Seawall Manual

City of Belleair Beach

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DISCLAIMER

The suggested design procedure of seawalls described in this Seawall Manual shall be at the sole risk and responsibility of the user with no liability of any nature whatsoever on the City of Belleair Beach. It is suggested that for any seawall design, a registered professional engineer with expertise be consulted.

INTRODUCTION

This manual is intended as an easy-to-understand guide for owners and prospective owners of waterfront property within the city limits of Belleair Beach. Almost all of the waterfront properties on Belleair Beach are protected by seawalls which were installed by the original developer or a marine contractor. Most of the original seawalls on Belleair Beach are nearing the end of their useful lives or have been replaced.

The manual contains an overview of frequently-used seawall terminology, illustrations of common problems with seawalls, and information regarding the repair and replacement of seawalls. In addition, there are tips on how to prolong the useful life of a seawall, and thus postpone the expense of major repairs or replacement.

The costs involved in repairing or replacing seawalls can be substantial. When considering the purchase of a home or lot located on the water, it is strongly recommended that potential buyers have the seawall evaluated by an engineering firm or contractor specializing in marine construction before buying.

The waterways of Belleair Beach are perhaps the most visible and important aspect of island life. Thank you for taking the time to learn about our seawalls and the critical role that they serve on our island.

FORM, FUNCTION AND IMPORTANCE OF SEAWALLS

A seawall or bulkhead is a structure which separates a body of water from the adjacent land. While the appropriate term for most of the structures on Belleair Beach is “bulkhead” (a straight wall) residents and visitors commonly use the term “seawall” instead.

Seawalls perform a number of functions which are important to property owners and to the City of Belleair Beach:

- they serve to protect property from loss of land mass into the water due to erosion, current, and wave action
- they help maintain the proper water depth in adjacent waterways
- they delineate between private property (the owner's land) and public property (the water)
- they define the width of a waterway for purposes of dock and accessory construction
- they contribute to the stability and value of waterfront property

An essential point to remember is that our seawalls are intended to keep “land in” rather than the “water out”. A seawall is actually not one unit; rather it is designed and constructed from a number of distinct components such as panels, cap, tieback rods, and deadmen.

Generally, a seawall consists of a series of interlocked panels (concrete, composite, PVC, metal) that are not watertight. A cap (usually concrete) ties individual panels together. The panels extend vertically from below the water floor (berm) to above the land elevation. Traditional construction methods include tie-back rods that anchor the vertical structure to concrete blocks called deadmen which are embedded in the landside soil.

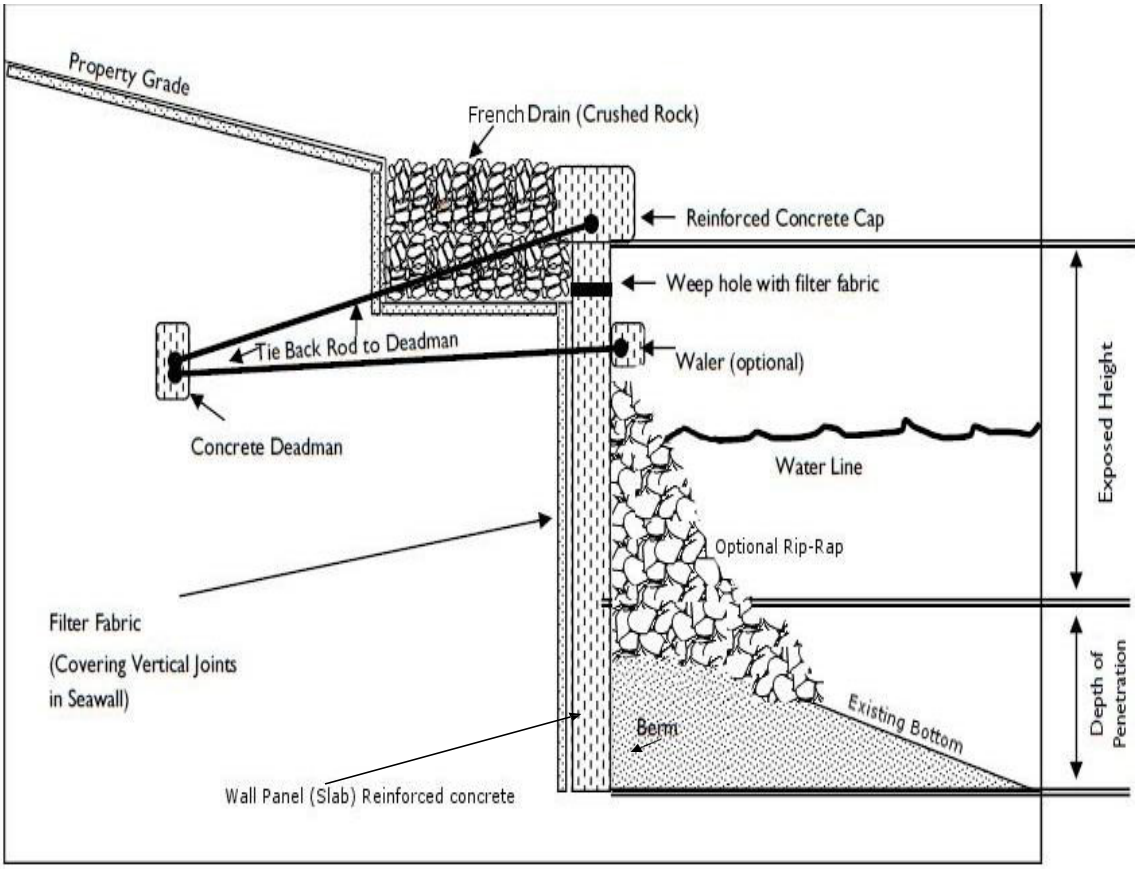
The tiebacks and deadmen are vital to maintain the wall in an upright position and prevent it from falling into the water.

