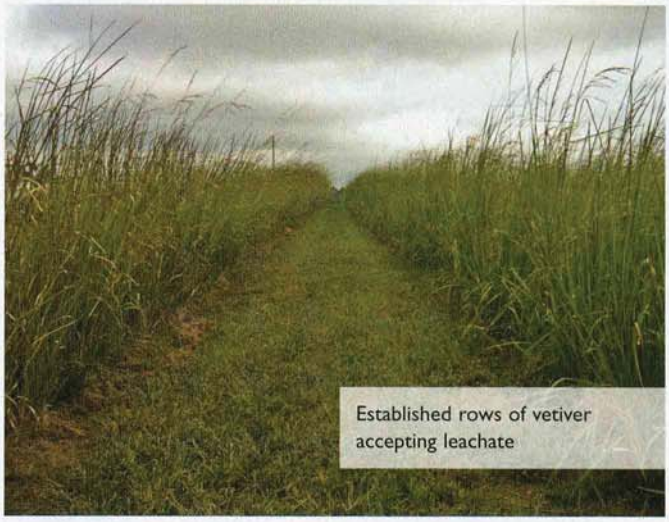
Sustainable Remediation

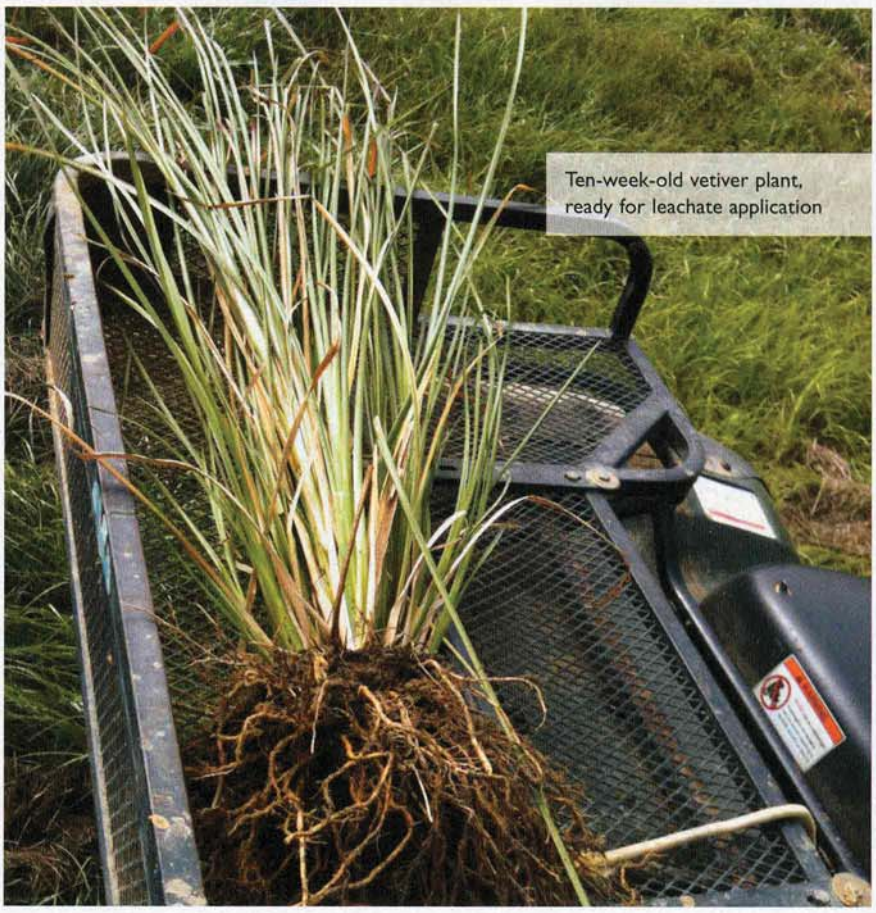
Technology creates alternative leachate management while cutting disposal costs by 50%.

