CASE STUDY

NEW YORK GOLF COURSE FOUNDATION BEST MANAGEMENT PRACTICES

Nutrient Management Planning @ Sunken Meadow State Park

Project Details

- **Location:** Kings Park, New York
- **Annual rounds of golf:** +/- 75,000
- **Staff:** 11, including mechanic and P/T seasonal workers.
- **Acres:** 100 (mapped)
- **Public or Private:** Public

- **BMP Implementation**: Soils mapping and nutrient management planning

- **Cost:** $90-$150/acre for detailed, on-site soils mapping

Overview

By accurately mapping golf course soils, superintendents can reduce, or possibly eliminate, supplemental fertilizer applications. These reductions can reduce the potential off-site movement of nutrients into ground and surface water, while still meeting turfgrass needs. Once mapped, soil mapping data can be interpreted using Minimum Levels for Sustainable Nutrition (MLSN) soil guidelines and growth potential (GP) models to determine the most efficient application of fertilizers.

To evaluate this methodology, a case study site was selected, soils mapped, and a nutrient management plan (NMP) developed for tees, fairways, and roughs at Sunken Meadow State Park in Kings Park, NY. The NMP final product from this effort identifies the appropriate timing, amount, and form of nutrients that can be applied to an area based on soil properties, turf species, topography, use, and proximity of the fertilized areas to environmentally sensitive areas.

MLSN Guidelines and GP Models

MLSN guidelines were introduced in 2012 by Pace Turf and the Asian Turfgrass Center for interpreting Mehlich-3 soil test results for producing acceptable turfgrass conditions. It focuses on reducing inputs and costs, improving sustainability, and maintaining turfgrass performance and health.

As opposed to conventional soil nutrition guidelines which identify optimum levels of soil nutrition, the MLSN guidelines identify the minimum levels of soil nutrients which can provide good turf performance. MLSN guidelines can be used in combination with the GP model (also developed by Pace Turf) which describes the relationship between turfgrass growth, temperature, and nutrient needs. For example, growth potential is greatest at 68F (20C) for cool-season turf, and 88F (31.1C) for warm-season turf. GP model values >50% indicate vigorous growth.

As growth increases (as indicated by the model as a percentage) turfgrasses require more inputs including supplementary fertility applications. By utilizing the GP model, turfgrass managers can adjust their maximum nitrogen input per month in to support increased growth while estimating the other macro and micronutrient needs. These nutrient needs (as calculated by the GP model) can be compared to the MLSN guidelines to determine if fertilization is necessary to maintain healthy turfgrass conditions.

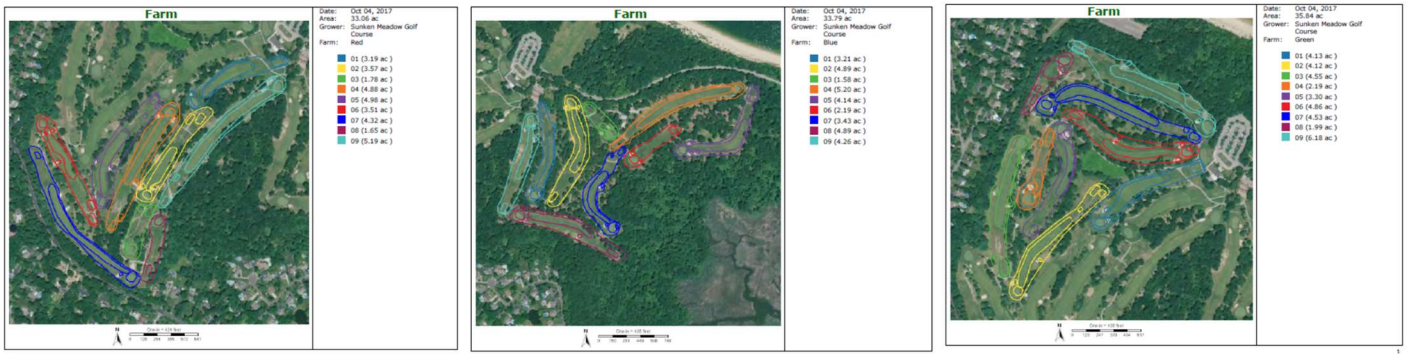
Figure 1. Veris 1000 sensor used to map soils at the case study site.

Case Study Site

The Governor Alfred E. Smith/Sunken Meadow State Park Golf course is a 27-hole facility consisting of three nine-hole courses (Red, Blue, Green). The facility was built in the early 1960s and was designed by golf course architect Alfred Tull. The turfgrass has been managed conventionally supplying mostly N as the primary nutrient to support turfgrass health and growth needed to withstand the level of traffic on the course.

