

# ClosureTurf®

## A PREDICTABLE BENCHMARK OF PERFORMANCE







## Soil Slopes Don't Work, Although They Keep You Working

Soil erosion continually plagues the ongoing management of landfills, industrial waste sites, CCR storage areas, and other environmental containment applications requiring constant rebuilding of slopes weakened by rain and wind. In addition to ongoing maintenance headaches, traditional systems utilizing soil and vegetation as their main components are costly to maintain, slow to install and introduce unwanted slope instability issues. ClosureTurf® is the only solution that provides a predictable benchmark of performance.

A prescriptive cover is effectively an engineered structure reliant upon vegetation and weather to perform as designed. With this in mind, ClosureTurf has been developed to provide an engineered solution that meets the federal and state landfill regulatory requirements and performs consistently under varying weather conditions. It is quickly becoming the closure system of choice across the country for engineers, owners and many others who are seeking the best solution to overcome challenges associated with solid waste management. The ClosureTurf system offers exceptional stability, long-term protection and natural aesthetics, all for a comparable price to traditional systems.





*Hilo Landfill, HI*

## ClosureTurf® Makes Erosion Control Easy—Install and That’s All.

ClosureTurf is a patented, three-component system comprised of a structured geomembrane, an engineered synthetic turf and a specified infill. The ClosureTurf system provides predictable performance over a prescriptive landfill soil cover by:

- Reducing construction and long-term maintenance costs
- Exceeding technical performance standards
- Withstanding extreme weather conditions
- Lasting well beyond the prescribed post-closure care period
- Easily integrating with existing landfill gas collection systems
- Improving storm water runoff quality
- Allowing for incremental closures for quicker landfill gas emission control, odor control and leachate reduction

With a footprint of thousands of acres, ClosureTurf has proven to be superior in performance when compared to other cover solutions. Because of its consistent ability to meet and/or exceed compliance and performance standards, ClosureTurf has become the preferred method in landfill final cover applications.

# A PREDICTABLE PERFORMANCE CHECKLIST



*Crazy Horse Landfill, CA*



*Baldwin County Landfill, GA*



*Portola Landfill, CA*

## Technical Performance

- Prevents common erosion, storm water and siltation problems, even during severe weather events
- Removes overburden soil layers and substantially increases final cover veneer stability on steep slopes
- With a projected design life of 100+ years, the ClosureTurf system extends well beyond the prescribed post-closure maintenance period
- Protects against vehicle loading, severe weather conditions, and wind uplift

## Cost Savings

- Allows for an additional two feet of airspace because the soil layer is eliminated
- Reduces maintenance and post closure care by up to 90% compared to a traditional cap
- Reduces construction costs for sites where local cover soils are not readily available
- Allows for alternate closure designs such as minimization of benches

## Construction Benefits

- Installs two to three times faster than traditional soil caps
- Eliminates on average 550 truck trips of soil per acre from local roadways
- Allows for incremental closures
- Easily adapted during or after construction for solar field development



## Environmental Benefits

- Provides clean runoff with very low turbidity
- No chemicals or fertilizers to contaminate the water
- Obtains control over landfill gas collection sooner rather than later (“close as you go”)
- Reduces overall landfill gas surface emissions
- Lowers the production of leachate with incremental closures
- Requires no irrigation, fertilizing, seeding or mowing
- Reduces carbon footprint by up to 80%
- No destruction of land to obtain cover soils



11 NTU

371 NTU

*Runoff from the same site:  
ClosureTurf (left); traditional soil  
cover (right)*

Port Angeles Landfill, WA



## TAKE A CLOSER LOOK AT CLOSURETURF®

ClosureTurf is a patented, three-component system comprised of a structured geomembrane, an engineered synthetic turf and a specified infill. The bottom layer of the system is an impermeable structured geomembrane with high interface shear strength. The engineered turf component makes the system blend in with the natural surroundings while protecting the geomembrane from extreme weather conditions for the long term. The specified infill component is placed between the blades of the engineered turf and allows the system to be trafficked while also providing additional protection from weathering. While ClosureTurf incorporates easily into existing landfill gas collection systems, the patented gas pressure relief valve protects it against gas uplift/ballooning in case the landfill gas collection system malfunctions. ClosureTurf is rapid, low impact and easy to install, as well as an aesthetically pleasing, cost-effective landfill closure solution.

