



FEATURE

# Means of Survival

High-tech tools are enabling landfill managers to extend the lives of their sites.

BY Bruce Clark

**HIGH-TECH RIDE:**  
Landfill operators are using compactors equipped with GPS programs to help conserve airspace.

For every municipal landfill owner, maximizing capacity is not only a mandatory, long-term objective, but a daily one as well. Though there is a temptation to stick with long-standing practices, new technologies also have their place. Operators today are using computer-based technologies — global positioning systems (GPS), geographic information systems (GIS) and computer-aided design (CAD) — to extract every cubic yard of airspace out of their landfills.



ernment and uses a constellation of orbiting satellites that transmit precise microwave signals. Ground-based receivers use the signals to determine the receivers' current location and velocity. A GPS receiver on a compactor transmits landfill surface and machine position data to a portable receiver on the landfill, which then relays the information to a computer terminal at the landfill office. The computer integrates the field data with the geometric configuration of the landfill.

In essence, GPS and its related accessories provide the compactor operator a real-time, computer-generated graphic of the landfill surface and the precise location of his machine. By sensing the changes in elevation and slope (grade) as the compactor moves across the trash, the operator is provided, in real-time, a graphic confirmation of when optimum density of the trash has been reached and when the surface is at the required grade. As a result, the operator works more effectively, neither under-compacting nor over-filling the trash. Compared to the conventional "seat-of-the-pants" method, which relied more on an operator's accumulated experience, the use of GPS results in less wasted airspace.

Prices for a GPS compactor system usually start at around \$125,000, depending upon the brand. If that

**MORE MONEY:** One landfill determined that a GPS program could bring in up to \$9 million in additional revenue.

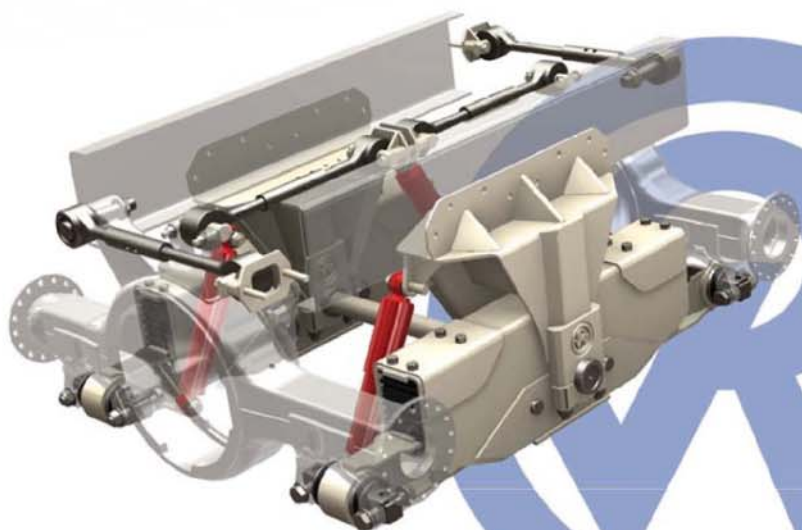
the value of the landfill airspace that can be saved. Wasting just 12 inches of airspace over a 20-acre area at a density of 1,200 pounds per cubic yard (lb/cy) and a tip fee of \$28 per ton results in more than \$500,000 in lost revenue. Charlotte County, Fla., determined it could potentially realize up to \$9 million in additional revenue over a 16-year period with just a 10 percent increase in compaction density afforded by a GPS-based program.

**Today's landfill manager can effectively delay the arrival of the day when all of his airspace is gone.**

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Photo courtesy of Lebanon (Pa.) Landfill



a mandatory, long-term objective, but a daily one as well.

## GIS

GIS software integrates data and information management, mapping functions, and analytic tools. It is widely used by local, state and federal agencies as well as private companies to manage natural resources, utility infrastructure and logistical planning operations. Landfill managers have shown increasing interest in this powerful tool because it is a perfect fit for their complex facilities, which have large amounts of data to collect and maintain.

The power of a GIS is its ability to contain all of the critical data on components such as networks of ground-water monitoring wells, surface water stations, landfill gas collection systems and leachate collection systems in one database. Typically, this information is in multiple formats, scattered between computers, file cabinets, loose files — even inside of employees' heads. When employees move on, agencies can lose years of landfill records.



Courtesy of SCS Engineers

A landfill manager truly has **an extensive arsenal** to take into battle and extend landfill life in a meaningful way.

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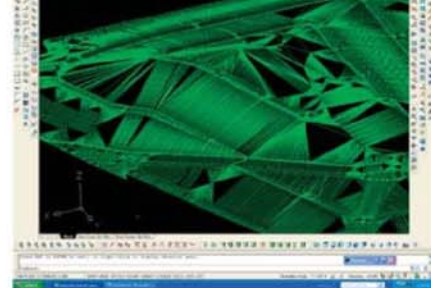


keystrokes by a facility manager reveals the history of any landfill gas (LFG) well, including flow, temperature, gas quality, maintenance and repair aspects, age, and exact location on the landfill. A similar level of detail is available for pumps, valves, leachate transmission systems, leachate treatment facilities, potable water supplies and sanitary sewer systems. An owner can even review his applicable permits or check to see if a particular issue has been evaluated and reported.