Many, but not all seawalls on Belleair Beach have wood or concrete pilings spaced along the waterside perimeter of the wall to minimize sagging or leaning into the water. All materials utilized in the construction of a seawall shall be maintained in their natural state. No alterations to include painting and epoxy may be utilized. This will facilitate the ability to conduct seawall inspections.

Seawalls are designed with weep holes to allow water collecting behind the panels to drain and relieve (hydrostatic) pressure on the structure. A special drain system called a "French Drain" is required on Belleair Beach. Its purpose is to facilitate drainage from behind the slabs. In addition, commercially available drain systems are sometime installed to increase drainage capability. Each of these features can help to prolong the life of seawalls.

To help visualize the seawall structure, an illustration is included below.

TYPICAL SEAWALL AND COMPONENTS



COMMON SEAWALL PROBLEMS

Seawall construction methods have improved significantly over time as a result of technological advances, experience and regulatory action. Older seawalls can suffer from a number of common problems:

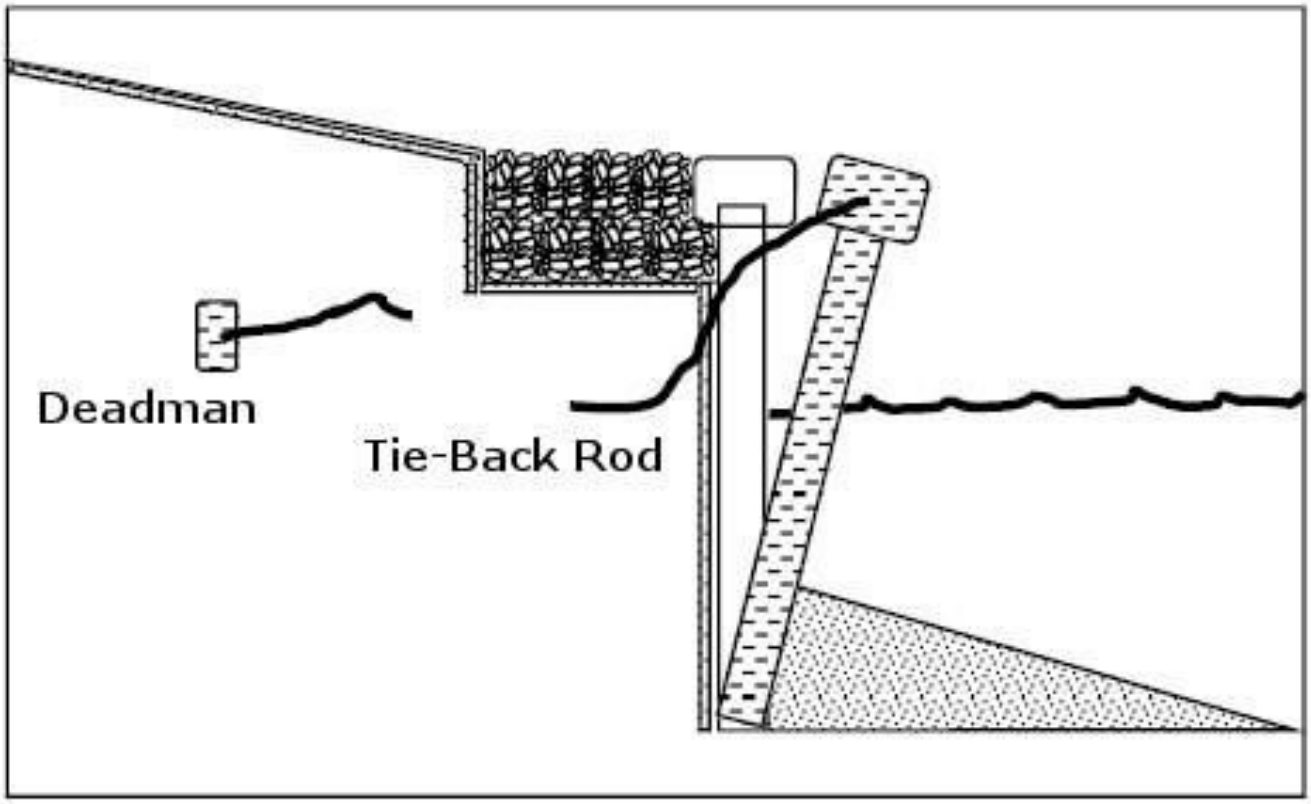
SINKHOLES:

