

## Modern Landfill Technology

### LANDFILL GAS COLLECTION AND MONITORING

Just as leachate must be collected and processed to keep a landfill functioning properly, so must gases produced by organic decomposition — primarily methane and carbon dioxide — be collected and controlled.

Waste Management uses the most advanced gas monitoring equipment available to ensure landfill gas emissions do not exceed EPA regulations. In addition, many landfills have been specially designed to collect landfill gas for use as an alternative energy source.

### GROUNDWATER MONITORING

To ensure the integrity of the surrounding environment, Waste Management installs permanent groundwater monitoring stations at all of its disposal facilities. Groundwater well placement and design standards are in accordance with the American Society of Testing and Materials (ASTM) and include the use of numerous components.

### FINAL COVERS GIVE FORMER LANDFILLS LONG-TERM LIFE

Sooner or later, all landfills fill to capacity. But that doesn't mean it's the end of their useful life. By "capping" landfills with synthetic membranes, clay and topsoil, Waste Management is able to convert closed disposal sites into beneficial community assets. Many closed landfills become:

- Parks
- Natural preserves
- Golf courses
- Baseball fields
- Recreational facilities
- Community common grounds

Continuous, long-term monitoring of groundwater and leachate conditions protect the environment and ensure the integrity of capped landfills for decades to come.



*Advanced monitoring and control systems ensure that landfills remain at levels that meet even the strictest local, state or federal standards.*



*Waste Management is able to return closed landfills to the community as nature preserves, public recreation areas, baseball fields and golf courses.*

For more information on Waste Management's advanced landfill technology, contact your Waste Management Landfill and Industrial Services sales representative.

*From everyday collection to environmental protection, Think Green. Think Waste Management.*



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MODERN LANDFILL TECHNOLOGY

## For Advanced Designs to Protect Local Environments

Think Green.®

**W**aste Management disposal facilities employ the latest advances in landfill technology. From selecting landfill locations to capping facilities that have been filled to capacity, every effort is made to ensure our sites' operational integrity as well as the safety of the surrounding ecosystems. As stewards of the environment, Waste Management sees that all of its landfills are designed, operated and maintained to meet or exceed all local, state and federal regulations.

### STATE-OF-THE-ART LINERS

Liners form the primary barrier between the landfill's content and the surrounding environment. Waste Management employs state-of-the-art composite liners made from both synthetic and natural materials. The exact composition of these liners depends on the nature of the waste that will occupy the landfill itself. Most liners include a high-density polyethylene (HDPE) geomembrane over a layer of recompacted clay at least two feet thick. The HDPE membrane is laid in sheets and heat welded by hand. Each seam is inspected and tested to prevent leaks. Quality control managers oversee every step of liner construction.



*Expert landfill design, construction and maintenance ensure the long-term integrity of all Waste Management landfills.*

### MODERN LEACHATE COLLECTION AND TREATMENT SYSTEMS

Leachate is the term given to liquids that percolate through landfill waste. Waste Management's modern leachate collection and treatment systems ensure leachate is captured, removed from the landfill and properly treated to prevent contamination of the surrounding environment.

Each landfill has a custom-designed leachate control system that takes into account:

- Environmental protection regulations
- Leachate composition
- Local climate
- Site age
- Site operations
- Waste type

Leachate may be treated at community wastewater treatment plants, or Waste Management's engineers may design on-site treatment facilities that use a combination of technologies, including:

- Air stripping
- Biological treatment
- Carbon adsorption
- Chemical treatment
- Filtering

In some cases, collected leachate is reintroduced into the landfill to help speed organic decomposition. In its bioreactor landfills, Waste Management uses leachate to promote the growth of microorganisms and accelerate the breakdown of organic waste materials.

### CHOOSING THE RIGHT LOCATION

A successful landfill begins with the right location. The landfill must not only be convenient to the market it is designed to serve, but must also be constructed on a site that is physically and geologically conducive to permanent waste disposal.