### STRUCTURED GEOMEMBRANE

- Hydraulic barrier to control infiltration
- High interface friction to provide cover stability
- Meets or exceeds regulatory thickness requirements

### ENGINEERED SYNTHETIC TURF

- Protects the underlying geomembrane
- Provides resistance for wind uplift
- Aesthetically pleasing
- Minimal maintenance
- Superior resistance to:
  - Long-term UV exposure
  - Extreme weather

### SPECIFIED INFILL

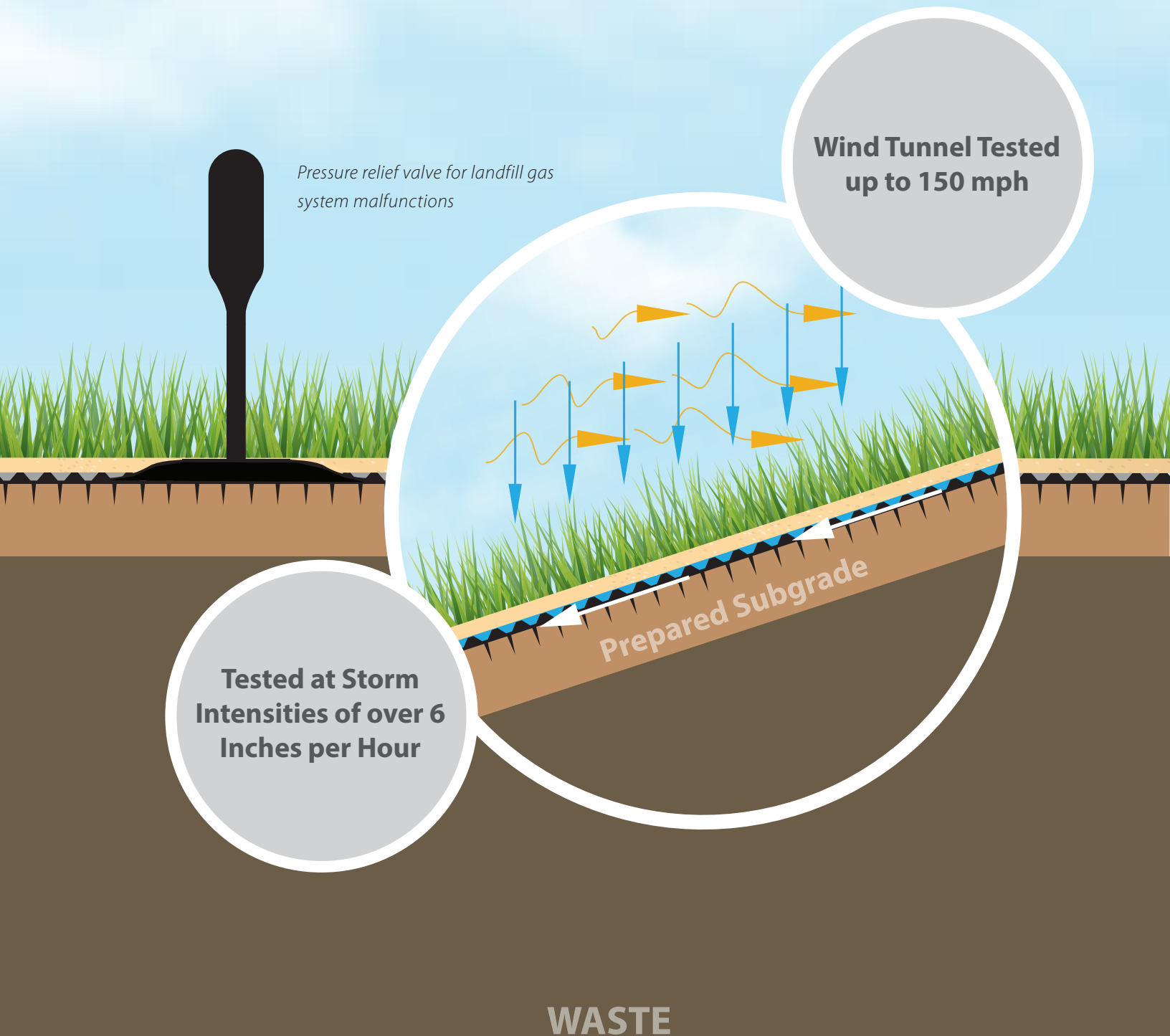
- Improves trafficability
- Provides additional UV protection
- Allows for construction and maintenance vehicle loading
- Provides additional ballast for resistance to wind uplift



WASTE



**ClosureTurf is specifically designed for long-term slope stability of the landfill final cover in the wake of severe weather events such as intense rainfall, hurricane force winds and earthquakes.**



# AN INNOVATIVE SOLAR SOLUTION FOR WASTE SITE CLOSURES

PowerCap™ is a patented solar system that uses ClosureTurf® as its foundation to turn an environmental liability into an environmental asset. Installing solar panels on capped landfills for clean power generation has proven to be an effective way for beneficial redevelopment of large, unused space. By combining the proven technology of the ClosureTurf landfill cover solution with the advanced solar power generation technology of PowerCap, the system achieves higher power production and easier maintenance than the conventional solar solutions available on the market. ClosureTurf's unique cover system enables solar panels to operate in a clean environment free of dust as a result of wind erosion of a soil cover or grass clippings as a result of lawn mowing. The solar panels are also free of potential damage from lawn mowing equipment. With the non-penetration, friction-based attachment method, PowerCap is able to operate and function without harming the final cover system.