Symptoms: Sinkholes upland of the wall, visible back-fill mounds in the water near seawall joints (most visible at low tide)

Cause: Age, settling, structural failure, insufficient berm at the slab toe of the wall. Slab separation allowing backfill to migrate through openings into the water. Frequently occur after heavy rains.

Remedies: Replenish or add rock to the French Drains if fill loss is excessive. Installation of a French Drain may be appropriate if not already present. Maintain water passage through weep holes by cleaning or add supplemental drainage. Add filter fabric to vertical slab joints. If berm is lacking at the slab bottoms, may require replenishment.

TIEBACK FAILURE

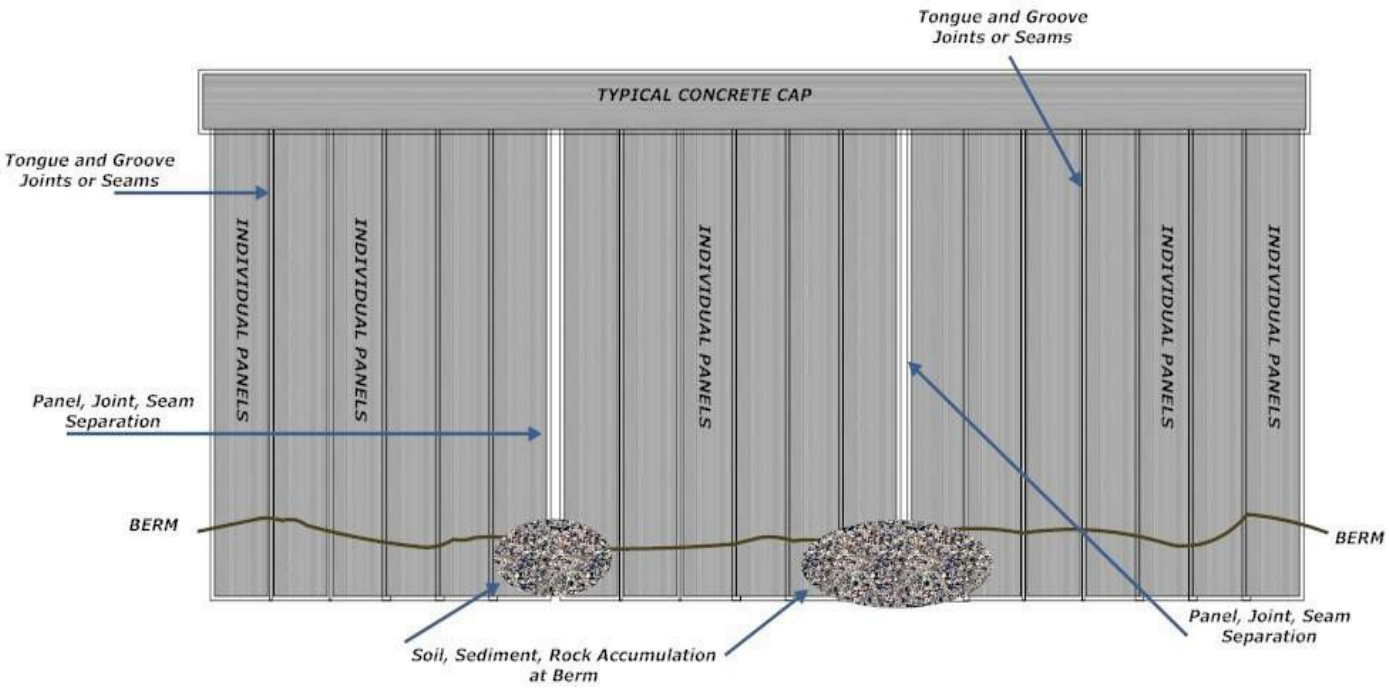


Symptoms: A deteriorating cap, wavy or sagging panels, cracks / spalling and backfill settlement.

