LANDFILL PLANNING

The long game

Landfill expansion requires long-term planning, foresight into future developments and patience.

BY BOB GAETJENS | MAY JUNE 2023

During a landfill's operational life, it's likely the owner will need to expand the landfill, which is a process rife with technical and communications challenges.

If a landfill owner plans to expand a landfill eventually, Michael Magee, a managing partner at Capitol Heights, Maryland-based WB Waste, says it should try to buy land surrounding the landfill if it becomes available for purchase.

"If you have an opportunity to buy a parcel of 100 acres next to an existing landfill, even if you don't need it today, or next year or three years from now—if it's a reasonable price and you can buy it, buy the land," he says.

Even if there is not an expansion plan, more land creates an additional buffer between the operational portion of the landfill and the nearest residents or other established developments, which Magee says can enable the owner to "control his own destiny."

It is equally critical to set the stage for the expansion by maintaining the goodwill of various stakeholders throughout the landfill's existence, Magee says.

"When you own a landfill, everything you do needs to be sensitive to the community around you and the politics," he says. "Make sure [community members] know who you are. Make sure they know what you do. And make sure they don't have a bad taste in their mouth from something they've heard from somebody else. Even if the neighbors don't like you, you need to be visible to them and accessible to them so that they know they're not dealing with this faceless company."

Magee says landfill owners must always keep community leaders and neighbors aware of changes in operations at the landfill.

"If you're building a new cell, it's saying, 'Hey, … by the way, there's going to be construction going on. We'll have more truck traffic; there's not more garbage coming in.' Those types of things may seem like little things, but they give people an understanding [of] what the facts are around what you're doing," he says.

Ultimately, clear communication creates trust with the community, which can help permitting go more smoothly when it comes time to expand a landfill, he adds.

Getting the details right

Ali Khatami, a project director and vice president at Long Beach, California-based SCS Engineers, says landfill operators need to plan for delays during the expansion process in case site studies do not go as planned.

"Geology plays a significant role in expanding a landfill or building a new landfill in a certain location," he says. "If that area is not geotechnically investigated by drilling borings and testing soil samples from the soil strata below the surface, that's the first thing to do."

Owners should develop a conceptual plan to determine the scope of the various studies needed to get an expansion permitted. For example, when conducting soil borings, the engineers need to know how high the landfill will be to determine how deep to conduct soil borings. If there are soil variations, landfill owners need to know about those variations and plan around them, Khatami says.

"Mother Nature creates fairly uniform layers, but elevationwise, sometimes the layers come together below the surface in an irregular manner," he says. "So, a layer that didn't exist below the existing landfill may exist in the lateral expansion area. That's why investigations are needed to make sure that you identify every layer that exists below the lateral expansion."

Designing around settling and compaction

The type of soil underneath the landfill will determine how pipes carrying leachate are designed, Khatami says. For example, clay tends to settle over time as the weight of the landfill compresses it from above. In situations where the soil beneath the landfill is prone to settling, he says leachate recovery pipes need to be more steeply sloped than usual. Sandy and coarse soil cause less settling than clay, he adds.

"Clay can consolidate over a 20-year period or a 10-year period, and gradual settlement occurs," he explains. "If it is not designed properly, a pipe that is supposed to drain one way may end up reversing itself as a result of the clay settlement."

Khatami says engineers must calculate the differential settlement possible given the soil characteristics when designing the leachate recovery system.

Leachate pipes also can be damaged by the compressive load of the landfill and differential settlement if the system is not designed properly. Leachate pipes usually are made of high-density polyethylene (HDPE) and require protection from the increasing weight of the landfill as it grows vertically.

"HDPE by itself is not a highly resistive material," Khatami says. "What you do is use a combination of HDPE and gravel, a very, very high-density gravel like river gravel. … When you put the pipe in the middle of a burrito of gravel, the gravel bridges around the pipe, and the stresses coming to that level reach around the pipe, and [the gravel] protects the pipe against higher stresses."

Older landfills in which the leachate pipes aren't surrounded by gravel are harder to expand vertically, he adds. "You have to put a lining system over the face of the whole landfill then expand above it," Khatami says.

In a lateral expansion, Khatami says each new cell usually should have its own sump pump for leachate.

"For example, if you want to do a 90-acre lateral expansion, you divide it into nine 10-acre cells, and each cell will have a spine—we call it a leachate collection pipe—in the center of each 10-acre area in the longitudinal direction of the cell," he says. "Leachate flows to the low point of that 10-acre [area] by the outer perimeter."

When those cells on the perimeter become sequestered in the middle of the landfill because of a subsequent expansion, that presents another challenge.

"Now you may need to find a way to connect the existing sump to the new cell so you can have a clear passage of leachate," says Jeff Reed, director of SCS Engineers' Texas region and a vice president with the firm. "During construction, you may need to breach the perimeter berm to create a pathway for the leachate to travel and install the liner system and leachate collection pipe trench within the corridor. It's a bit challenging, but it can be done."