Waste Management surveyors, engineers and designers employ the latest in computer imaging and CAD technology to:

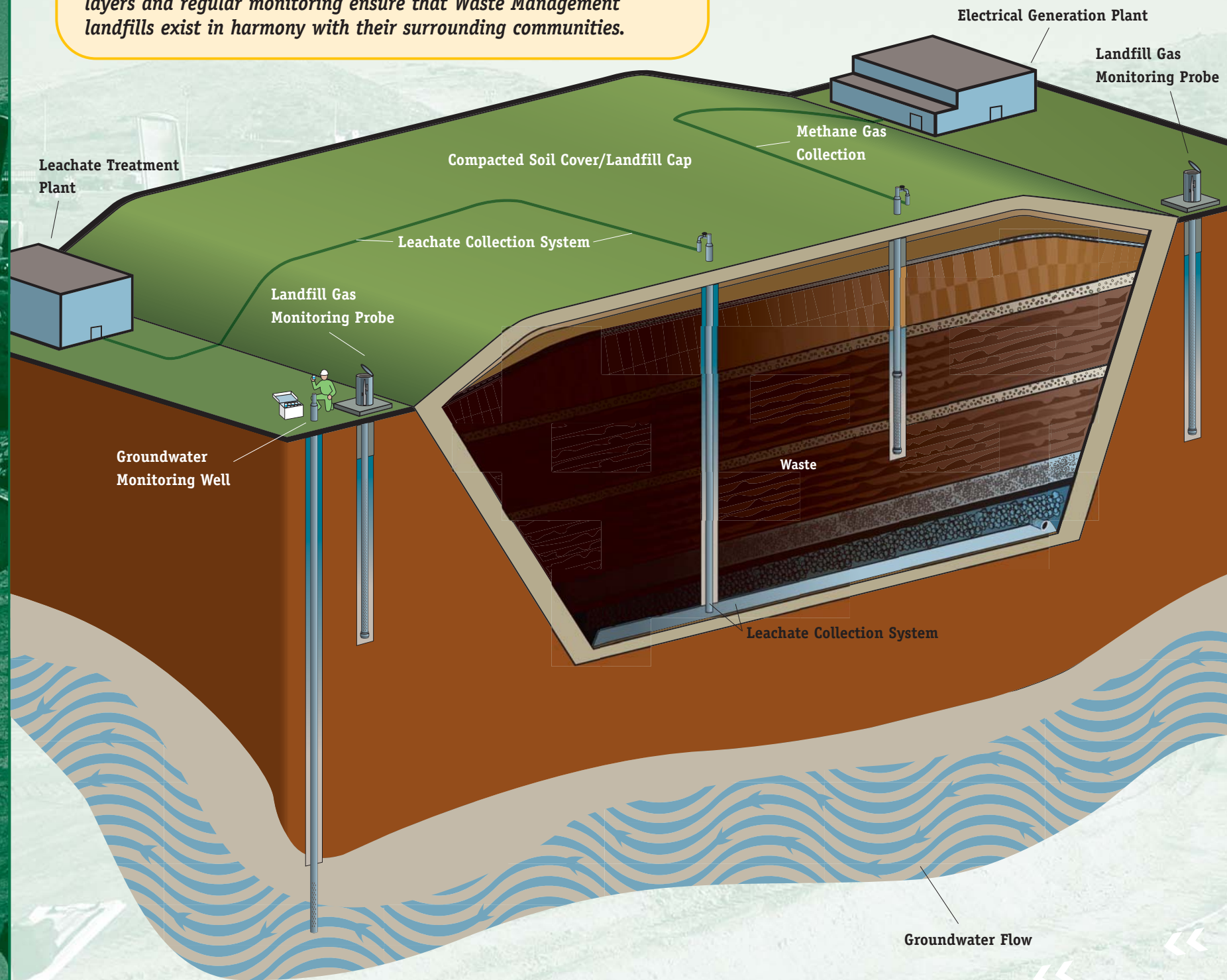
- Scout potential landfill locations
- Perform comprehensive geological surveys
- Develop landfill designs that work harmoniously with the local environment
- Create physical and operational safeguards to protect local ecosystems

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Waste Management landfills incorporate advanced design features, including complex, multi-layer liner construction, to facilitate organic decomposition and maintain structural integrity. Multiple protective layers and regular monitoring ensure that Waste Management landfills exist in harmony with their surrounding communities.