Cause: This is the result of saltwater corrosion and oxidation in the cap reinforcing or tie-back rods. It could also stem from movement of the structure. The results are upper rotation, cracking or crumbling of the concrete cap and its ability to keep the slabs aligned, and/or the slabs moving out of vertical (plumb).

Remedies: If tie-back rods are heavily corroded, excavation may be necessary for their replacement and integration into a newly poured cap. On many older seawalls, owners faced with tieback rod failure have installed a new set of tie-back rods and a waler -- a concrete structure that runs the length of the seawall about 2' below the top on the water side of the panels. Supplemental helical tiebacks are also a common remedy.

SLAB JOINT (SEAM) SEPARATION

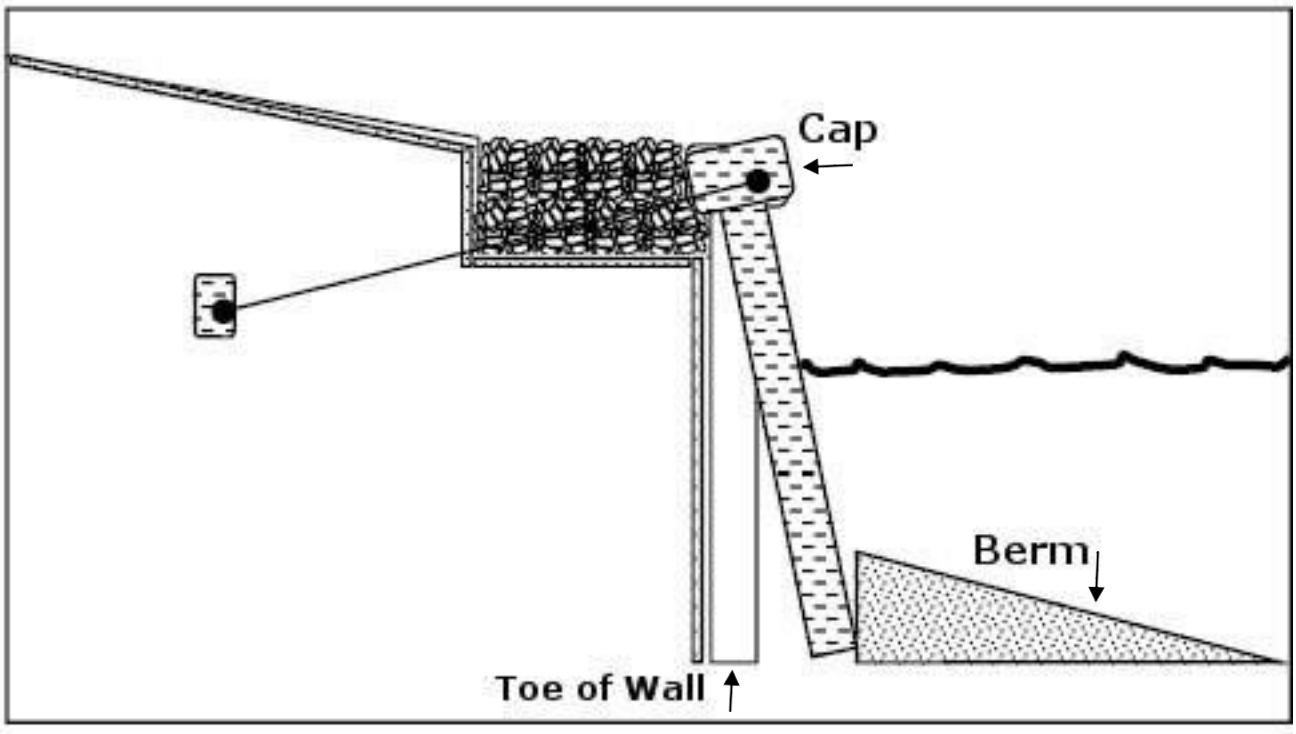


Symptoms: Sinkholes, separation in seams, accumulation of rock and sediment at base of affected joint.

Cause: Age, uneven exertion of hydrostatic pressure particularly during low tide. Tieback failures.

