060-1 Signature 500.

*ASTM F1632 Method B, Determination of Size Factors SOP, & Bunker Sand SOP

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

¹ USGA Green Section Record Volume 58, Issue 11, June 2020

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 with a transmittal letter.

Reviewed by Sam Ferro