Methods

The soils beneath the tees, fairways, and priority areas of the rough on each golf course were mapped over the entire utilizing a Veris 1000 sensor in July 2017 pulled behind a utility vehicle accounting for 100 total acres mapped. The Veris sensor measures electrical conductivity (EC) of the soil to map the spatial variability of the soil. Soil EC measurements are driven by soil texture and moisture and can be used to identify soil properties (such as salinity, sodicity, clay content, water content) valuable when managing plant and soil nutrition.



Soil mapping of the Red, Blue, and Green courses at Sunken Meadow State Park.

Using the resulting EC data, 3 representative soil samples per golf hole were harvested the following day. Soil sample analysis was conducted using the Mehlich-3 method. The sample data was then interpreted using the MLSN guidelines to generate nutrient management recommendations for P, K, Ca, Mg, and S. Though the soils were mapped for this case study using EC methods, less invasive electromagnetic induction (EMI) soil mapping methods are becoming more popular.

Pace Turf's Climate Appraisal Form was used to build the GP model and generate nitrogen fertilization recommendations. The form, which is free, allows users to input local weather data (30 year average monthly temperature and rainfall) to estimate turfgrass growth, nutrient needs, and withdrawals from the soil. The GP model utilizes the local weather information and the maximum nitrogen (N) rate per month (lb./1,000 ft^2) to estimate total N needed for the year and to estimate nutrient losses/usage that should be addressed in a fertility program. The Climate Appraisal Form and GP model allows users to adjust the maximum N rate per month, which affects turfgrass growth and subsequent soil drawdowns of P, K, and micronutrients. By using the GP model in concert with the MLSN guidelines, it is possible to supply only what is needed to support turf growth.

Results

MLSN guidelines are shown in Table 1. The climate appraisal form as populated with weather data for Sunken Meadow (Kings, Park, NY) is shown below.

Table 1. MLSN guidelines based on soil sample data from Sunken Meadow.

Nutrient	MLSN Guideline (ppm)
Phosphorus	21
Potassium	37
Calcium	331
Magnesium	47
Sulfur	7

Location: Sunken Meadow State Park, Kings Park, NY

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Avg T (F)	30.4	32.9	39.6	50.0	59.7	69.0	74.1	73.0	66.1	55.3	45.9	35.8
Rainfall (in)	3.7	3.0	4.2	4.5	4.2	4.2	4.0	3.9	4.5	4.6	3.8	4.2

Grass Maximum N/month lb/1000 sq ft = 0.50
Optimum Growth Temperature (F) = 68 Set to 68 for cool season and 88 for warm season grass
Variance = 10 Set to 10 for cool season and 12 for warm season grass

% Growth Potential	0	0	2	20	71	100	83	88	98	45	9	1	Total lb/1000 sq ft	Removed from Soil ppm	Plus MLSN ppm
N lb/1000 sq ft	0.0	0.0	0.0	0.1	0.4	0.5	0.4	0.4	0.5	0.2	0.0	0.0	2.6	NA	NA
K lb/1000 sq ft	0.00	0.00	0.00	0.05	0.18	0.25	0.21	0.22	0.25	0.11	0.02	0.00	1.29	42	79
P lb/1000 sq ft	0.00	0.00	0.00	0.01	0.04	0.06	0.05	0.06	0.06	0.03	0.01	0.00	0.32	11	32
Ca lb/1000 sq ft	0.00	0.00	0.00	0.01	0.04	0.05	0.04	0.04	0.05	0.02	0.00	0.00	0.26	8	339
Mg lb/1000 sq ft	0.00	0.00	0.00	0.01	0.02	0.03	0.03	0.03	0.03	0.01	0.00	0.00	0.16	5	52
S lb/1000 sq ft	0.00	0.00	0.00	0.01	0.03	0.04	0.03	0.03	0.04	0.02	0.00	0.00	0.19	6	13
Fe lb/1000 sq ft	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.013	0	44
Mn lb/1000 sq ft	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.005	0	6

Growth potential model and nutrient management guidelines.

Based on the data generated from the soil mapping, and utilizing the MLSN guidelines and GP model, the majority of soils at Sunken Meadow State Park do not require supplemental fertilization applications to support healthy turf. Based on the results, the nutrient deficiencies identified by the MLSN guidelines should be addressed by applying the necessary nutrients/amendments as calculated by the GP model. The fertilizer recommendations derived from the soil mapping and fertility data utilizing the MLSN guidelines represent a significant savings over previous soil interpretation guidelines.

Using these recommendations, the response from fertilizer inputs can be estimated to account for the depletion of soil nutrients. To do this, plant growth and clipping yield can be monitored as the growing season progresses. Going forward, fertility inputs of nutrients should be reviewed within the context of the MLSN guidelines and documented to provide a baseline for future management decisions.

Since the conclusion of the mapping project, the turfgrass areas mapped and analyzed have been fertilized with only N at a max rate of 3 lbs./1000ft^2/year. Monitoring turf growth and performance through clipping yield measurement is done periodically throughout the season.