BY BRAD GRANLEY, P.E., CCCA

Newly planted vetiver field



Established rows of vetiver accepting leachate



Ten-week-old vetiver plant, ready for leachate application

It is well known that leachate can lead to serious environmental problems if not handled properly. It's also easy to understand why leachate disposal is one the most persistent and expensive long-term challenges affecting the solid waste industry. However, even one of the most accepted and widely used methods of leachate disposal (load, haul, and dump) has a significant negative environmental impact that for the most part goes unconsidered. Many millions of miles have been driven and millions of gallons of diesel fuel burned in the process of hauling leachate across communities to wastewater treatment plants. Additional negatives, such as added traffic, wear and tear on roads, liability, safety, increased chemical loading on wastewater treatment plants, and the net cost of this inefficient method, compel the modern professional to reevaluate the status quo and consider new technologies.

One attractive new alternative, known as *phytoremediation,* is rapidly gaining acceptance and momentum across the industry, both in the US and abroad. Phytoremediation has been applied successfully for decades in the remediation of contaminated soil and groundwater by using specifically selected trees and grasses to remove pollution from the environment. More recently, the technology has been adapted to serve the unique aspects of the solid waste industry as a new method for leachate disposal. In fact, the process actually utilizes leachate onsite as a resource rather than disposing offsite as a waste.

The fast-growing, specialized plants used in a phytoremediation system have a great demand for both moisture and nutrients, making leachate a natural fit. Leachate, of

course, provides plenty of moisture, and the contaminants that are typically seen on laboratory analytical reports are actually utilized by the plants as micro- and macronutrients (a resource) to fuel fast growth. As a result, the truly green and sustainable approach eliminates the aforementioned environmental problems associated with load, haul, and dump and typically results in a zero-discharge scenario. In addition, a phytoremediation system will effectively remove and sequester tons of carbon dioxide from the atmosphere each year due to plant growth.

Financially, the technology has produced amazing results. Leachate-utilization projects designed and installed by Leggette, Brashears & Graham (LBG) have decreased disposal costs by 50% or more, resulting in millions of dollars in long-term savings. An additional financial bonus is also realized with respect to financial assurance (FA) policy premiums. By reducing long-term liability accruals by millions, FA policy premiums can be cut by tens of thousands of dollars annually.

It must be noted, however, that the technology is not a "silver bullet" or a "can't miss" approach. Although it has a wide range of applicability, including closed and open landfills alike, it must be applied to the right site under the right conditions. It must also be designed and installed only by those with the proper combination of training and experience. A phytoremediation project is much more complicated than simply planting a tree or spreading some grass seed and hoping for the best. In fact, to be successfully implemented, the technology requires a very unique blend of expertise from a number of specialty disciplines including, but not limited to, engineering, agronomy, biology (plant and microbiology), soil science, chemistry, and hydrology—all incorporated into the unique operating context of a landfill.

If not properly evaluated, designed, and implemented, failure is likely. And because the technology is new, any failure hinders the ability of others to gain regulatory approval in any particular state. The following project summary is one example of many successes that illustrates how Republic Services' (Republic's) enthusiastic investment in phytoremediation has reduced that company's carbon footprint while saving significant capital, and how it has begun to influence a positive change in the industry.

Located in Biloxi, MS, the Gulf Pines landfill is a pre–subtitle D facility that was acquired during a past acquisition. Approximately 350,000 gallons of leachate per year have historically been generated at Gulf Pines and hauled to the nearest permitted disposal facility. The facility was over 150 miles away from the landfill, but due to the low flow, costs were manageable. However, in late 2009, a change in site-specific conditions and regulatory requirements caused leachate recovery to spike to greater than 3 million gallons per year. The resulting transportation and disposal costs skyrocketed to over $300,000 per year, and an alternate approach was urgently needed. Republic contacted LBG to identify and implement a more financially favorable and environmentally friendly alternative.