Remedies: Seal seams and cracks, install filter fabric, install supplemental tiebacks (traditional or helical) for additional support in crack areas. Ensure proper drainage and relief of hydrostatic pressure. To the extent possible, route storm water away from the seawall.

TOE & BERM FAILURE

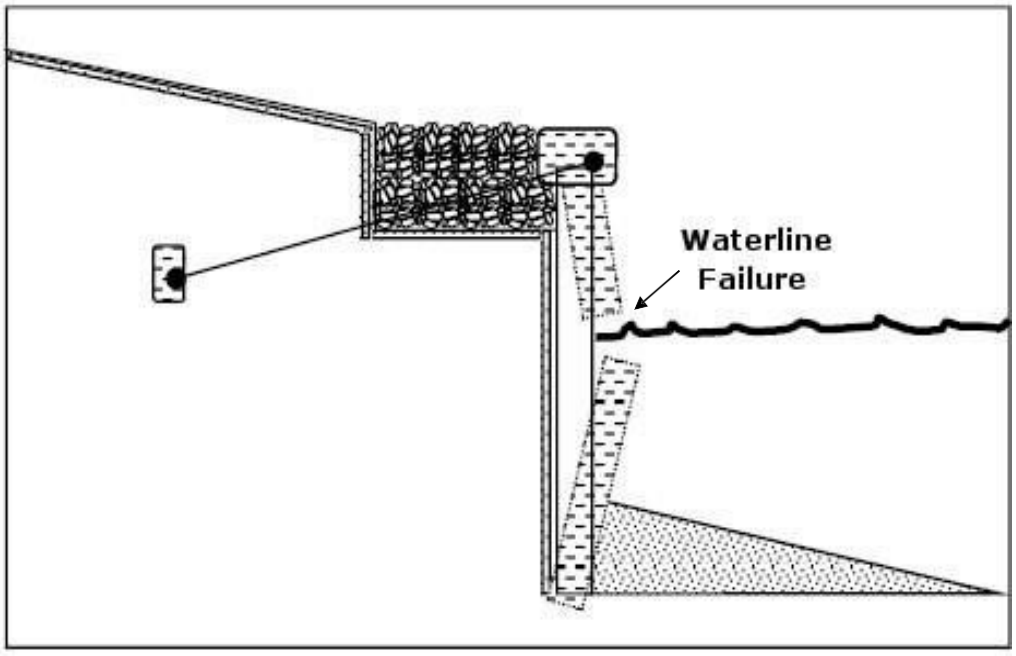


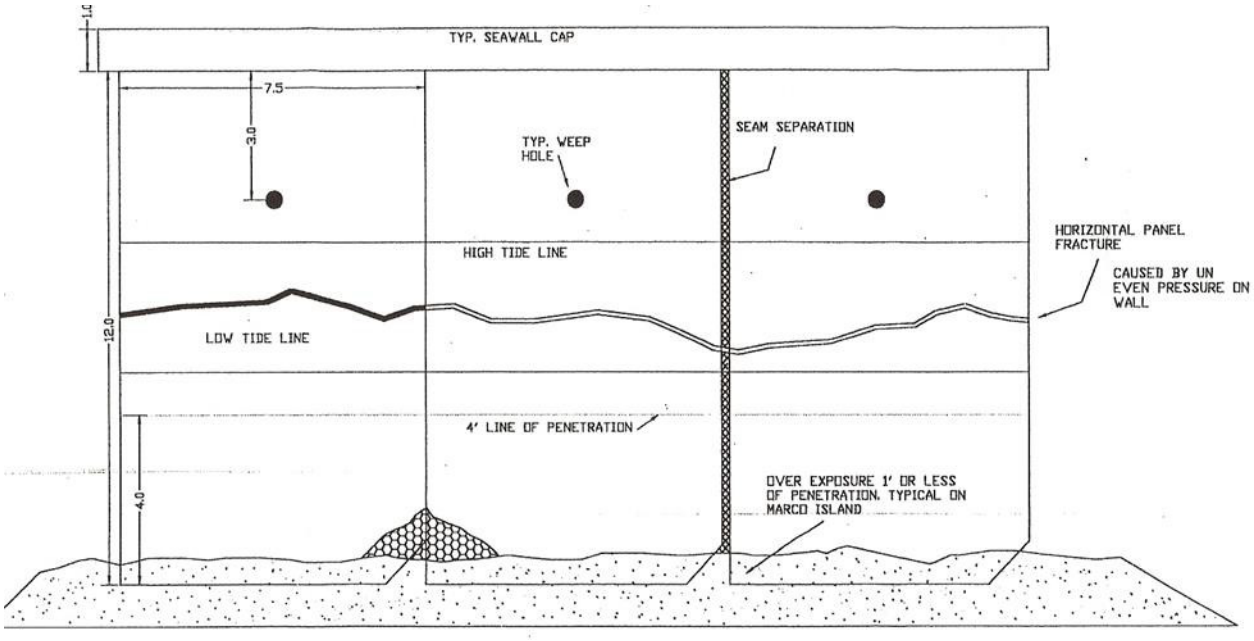
Symptoms: Cap rotation, movement or cracking, a gap opening between seawall and dock (if present), and support pilings (if present) tight against the seawall indicating pressure on the structure from the failure.

