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New turf system stops erosion … for starters

Award-winning slope survives typhoon

New wall repairs erosion, widens road

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Synthetic turf system stops erosion … for starters

Quest for erosion control delivers additional benefits

By Alexandria Hayes

PROJECT HIGHLIGHTS

LaSalle-Grant Landfill

LOCATION
Jena, La.

OPERATOR
IESI Corp., Fort Worth, Texas

GEOSYNTHETIC MATERIALS
ClosureTurf, Agru America Inc., Georgetown, S.C.

INSTALLER
Environmental Specialties Intl. Inc., Baton Rouge, La.

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All photos and figures courtesy of Mike Ayers, Closure Turf LLC

Introduction

After four years as a district landfill manager for IESI Corp., Delaney Lewis was discouraged. Although one of the Louisiana landfills for which he was responsible exhibited ideal geology, the soil characteristics were not conducive for effective side-slope maintenance.

The soil of the LaSalle-Grant Landfill in central Louisiana was highly erodible, had a high plasticity index, and had a natural pH of 4.0. Consequently, Lewis spent every spring repairing the slopes, amending the soil with lime (four tons per acre), seeding, and hydromulching, only to watch his hard work end up as sediment at the bottom of the landfill.

He had tried everything he knew how to do, yet every effort failed to rectify the problem. It became evident that erosion-control success would require an unconventional approach.

Lewis and IESI's south region engineer, Mike Friesen, started asking their contacts if anyone else in the field had a potential solution. Then industry veteran Juene Franklin, from the Houston engineering firm Riley, Park, Hayden and Associates, directed them to a new product developed to reduce greenhouse gas emissions and lower post-closure liabilities at landfills. Franklin thought the product, a synthetic turf system, could mitigate slope failures such as those at the LaSalle-Grant facility.

A new approach

This synthetic turf system consists of three primary components: (1) two layers of woven geotextiles with tufted UV-resistant polyethylene grass that is laid over (2) a 50-mil LLDPE structured drainage geomembrane and infilled with (3) sand, as shown in **Figure 1**.

The geomembrane layer serves as the containment liner atop the landfill's intermediate soil cover. Integral 3.6mm studs on the top surface facilitate drainage, while integral 4.4mm spikes on the undersurface provide friction.

The turf's grass blades are interlocked with 3/4–1in. of sand ballast that, combined with the liner's surface studs, provide sufficient interface friction that the structured geomembrane and turf layers do not require anchoring for stability. They are anchored for termination

purposes only at the toe or on the outside of a perimeter swale, depending on the site design.

Rainfall penetrates through the sand and into the high-transmissivity drain liner below, which can handle rainfall of more than 4in. per hour. Hence, erosion energy resides in the structured geomembrane and not in the sand surface.

The project

The LaSalle-Grant Landfill is situated on 232 acres about 50 miles northeast of Alexandria, La. Opened in 1991 and permitted as a Type I and Type II facility, it is owned by LaSalle Parish and is operated by IESI.

The landfill accepts 500 tons of combined municipal solid waste and industrial waste per day. The landfill's current working area has a 65-acre footprint and side slopes that range from 3H:1V to 4H:1V.

Since the turf system's 38-degree interface friction (more than a 3.0 factor of safety against sliding failure) looked promising as an effective side slope stabilizer **(see Figure 2)**, Lewis and Friesen were intrigued. "I felt we didn't have any other options, so why not try it," said Lewis.

In October 2008, installation of the new turf system commenced over 2.5 acres of the landfill. Installation workers needed four days to lay down the turf and it looked "just beautiful," Lewis said. But he wondered whether a system so simple to implement could fix such an intractable problem. However, the IESI team was persuaded enough by the initial results that in February 2009, the company moved on to Phase 2 of the project, covering another 3 acres.

Surprising results

It was only when Lewis and his colleagues saw the cover in action during the spring 2009 runoffs that they became truly convinced of the new turf system's ability to provide long-term erosion control. The friction characteristics of the cover are detailed in **Figure 3**.

Installation had little impact on ongoing landfill operations.

Since the initial installations, the covered area has endured 73.5in. of rainfall, including some in excess of 4in. per hour. Three months after Phase 1 was installed, a tornado spinning across the front of the landfill (about a quarter mile from the turf cap) generated 70mph shear winds. Then a levee situated above the turf area broke, releasing 5 acres of water to wash across the turf. None of these events affected the turf.

"The grass looks great. The sand didn't move and there was no erosion," Lewis said. "We'd been killing ourselves working and reworking these slopes and now it appeared we had a really good answer.