After evaluating a number of possible options, LBG recommended the use of phytoremediation. Republic and LBG already had great success at other sites using a hybrid-poplar-based phytoremediation system. However, a new approach was pursued at Gulf Pines using a unique grass called *vetiver*. Vetiver has been in the US for over a century, but has never been used to address leachate problems here, making the Gulf Pines project a first-of-its kind in the Western Hemisphere and a first for the US solid waste industry. Vetiver is ideally suited for use with leachate, thanks to its tremendous water and nutrient demand, fast growth, and extraordinary tolerance to extreme environmental conditions (contaminants, pH, soil, moisture, insects, and disease). Vetiver is also a USDA non-invasive plant. The seed produced is infertile, and the only method of propagation is asexual, so there is no concern for uncontrolled spread of the plant.

The end result is a project that directly eliminates tons of greenhouse-gas emissions by foregoing the traditional load-haul-and-dump process, sequestering additional tons of carbon dioxide each year through plant growth.

A preliminary evaluation at Gulf Pines, including a site visit and review of existing data, was conducted to determine the presence of any fatal flaws that could prevent success. The evaluation indicated that phytoremediation was a viable approach for the site, and plans were made by Republic to pursue implementation of the technology. Gaining regulatory approval was the next step in the process, and the Mississippi Department of Environmental Quality (MDEQ) was contacted. A face-to-face meeting was held, and presentation of the concept and technical details were provided. It can be challenging to gain regulatory approval for a new technology, especially one that has never been attempted in the US, as with the use of vetiver grass in this case. However, based on existing successful Republic/LBG phytoremediation projects using hybrid poplar trees, and by evaluating the science and data behind the technology, the MDEQ evaluated the project based on technical merit without prejudice against the novelty of the technology. Similar to other states (for hybrid poplar projects), approval was given and the project proceeded to the design stage.

Because of the extreme high cost of disposal and negative environmental impacts

For related articles:
www.mswmanagement.com/landfill

associated with hauling leachate such a long distance, the design-and-implementation process was expedited. Within approximately three months of receiving MDEQ approval, the design was completed and tens of thousands of vetiver plants were in the ground. The phytoremediation process at Gulf Pines consists of an automated distribution and pretreatment system that minimizes operation and maintenance requirements. Gulf Pines is a closed facility located hours away from any Republic staff, so any system had to operate independently without much onsite attention. In response, the system was designed to automatically adjust to changes in leachate production, leachate quality, and weather conditions. It is also equipped with a PLC control panel and remote telemetry system that can be monitored and adjusted from any computer with access.

The field installation consists of force main piping from the distribution/pretreatment shed to the planting area. From there, the force main feeds a specialized subsurface drip irrigation system adapted specifically for the phytoremediation process. Nearly 3 miles of subsurface drip tubing are divided up into multiple "zones of operation" to allow for the controlled, systematic distribution of leachate across the planted area.

Following an establishment period of approximately 10 weeks, leachate distribution to the field of vetiver was initiated in September 2011, and the Gulf Pines project has exceeded expectations ever since. The system has performed as designed, and 100% of leachate generated has been utilized onsite, well ahead of anticipated results. The low cost of operating a phytoremediation system has reduced leachate disposal cost by more than 60%, saving millions of dollars over a standard 30-year post-closure care period. According to Republic, "The approach is a game changer for leachate management."

The project was subsequently entered into the prestigious Engineering Excellence Competition sponsored by the American Academy of Environmental Engineers and was honored in Washington DC with a Grand Award, first in its category. The award was won based on the merits of the project, including originality, innovation, complexity, project quality, client satisfaction, contribution to social and economic advancement, and an integrated approach to better protect the environment.

The end result is a project that directly eliminates tons of greenhouse-gas emissions by foregoing the traditional load-haul-and-dump process, sequestering additional tons of carbon dioxide each year through plant growth. It has a quick return on initial capital investment, provides millions of dollars in long-term savings, is easy to maintain, increases habitat for wildlife, reduces Republic's carbon footprint, and provides landfill owners, engineers, and regulatory agencies with a new, truly green and sustainable alternative for leachate disposal. Republic's commitment to green practices and innovative technologies has indeed begun to change an industry. MSW

Brad Granley, P.E., is an associate and senior

Now with Leachate Management Specialists. bgranley@leachate.us
www.leachate.us