

## Failing Seawalls Relieve Hydrostatic Pressure with Weep Holes

by Sean Goforth

For thousands of years, seawalls have been constructed by coastal societies as a physical barrier between the land and the sea made of the toughest material available. Today, most seawalls are made of concrete panels that form around a hollow center, and while designs can vary significantly, they continue to serve the same purpose—to blunt the impact of harsh and rising waters on coastlines.

But in absorbing the impact of the sea and rising waters, the seawalls themselves become subject to failure. There is the direct, punishing impact of the landing storm. Water levels at ports, harbors and marinas can experience extreme changes, rising and falling by many feet during intense storms. Storms, as well as the regular strain of serving as a buffer between the sea and land, leads to a problem of water retention, also known as hydrostatic pressure, as groundwater builds up behind the seawall. The trapped water causes extreme stress on the wall. If the seawall is not built to allow for the water caught between it and the land to drain back out to the river, lake or sea, the wall itself can move, fail, crack or even break apart.

### Filtration and Drainage

Any earth retaining structure is at risk

of failure if there is not an adequate release valve through which the water can escape. One way of addressing this challenge is to create weep holes in order to reduce the hydrostatic water pressure behind the seawall. The weep holes allow the water to escape while, at the same time, weep holes that are properly fitted with filters can trap the soil from the coast side and thus prevent soil erosion. Properly functioning weep holes should allow for drainage of water through the seawall to the body of water and prevent the loss of soil.

"Filtration and drainage are a vital part of designing Earth Retaining Structures, including coastal retaining walls, bridge abutments, wing walls, all types of sheet piles, and the like," said David Gentry, president of JET Filter Systems. "The vast majority of retaining structure failures occur due to the build-up of excessive hydrostatic pressures, which are caused by either a lack of adequate drainage or impermeability of the backfill materials."

JET Filter Systems, based in Casey, Illinois, specializes in manufacturing filter systems that are specifically designed to prevent erosion of seawalls and wall failure by allowing water to drain properly while also capturing soil materials. JET Filter units keep the

seawall from the loss of soil material that causes sinkholes and wall movement.

In November of 2014, Ft. Lauderdale-based Sea Me Dive started a seawall renovation at Lake Park Marina in Lake Park, Florida. The project included the installation of nearly 150 JET Filters. The installation process started with the Sea Me Dive team, led by Alon Beilis, setting up a floating work platform alongside a seawall panel.

The team then measured and marked off core drill points. Work platform spuds would be dropped into the seabed in order to allow for safe and stable core drilling. Once the site was prepared, the Sea Me Dive team would drill a hole through a concrete panel. The average concrete panel was 10 feet thick, and each hole took 15 to 20 minutes to drill.

On occasion, the core drilling cut through steel re-bar, in which case the interior of the hole would be sleeved with a PVC 4-inch pipe and cemented to the affected area with 5200 adhesive. After the drilling was complete, the Sea Me Dive team installed the Filter housing, comprised of 316 stainless steel pipe that was 4.25-inch thick and 2.5-inch long. Mushroom anchors were aligned and fitted into the pre-drilled holes, fixed the piping, effectively fastening the filter into the seawall. Sea Me Dive finished the project in April of 2015. A video of the installation can be viewed at: <https://www.youtube.com/watch?v=Oga771oPqY>

### Long-term Maintenance

Crucially after installation, the cartridge

of a JET Filter System can be cleaned periodically, and this can be done at the front face of the seawall. Beilis recommends a cleaning every 12 to 24 months. This preventive maintenance can save a marina money in the long term, compared to the costs of excavation to repair a clogged seawall—and it helps ensure the wall design reaches its life span.

There are a number of general issues that marinas should consider in order to ensure seawalls are not under threat. Seawalls and bulkheads must have some sort of drainage system like weep holes in order to relieve hydrostatic pressure. Regular inspections, at least every six months, are key. Inspections can involve walking along the land near the wall and looking for signs of erosion — cracks in walls, sagging decks, and the frequent need to put backfill in the same location are all signs of hydrostatic pressure that needs to be addressed.

Beyond that, experienced licensed contractors can bring a level of expertise that ensures proper diagnosis of a problem

and renovation. For example, Sea Me Dive has become adept at negotiating the particular environmental demands of working in Florida. The company has completed renovations at homes in Miami that involved working with concrete imported from Cuba in the 1920s, and has consulted on renovations of the oldest seawall on the St. Johns River for the City of Jacksonville.

Stan Rudd, vice president at Intercoastal Marine, LLC, in Castle Hayne, North Carolina, is also experienced in working with seawalls. Among other projects, Intercoastal Marine has worked on marina restoration and, later, bulkhead replacement at Wrightsville Beach Marina. Each of the projects was performed while the marina was still active, serving customers at its restaurant and boaters in its marina. This required Intercoastal Marine to coordinate work with boat owners and a variety of other counterparties. When it came to the bulkhead replacement project, the early stages of the work advanced apace. But there was one

area of the wall system that seemed to accumulate much more water than the rest of the wall. Having diagnosed this as the high loading area, Rudd fixed the problem by installing weep holes of different sizes and he changed the backfill to a more porous material.

### Critical Soil Analysis

Rudd stresses that local expertise can be critical. In coastal North Carolina the numerous types of soil in the area often presents a problem. Rudd considers the lack of careful soil analysis as "the common denominator for issues with retaining wall structures." Among other factors, proper soil analysis can affect the lifespan of a seawall.

Multiple factors need to be taken into account. Ultimately, seawall construction and renovation depends on balancing the effects of the water as well as the characteristics of the soil. Successful renovations require the knowledge of an experienced contractor who appreciates the unique demands of working in a marine environment. ↴



Lake Park Marina in Lake Park, Florida (not shown here), renovated its failing seawall with 150 weep holes from JET Filter. The weep holes relieve hydrostatic pressure behind the wall, providing a mechanism for water to drain through the seawall.

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