Cause: Loss of supporting berm at the bottom of the slabs in the water. The panels tilt out, and sometimes crack or cause the cap to twist or break. Loss of berm is usually associated with wave action, either natural or from speeding boats. Insufficient panel penetration and /or improper placement in the berm may be the cause of such failures as well.

Remedies: Placement of additional berm, rip-rap or bags of dry concrete mix to stabilize the bottom of the structure if the toe-out is not too severe. In severe cases, the panels may be pulled and replaced, or reinserted if not badly damaged. If pilings are present along the seawall perimeter, dry concrete bags wedged between the piling and the wall may help.

WATERLINE FAILURE





Symptoms: The principal symptom is cracking with rust marks on the panels facing the water.

Cause: Aging, corrosion of concrete and reinforcing rod and uneven hydrostatic pressure. Slabs or panels develop horizontal cracks usually along the water line, and the panels eventually break along these lines.

Remedies: Replace affected panels if possible. Potential for helical tieback usage.

CAP FAILURE

Symptoms: The principal symptom is rust, spalling, exposed rebar, fractures.

Cause: Aging, corrosion of concrete and reinforcing rod and uneven hydrostatic pressure. Slabs or panels develop horizontal cracks usually along the water line, and the panels eventually break along these lines.

Remedies: Partial or full cap replacement.

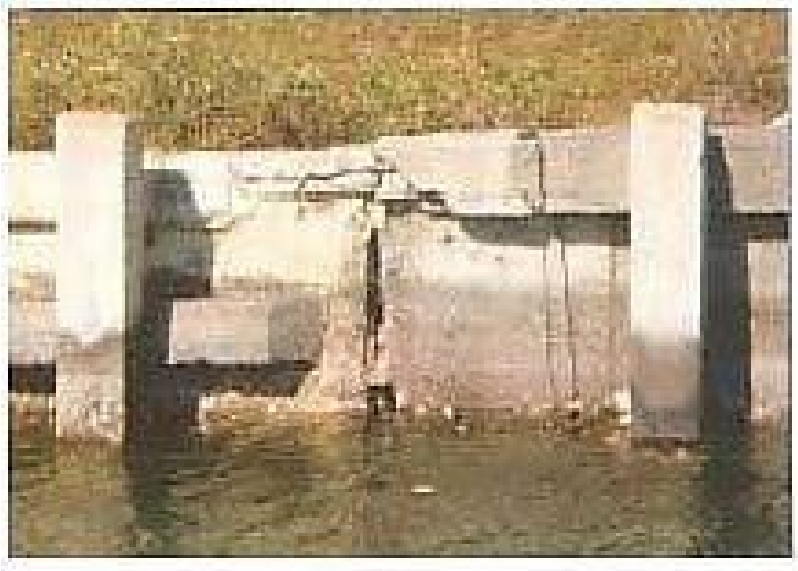
ADDITIONAL
PHOTOGRAPHIC EXAMPLES

Note the horizontal crack just above the water line and the wide gap between slabs at the right. Concrete pilings have been driven to attempt to stabilize the wall.

The tieback rods to the reinforced concrete waler have rusted through and the unsupported waler is useless and falling into the water.

The concrete cap on this seawall has failed. As the cap comes apart, tie-back rods will have no anchor point. Without a solid cap there will be nothing to hold the vertical walls in alignment

Note the back-leaning cap on this seawall. The berm has failed, and the toe has moved out toward the canal tipping the whole structure. The pilings are the only component retaining the toe of the wall. The concrete waler is also starting to fail.



Note the extreme slab joint (seam) separation visible in this photograph taken at the property line. Rock and soil from behind the wall will be washed out from between the panels with wave and tidal action. Heavy rain will also contribute to erosion. Advanced cap deterioration is plainly visible. Concrete pilings have been placed in front of the waler to attempt stabilization.