With a GIS, monitoring groundwater becomes vastly more useful and effective with the potential to save owners substantial costs, particularly when contamination from the landfill or other facilities is suspected. The powerful automated mapping functions built into a GIS allow for the creation of highly accurate, detailed hydrogeologic maps, integrated into the exact topographic features of the site. As with a LFG well, all of the information on the monitoring network is readily available. Taken as a whole, GIS provides managers and their consultants a level of efficient data

seen previously available. What does this have to do with extending landfill life? Plenty. For example, gas collection systems and leachate re-injection points for bioreactor systems can be located precisely where they will do the most good, helping to maximize decomposition of the waste fill and laying the groundwork for possible future reuse of some of that space. Coupled with timely surveying of the landfill surfaces at these points, a more accurate measurement of the volume reductions at these points is available to the manager. System adjustments are then more effective and result, over time, in more precise management of the waste fill and resulting airspace.

The monitoring well network at a landfill is an early warning to potentially big problems. If quality trends are missed or misinterpreted and groundwater contamination is more severe than perhaps thought, the continued growth of the landfill could be significantly affected. The regulatory agency could require corrective action, which could include restricting waste dis-



**A NEW DIMENSION:** CAD software uses three-dimensional modeling to create clear and concise construction drawings.

posal in certain areas. Worse, it could prohibit waste disposal completely and require premature closure of certain areas of the landfill.

#### CAD

As disposal space is at a premium for many sites, there is a need to maximize every cubic yard of remaining airspace for future disposal areas. The filling of waste in valley spaces between existing disposal areas, piggy-backing against existing disposal areas and filling

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## the box?

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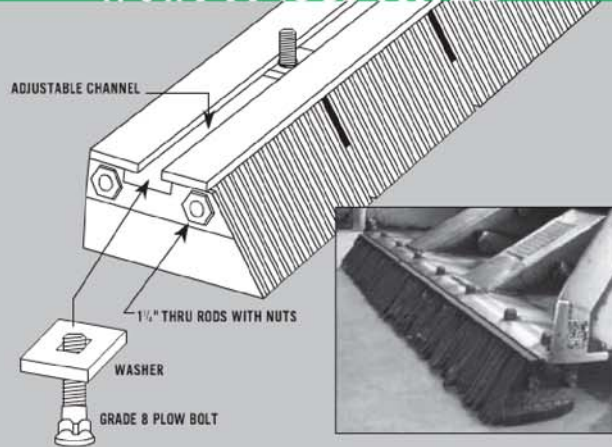
This spring, Metro will issue a draft RFP for operation of its two solid waste transfer stations. We want your feedback before we issue a final RFP in summer 2009.

In 2008, the two facilities transferred about 520,000 tons of waste to landfills after removing 30,000 tons for recovery. With a new operator, Metro seeks to increase the amount of material recovered and ensure the facilities operate even more sustainably.

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coupled with continued pressure to reduce development costs and compress time schedules — have resulted in an increased use of computerized three-dimensional (3-D) CAD modeling software.

This sophisticated and powerful computer tool allows designers to configure, model and calculate airspace volumes more rapidly and accurately for a far greater number of different design scenarios than would have ever been

(3-D) methods. The old method of calculating airspace volumes relied on estimates derived from a limited number of cross-sections and basic fill surfaces with as few angularities as possible in order to simplify the process and come to an approximation. With the 3-D, CAD program and a skilled operator, the most effective proposed design can be refined to an unprecedented level of accuracy in far less time.

Three-dimensional designing and

process, but one that ultimately pays off in improved accuracy and faster creation of clear and concise construction drawings. Engineers, designers, and 3-D CAD technicians have to collaborate closely, developing the design criteria and the “model” for the landfill, in effect a wiry, frame-like shape (to scale) that is composed of thousands of triangular surfaces known as “tins.” The 3-D software calculates the areas and volume of the space inside the tins quickly. The result is more accurate calculations of valuable airspace and assurance that volume targets will be met.

**Though there is a temptation to stick just with long-standing practices, new technologies also have their place.**

In some cases, it's possible to gain up to an additional 5 percent in available airspace over older manual design methods. Then, coupled with sophisticated landfill construction techniques and GPS as described earlier, the landfill design may be implemented with maximum benefit to the owner.

What does that potentially translate into for the landfill manager? Suppose you had an airspace remaining that was estimated at 100,000 cubic yards. The loss of just 5 percent of that volume represents 5,000 cubic yards and a potential value of \$84,000 (assuming a density of 1,200 lb/cy, and \$28 per ton).

So in closing, today's landfill manager can now effectively delay the arrival of the day when all the airspace is gone. When the technologies described here are coupled with airspace conserving physical products, such as alternative daily covers and operational best management practices (such as diversion of bulky construction and demolition materials, etc.), the manager truly has an extensive arsenal to take into battle and extend landfill life in a significant way. ■

For more landfill stories, visit our “Landfill Management” link at [WasteAge.com](http://WasteAge.com)

Bruce Clark is a project director for Long Beach, Calif.-based SCS Engineers. He works in the firm's Tampa, Fla., office.



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