Figure illustrations 1-3

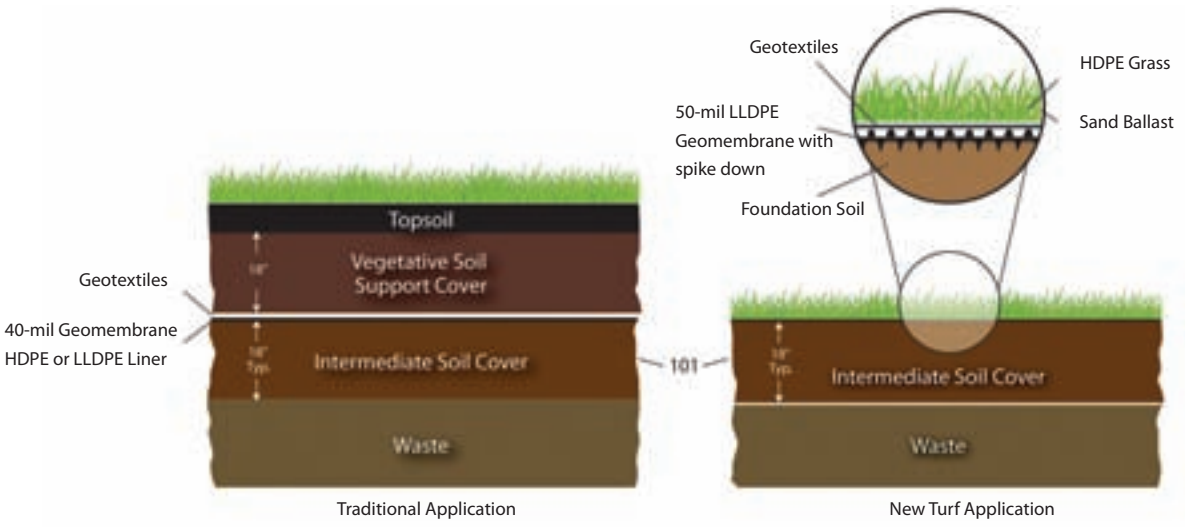

Figure 1 | The synthetic turf system's tufted geotextile layer is positioned on top of a 50-mil LLDPE structured drainage geomembrane, obviating the top 2ft of soil.

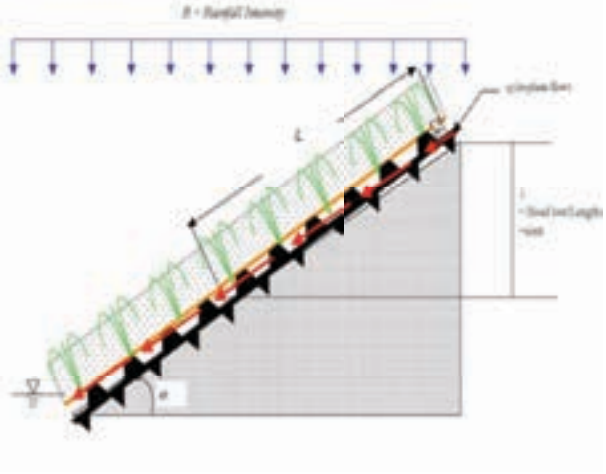

Figure 2 | The synthetic turf system can handle rainfall intensity of up to 4in. per hour.

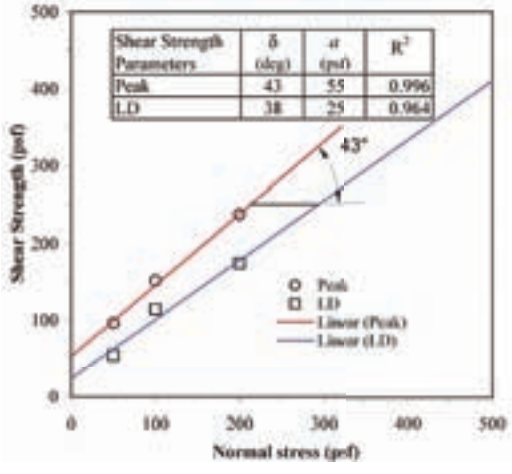

Figure 3 | The synthetic turf system's high friction coefficient makes it ideally suited for steep slopes.

Figure 4 | The synthetic turf system at the LaSalle-Grant Landfill proved cost-effective, relatively efficient to install, and it controls fugitive emissions, erosion, leachate, and siltation.

"After we put the turf down, we didn't have to do anything to it again," he said.

The turf system required no mowing, reduced leachate, emitted no fugitive gas, and stayed in place under extreme weather conditions.

"We [believe that] this cover meets or exceeds the intent of the EPA's Subtitle D landfill closure regulations," said Mike Friesen, IESI's regional engineer. "The life of the grass is 50 or more years." And if the grass color begins to fade 55 years from now, he noted, it is simple—and relatively cost-effective—to replace the grass, which has no effects on the integrity of the LLDPE structured geomembrane cap itself.

"At that time, we're talking about an aesthetic issue, not a compliance issue," Friesen said. And the geomembrane never needs to be replaced.

Operational efficiencies

As the IESI team members realized how effective the turf system was at preventing side-slope erosion, they also discovered other ways it was proving beneficial.