Berm failure (insufficient panel penetration during installation or scouring of berm due to tidal action) has caused the seawall to kick-out. Complete replacement of the seawallis necessary.

SEAWALL REPAIR & STABILIZATION

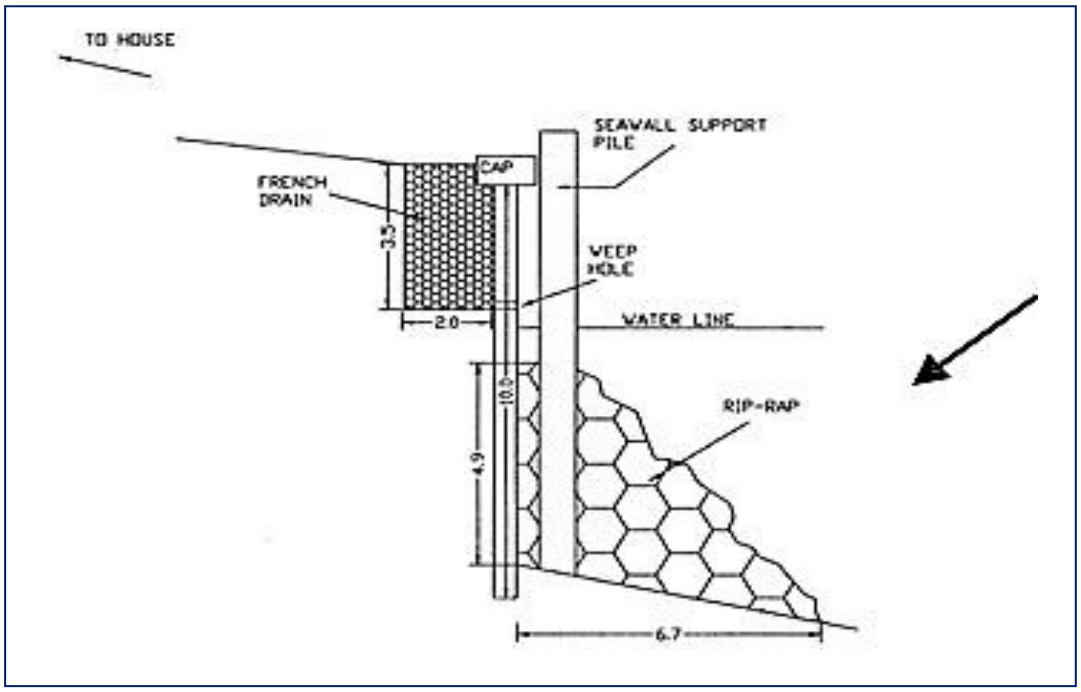
A waler is installed about 2 ft. below the seawall cap. The waler is a horizontally placed reinforced concrete beam which is connected to tie-back rods anchored to deadman. A waler is usually added as reinforcement when it is suspected that the original tie-back rods to the cap have rusted-through.

This seawall has a waler plus concrete pilings driven into the canal bottom for extra support. The pilings help stabilize the wall to keep the toe of the wall from moving out.

Wooden pilings are also used for stabilization. This seawall also has galvanized steel channels just above the water level which are anchored to the deadmen in the same manner as a waler.

Supplemental tieback example – in this case, a helical tieback installed at corner point with vertical flange. The actual tieback is a solid rod with helices driven 14-21 feet into the ground at a specified angle.

Rip-Rap (stone piled against the seawall) is particularly useful in areas of high tidal velocity to keep berm from washing away. Unfortunately, rip-rap can hamper boat docking and dock installation.



Profile illustration of rip-rap. Note degree of necessary protrusion into canal which may make installing a future dock difficult.

Framing and pouring of new (replacement) cap

Note horizontal crack at mid-point of concrete panel – the weakest point of the seawall, particularly at low tide. Crack is likely caused by either excess hydrostatic pressure or possibly a tieback failure. Drain (bottom of picture) was likely installed in response.

Supplemental drainage system designed to relieve hydrostatic pressure

MAXIMIZING THE LIFE OF YOUR SEAWALL

There are a number of things that a property owner may do to prolong the useful life of a seawall, and thereby postpone the expense of major repairs or replacement. Please consider the following recommendations:

1. Install a French Drain. This will help even out the pressure differential between the two sides of the seawall, the land side and the water side. This pressure differential is one of the major causes of seawall damage.

2. Maintain the French Drain and the seawall weep holes so that effective drainage occurs. Weep holes tend to become clogged with sand or soil, thus reducing water flow. French Drains need "replenishing" with rock or gravel to work properly and prevent erosion.

