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ACCREDITED
TESTING CERT #1014.01

Date Received: June 21, 2021
Date Reported: June 23, 2021
Sample Number: L136A-21

Test Report For: Bulldog Field Equipment
4250 Longwood Avenue NW
Roanoke, VA 24017
Attn: Chad Kropff

RE: Topdressing Sand Test

PHYSICAL ANALYSIS[1]

MIXES ANALYZED (% by Volume)			SATURATED HYDRAULIC CONDUCTIVITY in/hr	POROSITY (%)			BULK DENSITY g/cm³	WATER RETENTION AT FIELD CAPACITY %	CHEMICAL	
SOIL	SAND	AMENDMENT		NON-CAPILLARY (air-filled)	CAPILLARY (water-filled)	TOTAL			pH[2]	EC[3] mmhos/cm
Topdressing Sand			12.8	24.2	20.3	44.5	1.47	13.8	5.0	
General Recommendations for a Topdressing Sand:			≥ 20 in/hr.							

PARTICLE DENSITY[4] 2.65 g/cm³

PARTICLE SIZE ANALYSIS

SAMPLES	GRAVEL 2 mm %	SAND FRACTIONS (% Retained)[5]					SAND[6] 0.05-2 mm %	SILT[6] 0.002-0.05 mm %	CLAY[6] <0.002 mm %	ORGANIC MATTER[7] % by wt.
		VERY COARSE 1 mm	COARSE 0.5 mm	MEDIUM 0.25 mm	FINE 0.15 mm	VERY FINE 0.05 mm				
Td Sand	0.5	0.8	7.4	45.9	29.1	13.9	97.1	1.6	0.8	
			← Topdressing Sand →							
USGA Recommendations for a Topdressing Sand:	≤ 10% (≤3% gravel)		60% minimum		≤ 20%	≤ 5%		≤ 5%	≤ 3%	

Note: Coarse Gravel (>4 mm) should be 0%. Total "fines" (very fine sand, silt, and clay) should be less than (<) 10% in a rootzone mix.

1. Determined at 30 cm tension by USGA testing protocol (ASTM F1815) 2. ASTM D4972 Method A (water only) 3. SSSA Soluble Salts 4. ASTM D854-98 5. ASTM C136 and F1632 6. Bouyoucos, 1962 7. ASTM F1647

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RE: Topdressing Sand Test

Recommendation Form (Version 2) - Effective Date: 6/2/21

Recommendations:

The Topdressing Sand from Bulldog Field Equipment was evaluated on June 22, 2021, to determine if it meets USGA recommendations for a topdressing sand as requested. The condition of the sample as received was normal.

The Sand is a medium type sand that is finer (18.0%) than USGA recommendations for a topdressing sand. The Sand has 29.1% fine sand particles whereas the USGA recommends $<20\%$ and 13.9% very fine sand particles whereas the USGA recommends $\leq 5\%$ in a topdressing sand.

The Sand has 82.4% particles within the USGA range of 1.0 - 0.15 mm for topdressing sand. This is not a high percentage of particles within this range, with a majority of the particles (45.9%) in the medium sand fraction range. The USGA has recognized for many years that the medium sand fraction is the best sand fraction for a topdressing sand.

The Sand has a Coefficient of Uniformity (D_{60}/D_{10}) of 3.0, which is within the USGA recommended range of 2.0 - 3.5 for Pure Sand Rootzone Mixtures (USGA Recommendations for a Method of Putting Green Construction, 2018 Revision).

The Sand is a silica sand and not a calcareous sand with a soil water pH of 5.0.

The Sand had a low water permeability rate of 12.8 in/hr. when compacted by the USGA procedure ASTM F1815 to simulate a compacted golf green. A topdressing sand should have a water permeability rate >20 in/hr. to allow for adequate drainage.

Conclusion: This Sand is finer than USGA recommendations for a topdressing sand. Champion Dwarf Bermudagrass greens have their own specs for a greensmix/topdressing sand, which is finer than USGA recommendations, and this Sand would meet those specs. The Sand as is would be good sand to use for a Sportsturf Rootzone Mix (SRM) Sand for athletic field construction because of the fines. The field would set up firm not loose to insure good footing. The water permeability rate of 12.8 in/hr. is within our recommended initial rate of 8 to 15 in/hr. for a SRM Sand (see attached article).

Hope Mullis

Sportsturf Rootzone Mix (SRM) Sands

By Powell Gaines, Tifton Physical Soil Testing Laboratory, Inc.

A Sportsturf Rootzone Mix (SRM) Sand for athletic field construction should have more fines (total of very fine sand, silt and clay) than a USGA golf green construction sand because it has to withstand the heavy mechanical stress associated with the rigors of athletic competition. For example, a football scrimmage on a USGA golf green would be quickly destroyed because the players' cleats would rip through the canopy of the green. Fines are needed in a SRM to allow the field to set up firm, not loose, to ensure good footing.

Coarse sands should not be used for SRM Sands because they would cause the field to set up loose with unstable footing and would be a slow track. Also the field would require more unnecessary maintenance to overcome drought and fertilizer leaching. If a coarse sand is used, it should be amended with 10-20% soil to develop a SRM with optimum physical properties.

Optimum physical properties for a SRM for athletic field construction would be a water permeability rate of about 8-15 in/hr., a good balance in the non-capillary (air-filled) and capillary (water-filled) porosities, and water retention of 12-18% to reduce fertilizer leaching.

Rototilling 80-90% sand into an old existing loamy soil sports field to develop a SRM with optimum physical properties is not a very exact or practical way to develop a SRM with optimum physical properties. For an 8" cap, this would be removing about 6-7" of the existing field, rototilling 6.4 - 7.2" of sand into only 0.8 - 1.6" of soil, which would not be a very exact or realistic way to establish a good uniform 8"cap. Instead, using 8"of a straight "dirty" fine sand with about 6-10% silt and clay would serve the same purpose and would involve a lot less work, be less expensive, and would be a better, more uniform sand cap.

To eliminate the need of mixing a large amount of sand with a small amount of soil to develop a SRM with optimum physical properties for an athletic field, a fine "dirty" sand could be used instead. Such a sand could be used straight with no soil amendment because such a sand already has an adequate amount of fines to allow the field to set up firm, not loose, to ensure good footing. Also a dirty fine sand with about 6-10% silt and clay (<5% clay) would have a water permeability rate of about 8-15 in/hr., a good balance in air-filled and water-filled porosities, and adequate water retention of 12-18%. Dirty fine sands can be local unwashed creek bank sands which typically fit this description. Such sands usually are considered low quality sands because of the 6-10% silt and clay (mostly silt), and would be expected to be relatively less expensive than higher quality washed sands. Dirty fine sands can be the "finished product", and are good Sportsturf Rootzone Mix (SRM) Sands that our lab recommends for athletic field construction.