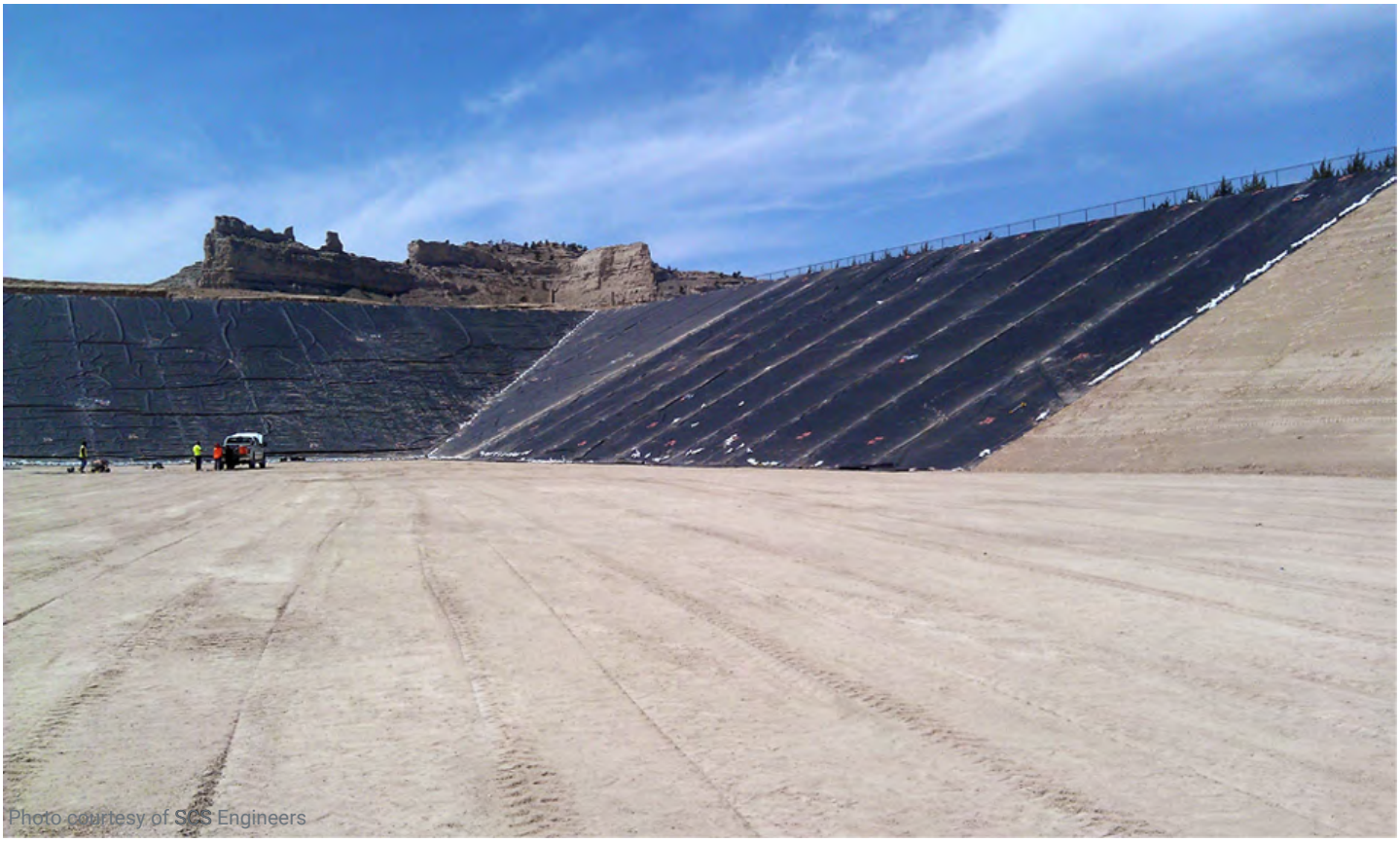

Photo courtesy of SCS Engineers

Liner challenges

In addition to issues associated with designing around leachate collection, Reed says liners can sometimes present challenges. In some older landfills, he says the type of liner underneath can dictate how much vertical expansion is possible.

"You need to evaluate the older cell areas to determine if those liners can accommodate the extra height and weight from a waste stability perspective," Reeds says.

If a smooth geomembrane liner was used on the bottom floor or side slopes, those cell areas may not be able to accommodate the full height of an expansion, he explains. However, cell areas constructed with textured liners generally can sustain more weight as they work in coordination with geocomposites and have greater frictional characteristics.

“The textured liner and the fabrics act like Velcro together,” Reed says.

Before textured liners were developed, it was common for smooth layers to be used on a slope.

“You’d have to install protective cover on a sideslope with an incremental approach,” Reed says.

Permitting and construction of new individual landfill cells can take 18 months to two years, he says, even after the studies for a larger expansion are completed.

Khatami adds that planning for a significant landfill expansion should begin at least 10 years ahead of time with a conceptual plan.

“On the engineering side, planning should start no less than five years ahead of time because it takes time to do all the evaluations, investigations, studies, design and then you have to go through permitting, which varies from six months to two years, depending on location and the agencies you deal with,” he says.

Foresight, clear communications, long-term planning and patience with studies that don’t go as expected all are necessary to successfully expand a landfill.

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