### Typical Subtitle "D" Landfill Cross Section

#### PROTECTIVE COVER

**1** As portions of the landfill are completed, native grasses and shrubs are planted and the areas are maintained as open spaces

**2** Top soil helps support and maintain the growth of vegetation by retaining moisture and providing nutrients

**3** Cover soil protects the landfill cap system and provides additional moisture retention to help support the cover vegetation

#### COMPOSITE CAP SYSTEM

**4** A layer of sand or gravel or a thick plastic mesh drains excess precipitation from the protective cover soil

**5** A thick plastic layer forms a liner that prevents excess precipitation from entering the landfill and forming leachate

**6** Clay is placed over the waste to form a cap when the landfill reaches the permitted height

#### WORKING LANDFILL

**7** At the end of each working period, waste is covered with six to 12 inches of soil or other approved material

**8** As waste arrives, it is compacted in layers within a small area to reduce the volume consumed within the landfill

#### LEACHATE COLLECTION SYSTEM

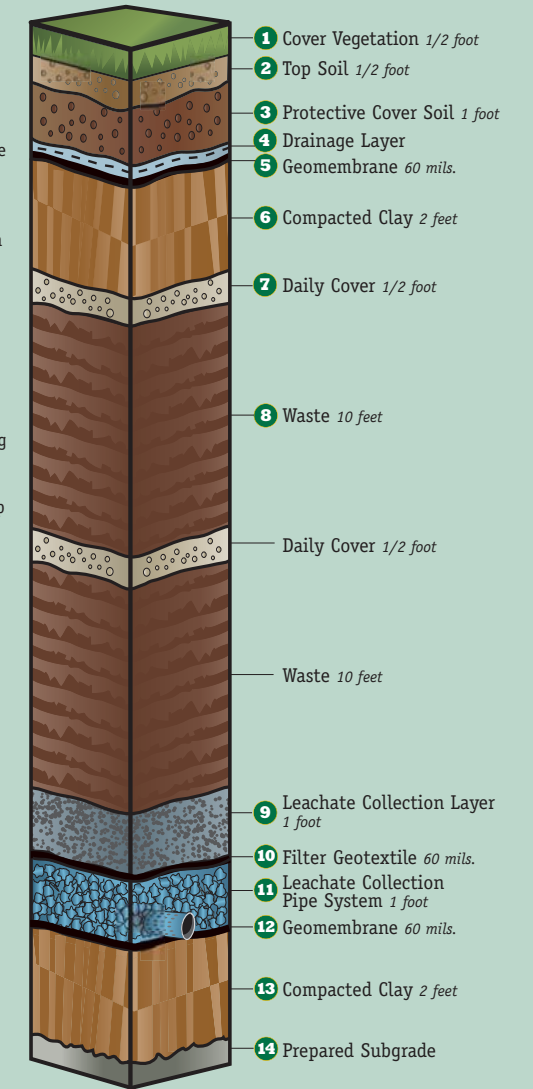
**9** A layer of sand or gravel or a thick plastic mesh collects leachate and allows it to drain by gravity to the leachate collection pipe system

**10** A geotextile fabric may be located on top of the leachate collection pipe system to provide separation of solid particles from liquid

**11** Perforated pipes, surrounded by a bed of gravel, transport leachate to specially designed low points where pumps remove the leachate and transport it to leachate management facilities for treatment or disposal

#### COMPOSITE LINER SYSTEM

**12** A thick plastic layer forms a liner that prevents leachate from leaving the landfill and entering the environment



**13** Clay forms an additional barrier to prevent leachate from leaving the landfill and entering the environment

**14** The native soils beneath the landfill are prepared as needed prior to beginning construction