Speed

It took a crew of workers about four days to install the first 2.5 acres of the new turf system **(see photos in Figure 4-above)**. Even during spring—the rainiest season in Louisiana—turf installation can be accomplished in a few clear days.

There was no delay on cap performance while waiting for grass to grow. Erosion, water infiltration, and emissions were controlled once the turf system was in place. A Louisiana Department of Environmental Quality official, upon seeing the turf for the first time, said that he was impressed with the immediate impact the system had on surface water runoff.

Driven by the need to solve side-slope erosion problems, IESI managers say they have also realized a landfill-cap solution.

Figure 5 | The synthetic turf system's grass, tested under extreme conditions, is projected to retain nearly three times the required strength over its 50-year lifetime.

Impact

Installation had little impact on ongoing landfill operations since there was no need for heavy equipment to traverse the property to deliver vegetative support soil **(see Figure 1)**.

With soil-poor locations where dirt needs to be transported significant distances, the turf system eliminates the destruction of borrow locations as well as the cost of both the top 2ft of borrow soil and its transportation, potentially a significant cost savings.

Maintenance

Once the turf system was installed, there was no need to rebuild slopes, fertilize, plant seed, or mow grass. Perimeter roads remain clear of silt, water runoff is clear, and paper blows across the surface and is collected at litter fences.

Durability

The grass component maintains strength long-term **(see Figure 5)**, with a 50-year-plus lifetime. The 50-mil LLDPE structured drainage geomembrane lasts indefinitely if installed and maintained per instructions.

Compliance

Because the underlying structured geomembrane is impermeable, the turf system cap meets or exceeds EPA Subtitle D regulations.

The product's strength and durability provide protection from leachate, while eliminating gas emissions by containing 100% of the methane.

"Post-closure cap inspections are quicker and more effective," said Friesen. "Without 2 feet of soil covering the liner, any deficiencies can be easily observed and repaired."

Maintenance and soil cover savings vary from site to site, but all users will gain airspace with the turf system, thereby expanding landfill capacity.

Gas control

The turf system precludes the need for gas wells and piping.

Pulling a vacuum on the structured geomembrane allows all gas to be vented for flaring or alternative energy generation. Under the turf system, the gas rises to the surface due to positive pressure and generates little condensate to be caught and managed.

Because it is economically feasible to close as little as an acre at a time, overall site emissions can be reduced in a working landfill by closing smaller areas. As soon as an area is closed, all emissions are controlled. Also, the structured geomembrane protects against oxygen infiltration, eliminating that as a fire pathway.

Environmental benefits

By reducing borrow soil locations, the turf system prevents additional land destruction.

Capturing 100% of methane provides options for carbon credits and for potential energy conversion. The turf minimizes leachate, as the LLDPE structured geomembrane keeps water out of the landfill, and prevents siltation, as water runs cleanly off the synthetic surface.

It also results in reduced carbon emissions since heavy equipment is no longer required to prepare a vegetative soil cover on top of the geomembrane liner.

Financial benefits

Both Friesen and Lewis agreed that IESI's cost savings have been significant.

Estimated maintenance and soil cover savings range from $18,000 to $44,000 per acre per year, depending on the cost of soil, labor, and supplies, according to the turf's manufacturer.[1]

Maintenance and soil cover savings will vary from landfill to landfill, based on disposal rates and operational costs. But all sites will enjoy an increase in vertical landfill area gained by reducing—from 2ft of soil to 1in. of sand—the layer above the geomembrane liner.

[1] See calculations at www.agruamerica.com

"The grass looks great."

"When we realized that we could regain 2ft of airspace, coupled with reduced post-closure costs and a dual-use gas collection system, it became a very easy decision for us to include the turf system in our closure plan," Lewis said. "The gain in airspace alone has the potential to offset half or more of the cost per acre of using the turf."

Another area of universal savings is in capital spending and bond requirements. Friesen speculates that the millions of dollars set aside for future gas-system development and post-closure cap maintenance may be dramatically curtailed with the turf system.

"As a final cap, the turf is exceptional," Friesen said. "Our landfill gas system costs have been reduced by 85% and post-closure costs have been reduced as well. Add to that the cap's ability to act as a gas system and then future revenue from carbon credits and energy projects—it's the icing on top of the icing on top of the cake."

Conclusion

Louisiana is considering approval of the synthetic turf system for a final cover and Friesen said he is optimistic that other state's officials will see the benefits of approving it also.

"It's really a win for the states too. Some states will approve turf [for final covers] based on its performance at LaSalle. Others may require a trial study and they'll get an incredible intermediate cover in the meantime," Friesen said. He is working in Arkansas and Missouri to set up test sites to begin the approval process there. The synthetic turf system "will revolutionize this industry," he predicted.

"From an operational standpoint, if we can relieve some of the headaches that [our landfill operators] have to deal with, it makes sense regardless of the cost," said Friesen. "Add the fact that the turf system provides environmental protection while saving/making money—why wouldn't you use it?" G

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