3. Install pilings or supplemental tieback rods around the perimeter of the seawall. These will add support and help to maintain alignment of the slabs or panels.

4. If you boat, maintain "Idle Speed" in the bays, waterways and canals of Belleair Beach. This protects berms securing the lower end or toe of the slabs or panels. Encourage your friends and neighbors with boats to do the same.

5. Encourage your neighbors to properly maintain their seawalls. A sagging seawall adjacent to yours may cause you some damage.

6. Avoid the placement of large trees adjacent to seawalls and avoid the use of heavy equipment traveling along seawall perimeter so as to reduce pressure on the seawall.

7. Adjust sprinkler heads in the vicinity of seawalls to minimize water application behind the wall. Try to redirect drainage from yard and roof so that it does not flow directly into French Drains or pond behind the seawall structure.

SEAWALL REPLACEMENT

The best way to maximize seawall life is to start with a properly engineered and installed seawall. Subsequent problems will be reduced if the original design and construction is properly done. Approved construction specifications are attached to the City Seawall Ordinance.

Undeveloped (vacant) lots provide reasonable access for a contractor's equipment and materials. However developed lots present access problems, often requiring work to be done from a barge. The presence of a house, dock, davits, trees, other landscaping, sprinkler systems, exterior plumbing and electric conduits will add to the cost of replacement, as these items will either limit access or require removal and replacement.

Seawall replacement represents a significant investment. Use good judgement when selecting a marine contractor and thoroughly check-out their history and credentials:

- ✓ Check with neighbors and friends
- ✓ Check with the Better Business Bureau
- ✓ Check for required insurance including Liability & USL&H with the City of Belleair Beach
- ✓ Check for proper licensing with Pinellas County Contractor Licensing
- ✓ Check the number of years in business
- ✓ Check references provided by the company
- ✓ Check on completed jobs and ask to visit ongoing job sites

Many seawall repairs and all seawall replacements require a permit from the City of Belleair Beach. A plan submitted by a qualified professional engineer or design professional registered in the State of Florida is also necessary.

Concrete seawall

Vinyl Seawall with Concrete Cap

SEAWALL PERMITTING PROCESS

- Select Marine Contractor
- Notice of Commencement filed with Clerk of Courts
- Permit application made by contractor
- Marine Contractor recommends engineer or engineering firm
- Engineering Plans and Pre-permit Affidavit developed and submitted
- Plan Reviews conducted and approved by City of Belleair Beach
- Plan Reviews conducted and approved by Pinellas County
- Permit and associated fees paid
- Permit Issued
- Construction Begins
- Construction Ends

See important information below

- Engineer submits Final Affidavit and Letter
- Certificate of Completion Issued

IMPORTANT

The engineer of record is responsible for ensuring that construction methods and materials used are in conformance with City of Belleair Beach Ordinances and the accepted engineering plans. The engineer of record is generally engaged by the marine contractor – individuals contracting for replacement seawalls may wish to engage their own engineer or 3rd party consultant. Pinellas County conducts all inspections of seawall construction.

GLOSSARY OF TERMS

Berm:

Ground or soil which supports toe of the wall at the bottom. May also include rip-rap.

Cap:

Concrete (usually reinforced) box structure which ties seawall together at top.

Deadman:

Poured concrete block approximately 15' back in the yard which anchors panel and cap structure by means of steel tie-back rod.

Erosion:

Soil from behind the wall escaping into the water. This may occur through defective seawall joints, or cracked panels.

French Drain:

Usually a 2' by 2' trench dug out behind the seawall lined with filter fabric and filled with crushed stone.

Hydrostatic Pressure:

Invisible but constant force created from water on the landside of the seawall.

Panel (or Slab):

A reinforced concrete rectangle, 6" thick and 5' to 8' wide and 10' to 16' long. These are placed vertically to form the wall. Alternatively, plastic (PVC) sheet piling, composite sheet piling, or metal sheet piling are issued for this purpose.

Piling:

Concrete or wood poles placed at regular intervals outside of the panel perimeter in the water to reduce movement of the seawall.

Rip-Rap:

Large size stone placed at the toe of the wall to stabilize its position and prevent or reduce erosion.

Tie-Back or Rod:

Steel bars connecting the seawall cap and the anchor.

Waler:

A supporting structure installed about 2' below the seawall top placed on the outside of the panels which normally anchors a separate tie-back rod system to help support the seawall.

Weep Holes:

Drilled holes in seawall above the water line to facilitate drainage and reduce water pressure.