

# PROJECT UPDATE - AMPHIDROME® TREATMENT SYSTEM



**F. R. Mahony & Associates, Inc.**

## Jennette's Pier On-Site Wastewater Solution

### Special points of interest:

- **Historic Landmark to be restored.**

### Advanced wastewater treatment system to provide:

- **Small Building footprint.**
- **Low Visual Impact.**
- **Low energy demand.**
- **Re-Use Quality Effluent**

### Nags Head, NC

Originally built in 1939, Jennette's is the oldest fishing pier on the Outer Banks.



North Carolina's Outer Banks has long been known for its spectacular fishing. Red drum, bluefish, striped bass, flounder and king mackerel are just some of the prized fishes

sought by anglers young and old.

Fishing on the banks was forever changed when the first fishing pier—Jennette's Pier—was opened in Nags Head back in 1939.

Battered by storms and rebuilt many times throughout its seventy-year life, Jennette's was knocked down by Hurricane Isabel in 2003, just after the pier and its five-acre tract were purchased by the NC Aquarium Society.

Now, after years of planning and twenty-four months of construction, Jennette's will reemerge in 2011 as a one-of-a-kind educational ocean pier. The Aquarium-operated complex will feature educational classrooms and programs, alternative energy demonstra-

tions, live animal exhibits, meeting facilities, a snack bar and tackle shop, and a host of other displays and features for good family fun....with great fishing too!

Check this website frequently for updates on grand opening events, fees and hours, activity calendars, facility rental options, employment opportunities, and other pier news.

[www.jennettespier.net](http://www.jennettespier.net)

### Unique solutions required

Anticipating that this location will once again draw large crowds, a responsible wastewater solution had to be found to protect this valuable resource.

**See More on the Amphidrome® Wastewater Solution.**

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## Project Scope—Advanced Treatment Required

**The Jennette's Pier** project was designed by **Bowman Murray Hemingway Architects and Quible Engineering & Associates, P.C.**

The project was designed for the **Department of Environmental and Natural Re-**

**sources** for the **North Carolina Aquarium Pier at Nags Head.**

The **Amphidrome®** Treatment System was furnish by **F. R. Mahony & Associates, Inc. of Rockland, MA** who also furnished the remainder of the

treatment equipment to the General Contracting firm of **Basnight Construction Co. Inc., Manteo, NC.**

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See (*The Amphidrome System—page 2*)

## Advanced Treatment Required (from page 1)

The Wastewater Treatment system at Jennette’s Pier provides full wastewater treatment to remove BOD, TSS, nitrogen and phosphorus and turbidity.

The Amphidrome Plus treatment process removes organic and solid wastes and provides a very high removal of nitrogen.

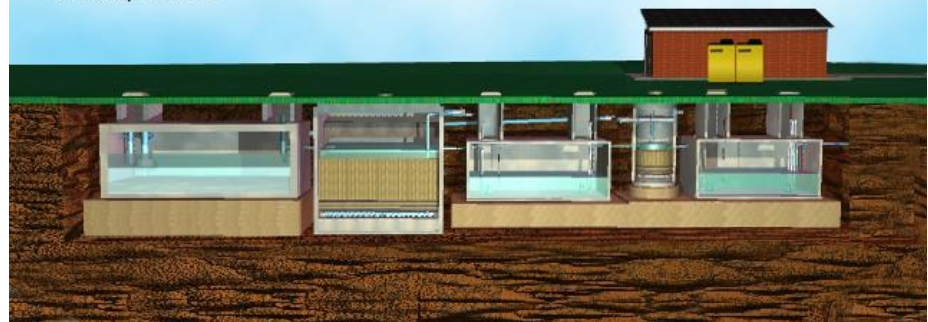
The membrane filtration system further removes phosphorus and turbidity. Final (UV) Ultraviolet disinfection follows these treatment steps to provide a very high quality re-use water.

This advanced treatment system allows for above ground discharge to an infiltration pond and provides for full re-use water for toilet flushing making this a truly “green” solution to wastewater disposal.

**AMPHIDROME™**  
for more information call: 800.791.6132

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## Amphidrome System—For Re-Use

The Amphidrome system utilizes two tanks and one submerged attached growth bio-reactor, subsequently called Amphidrome reactor.

The first tank, the anoxic/ equalization tank, is where the raw wastewater enters the system. The tank has an equalization section, a settling zone, and a sludge storage section. It serves as a primary clarifier before the Amphidrome reactor

This Amphidrome reactor consists of the following four items: under drain, support gravel, filter media, and back-wash trough. The under drain, constructed of stainless steel, or HDPE encased concrete block, is located at the bottom of the reactor. The

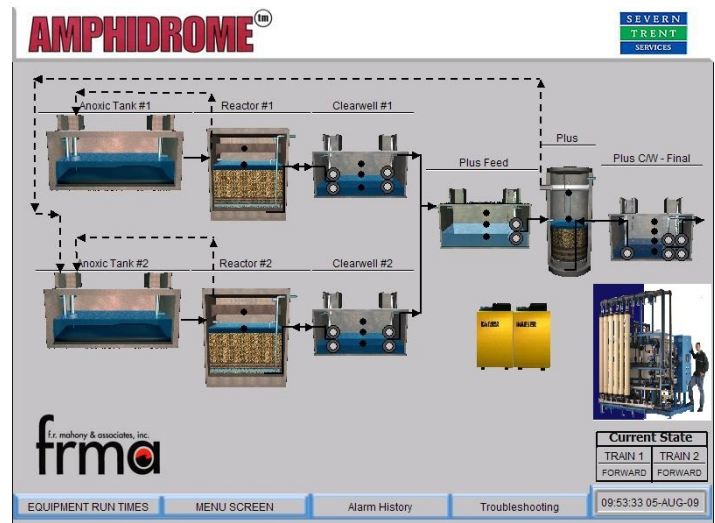
under drain provides support for the media and even distribution of air and water into the reactor.