## Benefits of Solar Development on Closed Landfills:

- Provides a financial and environmental solution to beneficially use a land resource that typically has minimal reuse
- Receives federal and/or state financial incentives
- Prevents clear-cutting and grading of forests, grasslands and greenfields
- Makes use of existing access roads, storm water management and security perimeters

## PowerCap is the Preferred Solar Technology:

- Designed for versatility in panel configurations
- Utilizes a low-profile direct attachment technology to protect against wind uplift and panel movement
- Does not use a bulky racking system
- Does not penetrate the closure system
- Maximizes power production by installing solar panels on both top decks and side slopes
- Simplifies wiring and increases the power per unit area by more than 35%







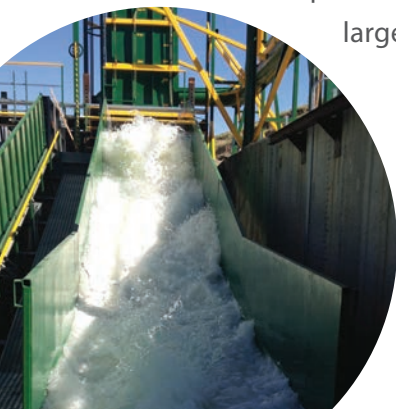


## OTHER ENGINEERED LANDFILL SOLUTIONS

### HydroTurf® Storm Water Revetment Technology



HydroTurf is an innovative, environmentally-friendly alternative revetment to rock and concrete hard armor linings for landfill storm water management system applications, including downchutes, perimeter channels, bench drains, outfall structures, slopes and basins. It is a patented, three-component system made up of a structured geomembrane, an engineered synthetic turf and a specialized cementitious infill called HydroBinder®. Created specifically for hydraulic applications on landfills, HydroTurf can tolerate relatively large differential settlement without compromising performance. It provides superior hydraulic properties capable of handling large flows resulting in very high velocities.



*HydroTurf has been comprehensively tested at Colorado State University (CSU). CSU's laboratory has some of the largest flumes for hydraulic testing in the world. HydroTurf did not reach failure at the flume's maximum steady state overtopping velocity of 40 feet/second or after 13 hours in the wave overtopping simulator being subjected to a five-hundred-year hurricane event for the New Orleans region.*

#### **Benefits Over Traditional Landfill Storm Water Management Systems:**

- Excellent hydraulic performance
- Cost-effective and reliable solution
- 50+ years of service life
- Ability to tolerate relatively large differential settlement
- Impermeable for superior erosion protection of subgrade soil
- Lightweight for rapid, low-impact and scalable construction
- Easy to install in difficult areas
- Minimal long-term maintenance
- Natural aesthetics to match surrounding environment



## VersaCap® Intermediate Cover



VersaCap is a wind and erosion resistant, intermediate engineered turf cover that reduces operational headaches and allows for increased landfill gas collection efficiency and reduced leachate generation before final closure takes place. VersaCap prevents erosion, minimizes infiltration, and reduces landfill gas emissions during the operational phases of the landfill, and is designed to have 15+ years of service life. It is fast and easy to install, and generally does not require ballasts, such as tires or sandbags, to keep it in place. Compared to other temporary covers, it substantially improves aesthetics with a green solution all year.

## ClosureTurf® Surficial Landfill Gas Management System

The ClosureTurf surficial landfill gas collection system consists of surficial gas collection wellheads, gas conveyance strips and pressure relief valves. It can be used in lieu of the conventional landfill gas collection system that consists of deep vertical extraction wells. Benefits of the surficial landfill gas collection system include reduced condensate management and treatment, high collection efficiency, improved odor and surface gas emission control, fast installation, and reduced construction costs. It can also be integrated with the conventional system to improve landfill gas collection efficiency and reduce the number of costly vertical extraction gas wells. The surficial gas collection system utilizes the internal landfill gas pressure differentials to drive the gas to waste surface below the geomembrane, where it is conveyed through the collection strips to collection points (i.e., wellheads). The landfill gas pressure relief valve is designed to mitigate potential uplift of ClosureTurf due to gas pressure build-up in case of malfunction of the landfill gas flare system.



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