Turfguard Sensors monitor soil temps, salinity and moisture, they also became something that I checked everyday and found very helpful, numerous times through the year I checked them for moisture and decided against turning the irrigation on, letting it go for one more day. They don't replace actually walking the field and pulling plugs to check moisture but are a very helpful tool.

We do not have anything new planned for 2010, I just plan on improving what we have with what is in place. The other huge item for us moving into the new building was that we installed infield mix that we had made to our desired specifications, I worked with Grant McKnight of Natural Sand and we came up with a mix that is roughly 54% sand, 26% clay and 20% silt, the mix performed really well and we received rave reviews from Mets players, coaches as well as many visiting players and coaches. We could spend pages talking about the infield mix but it held together really well, took water really well and overall allowed us to have more events on the fields without sacrificing playability.

ST: Do you have any recommendations for the next groundskeeper with brand new, expensive field?

Deacon: The advice that I would give is to stick to your guns, there are a few things that I thought would be better if they were done a different way and after a year in the new building am still of that belief. Talk to other people in our industry and other industries and try different things out, if you want to try a new mound clay put it in one bullpen, build little test plots to see how different infield materials perform etc. Overall I am very happy with all the new technology that we were able to use and will keep exploring looking for new ideas. ■

Drainage system *flexibility* needed at Citi Field

Editor's note: *This section was supplied by Steve Cooper of SCA Communications, steve@scacommunications.com*

The playing field at the New York Mets' Citi Field is state-of-the-art and actually floats. Because of the flexibility of the field, the drainage system needed to be designed so that it would move with the field. For this reason high-density polyethylene (HDPE) pipe (Advanced Drainage Systems, Columbus, OH) was selected due to its ability to flex and maintain joints. Sections of the pipe are perforated to allow water from the field to enter and to be drained.

Built on reclaimed marsh land at Willets Point just south of LaGuardia Airport, the stadium is on piles imbedded into the bedrock. The field, however, was designed to be independent of the open-air stadium to accommodate future, if any, settling.

Underneath the field is a network of HDPE pipe that enables Bill Deacon, head groundskeeper, to create a vacuum to remove standing water or force cool or warm air into the root system of the natural grass.

The pipe pattern is set up like an underground tree. A 30-inch diameter pipe runs under the field from behind home plate to the warning track. This 430-foot run of ADS N-12 WT pipe has watertight bell and spigot connections between sections. Connected to this trunk line are six-inch diameter lateral branches, 42 lines on each side, 10 feet apart. The HDPE pipe is perforated on the top to allow water to infiltrate and will also provide a means for air exchange in the turf.

Installation of the field, drainage system and turf was done by the LandTek Group, Amityville, NY with John Sulinski heading the project. LandTek was responsible for all of the field construction including the drainage system, the subgrade for the field, laser grading clay, sod and the warning track.

"The goal was twofold," Sulinski said. "First was to effectively drain the field, and the second was to aid in the growth and integrity of the natural grass turf. The system can blow warm air up through the root system of the grass. This three to four degree boost actually can help green the turf and is a key part of starting the grass to grow in the early spring in the northeast."

Sulinski and his 15-man crew started as soon as the foundation for the field was ready. Installing the 30-inch diameter trunk line first, a trench was dug to five feet deep and 22 sections of the corrugated pipe were put together.

"Connection of the 42 lateral lines was very unique because the custom-made saddle tee's had to set into each of the 30-inch diameter pipe sections. It took about 20 days to do the installation," Sulinski said.

Each run of the perforated lateral line pipe is surrounded in an envelope of a bluestone product with 4 inches of that stone across the entire subgrade. On top of that stone is roughly 10 inches of root stone, which is a sand mix, followed by the sod.

An ADS 4-ounce woven geotextile fabric lines the trench. This fabric lays on the subgrade, drops down to the bottom of the trench, comes back up the wall and lays on the subgrade on the other side of the trench. Consistent throughout the field, the trenches are on 10 foot centers. "We don't believe in wrapping the fabric around the pipe itself," Sulinski said. "The fines on the stone would clog the geotextile on top in no time, especially with the water movement that you have through the profile."

To solve this problem, LandTek used a natural soil bridging criteria for the fabric that allows for rapid water filtration.

"We use this method all the time in natural grass construction," he said. "We measure the size of the particles and their cohesive properties. So for example, the sand we put on top had to have a bridging criteria greater than the stone on the bottom. This means the sand mix would stay fully suspended on top of the stone, which would not allow the fines to migrate through the stone and into the pipe, a very critical aspect of the job. If the components of the bridging criteria weren't formulated in the proper ratio or particle size, what you'd have, obviously, is settlement over time, cause you'd wash the fines though the stone product into the perforations on the pipe and out, exiting the stadium."

Citi Field is built on piles and the field is designed to "float" within the stadium. The area was a swamp called the Meadows and filled in with ash. It still has a very high water table.

"So when they built Citi Field they had to come up with a design that would enable the field to float independently of the structure," Sulinski said. "Naturally, the design for any drainage system is at a predetermined elevation with a percentage of slope. But here, the field is designed to move. Therefore, the drainage system underneath also has be able to move in order to maintain that gradient for the water to travel.

"We had to come up with some very key fittings that were designed and custom made from corrugated HDPE pipe to a cast iron fitting that would be strong enough to hold the cast iron double ball joint. There was a lot of engineering work to come up with a fitting that would actually work."

"That pipe was hung from the structure itself, so it is supported by the structure on piles," Sulinski continued. "We connected to the HDPE pipe with the ductile iron FLEX-TEND joint. This allowed us to pull the double joints to the highest position. So if the field settled, in theory, it will set-

tle uniformly and still provide positive drainage because the fitting was set at its highest point. If the fitting dropped there would still be positive drainage. It's a very unique system." The hypothetical rate of drop predicted is 6-7 inches in 10 years.

"When we put the pipe in we used a laser-guided trenching machine to trench through this lightweight concrete fill," he explained.

"It's automated with a computer on board that we could dial in percentages, so it automatically pitched the trench from the warning track to our 30-inch collector pipe. Everything was pitched towards the collector pipe, which runs into a large manhole. And that manhole has another 30 inch pipe coming off it which is called an "air line" for the SubAir system inside the stadium. Not only can they pull a vacuum to draw the water through the rootzone and the stone and into the pipe, they can actually introduce cool air as well as heated air through the pipe network that comes out through the perforations on the 6-inch diameter lines. This will uniformly warm the gravel layer, acting as radiant heat to warm the root zone so that you can warm the grass plant itself and start to mature the grass plant in February. It's amazing."

"Remember there are days in spring, when they start playing, when temperatures are chilly and also go from relatively warm to cold. So you're going to need that little last step to jump start it. "People forget that when you build these fields, they are 90 percent sand," Sulinski said. "So it does drain, but with that added vacuum mode, if there is 2-3 inches of rain, and you have a game that night, the system can actually help pre-dry the field.

"And when you play on a dry field the chances of disturbing the turf and destroying the root system are reduced. You can't ever prevent it, but you can make it better. That's what this drainage system is designed to do." ■