Air laterals are provided to distribute the air evenly over the entire filter bottom. The design allows for both the air and water to be delivered simultaneously, or separately via individual pathways to the bottom of the reactor.

The system utilizes an automated PLC control system with touch screen interface to provide the operator easy access to process controls

This system is in use throughout the United States and Internationally and has been in use since 1996.

The Amphidrome® system provides the highest level of treatment attainable with the lowest site impact.



## The Amphidrome Process

The Amphidrome system is a submerged attached growth bioreactor process (SAGB). It is a deep-bed sand filter designed for the simultaneous removal of soluble organic matter, nitrogen and suspended solids within a single reactor.

However, if stringent total nitrogen limits, (i.e. less than 10 mg/l), are required, a second smaller polishing reactor is required. Since the process removes nitrogen, it is also classified as a biological nutrient removal (BNR) process.

To achieve simultaneous oxidation of soluble material, and to provide nitrification and denitrification in a single reactor, the process must provide aerobic and anoxic environments for the two different populations of microorganisms.

The Amphidrome process can be used as a stand-alone treatment process or can be used with other processes to provide further treatment. Depending on the discharge permit requirements these systems can include micro-filtration, Chemical coagulation processes and ultraviolet disinfection.

As the air flows up through the media, the bubbles are sheared by the sand-producing finer bubbles as they rise through the filter. On top of the under drain is 18", (five layers), of four different sizes of gravel. Above the gravel is a deep bed of coarse, round, silica sand media. The media functions as a filter, significantly reducing suspended solids, and provides the surface area for which an attached growth biomass can be maintained.

To achieve the two different environments required for the simultaneous removal of soluble organics and nitrogen, aeration of the reactor is intermittent, rather than continuous.

Depending on the strength and the volume of the wastewater, a typical aeration scheme may be three to five minutes of air and ten to fifteen minutes without air. Concurrently, return cycles are scheduled every hour, regardless of the aeration sequence. During a return, water from the clear well is pumped back up through the filter and overflows into the trough. The trough is set at a fixed height above both the media and the influent line; and the flow is by gravity back to the front of the anoxic/equalization tank.

The cyclical forward and reverse flow of the waste stream and the intermittent aeration of the filter achieve the required hydraulic retention time and create the necessary aerobic and anoxic conditions to maintain the required level of treatment.

### Applications

The Amphidrome process is used in applications from single family homes to very large flows in excess of 200,000 gpd.

Applications can include new home construction, remedial applications to fit in reduced space limitations, commercial and residential development and community wastewater treatment solutions.

Effluent quality provides advanced treatment to enable a vast range of discharge solutions from direct soil absorption systems to end of pipe water re-use systems.

More information may be found at:

[www.frmahony.com](http://www.frmahony.com)

## Vital Statistics for Jennette's Pier Amphidrome

### NC Discharge Limits

- Flow 15,000 gpd

### Monthly Average - Daily Limits

- BOD <math>\leq 10</math> mg/l - 15
- Ammonia <math>\leq 4</math> mg/l - 6
- TSS <math>\leq 5</math> mg/l - 10
- Fecal 14/100 ml - 25/100

### Monthly Average

- Nitrate <math>\leq 10</math> mg/l
- TN <math>\leq 7</math> mg/l
- TP <math>\leq 3</math> mg/l

### Daily Maximum

- Turbidity 10 NTU

### Treatment Plant

**Dual Train Amphidrome®  
Plus 15,000 gpd**

- (2) Anoxic/Equalization Tanks @ 14,000 per train
- (2) 9.5 by 10.5 ft. Amphidrome Reactors.
- (2) 12,000 gallon clear wells/Plus Reactor Dosing Tanks
- (1) Plus Reactor Pump chamber 4 ft dia..
- (1) 3,000 gallon Membrane Filtration feed tank.r
- (1) PALL Processing Aria AP-1 Package Filtration Unit.
- UV In vessel Disinfection Unit
- (1) 500 cfm Tub Scrubber with Mist Eliminator

### Collection System

- Pumping Station Feed



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We specialize in process solutions for the collection and purification of wastewater from single family homes to large municipal systems.

#### WATER

We will assist you in the application of state of the art processes for the clarification, treatment and disinfection for drinking water.

#### ON SITE TREATMENT

Our Amphidrome® system provides the highest level of treatment attainable with the lowest site impact

Providing SBR, MBR, and RBC technologies to fit the right solution for you.

#### SEWER SYSTEMS

Our applications group will assist you with the application of Pressure Sewer System technology and custom designed pump stations for your project.

#### SAGB® SYSTEMS

Process solutions for the nitrogen reduction in recycle streams.

## About Jennette's Pier

You can become part of history and help rebuild Jennette's Pier. Over 1,000 of the new pier's deck boards are available for sponsorship through our Own A Plank! campaign.

Your tax-deductible contribution of \$200 will be used to support the many programs and exhibits featured at this new coastal landmark. Sponsors' names will be engraved in personalized fish tiles prominently embedded in deck boards along the pier. Pier benches are also available for sponsorship

For more information, please visit [www.jennettespier.net](http://www.jennettespier.net).

