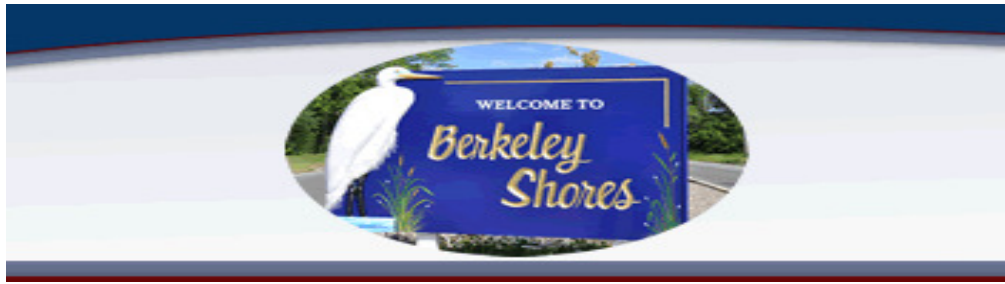




WATER QUALITY STRATEGIES PROPOSAL FOR BERKELEY SHORES

On a daily basis water from the lagoon flows into the salt marsh where it is treated better than any man made treatment facility could provide. The water is denitrified, oxygenated and purified by the 150 acres of salt marsh. It is then returned back into the lagoon in a purified state with no turbidity or algae. This occurs twice a day with the tide.

PREPARED BY: BSHCA ENVIRONMENTAL COMMITTEE



**BARNEGAT BAY AND LAGOON
WATER QUALITY STRATEGY PROPOSALS
FOR BERKELEY SHORES
BERKELEY TOWNSHIP, OCEAN COUNTY, NJ**



PREPARED BY:

BSHCA Environmental Committee

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Background:

Networks of dead end lagoons along coastal Barnegat Bay were created in the 1960's and early 1970's by development projects that dug the lagoons from mostly upland areas to obtain residential waterfront lots. At that time, thought was not given to the impact of the design, construction and types of materials used to build the lagoons might have on the environment. Berkeley Shores, with almost 1000 waterfront homes is very typical of that era of development. Berkeley Shores has 79,000 lineal feet of waterfront frontage which amounts to 15 miles! Most of this waterfront lineage is used to create a series of dead end lagoons (see aerial photo)page).

In recent years, and with the continuing degradation of Barnegat Bay, the lagoons have been experiencing many challenges to their ecosystems. Some of these include:

1. Poor circulation and flushing.
2. Excessive nutrient buildup.
3. Low dissolved oxygen buildup.
4. Hydrogen sulfide.
5. Eutrophication due to excessive nitrates and phosphates.
6. Odiferous, unsightly and harmful algae blooms.
7. Stagnant, polluted and turbid water.
8. Declining benthic, shellfish and blue crab communities.
9. The proliferation and propagation of harmful sea nettles.
10. Retention of toxic materials from storm sewer outfall pipes.



The end of Moorage lagoon with sea nettles, extreme turbidity, and noxious foul smelling algae

Governor Christie's Comprehensive Action Plan To Address The Ecological Decline Of Barnegat Bay:

This proposal of strategies for the Berkeley Shores area addresses No. 2 of the Governor's 10 point action plan. Specifically funding storm water mitigation projects utilizing State Revolving Funds (\$17 million in grants) and New Jersey Environmental Infrastructure Trust (targeted at \$100 million over the next decade for zero-interest or very low-interest loans).

It is noted that the Berkeley Shores Homeowners and Civic Association (BSHCA) and its 700 members are very pro-active in addressing the water quality concerns of Barnegat Bay. Its volunteers planted over 30,000 American dune grass plants on Allen Road Beach, and most recently constructed a "living shoreline" of *spartina alterniflora* along the shores of Barnegat Bay. If proven successful, BSHCA will seek additional grant funding to complete the remaining 1300 lineal feet of shoreline to the Amherst Inlet. The Living Shoreline project and Dune Grass Plantings are documented on the following websites:

<https://picasaweb.google.com/berkeleyshores/LivingShoreline#>
<https://picasaweb.google.com/berkeleyshores/LivingShorelineDay2#>
<http://bshca.blogspot.com/>

A future volunteer project, based on available funding, will give consideration to the planting of eel grass along our shoreline, similar to a plan implemented in New Hampshire.

Although these projects are noteworthy, they do little to significantly improve the overall water quality in our lagoons. It is with this proposal, that we address problems 1 thru 10 outlined above in the context of funding storm water mitigation projects in the Governor's action plan.

This proposal is addressed to the Township of Berkeley and the County of Ocean along with the NJ Department of Environmental Protection for consideration, discussion and consultation.

Description Of The Area:

Berkeley Shores contains an area of approximately 265 acres consisting of approximately 1,100 individual residences and a residential condominium complex of 90 units. Almost all of the residences are on waterfront lagoons and/or Barnegat Bay.

It is bounded on the northeast by approximately 150 acres of spartina tidal salt marsh, on the east by approximately 46 acres of spartina tidal salt marsh, on the southeast by Barnegat Bay, on the south by approximately 92 acres of spartina tidal salt marsh, on the west by the Potter Elementary School and Little League complex and on the northeast by low woodlands. All of the spartina tidal salt marshes have an extensive series of mosquito ditches that have a continuous flow of water ebbing and flowing with the tide.

The normal tide range in Berkeley Shores is 0.55 feet (from NJDEP tide station #85331135). Although, occasional wind driven surges magnify that range by as much as 1 to 2 feet or more.

All of the uplands adjacent to Berkeley Shores containing low woodlands and spartina tidal salt marsh are part of the Ocean County Public Land Trust. They are on the north side of Veeder Lane and Bayview Avenue, to the east of Bow Sprit Drive and to the south of Allen Road.

Contributing Storm Drainage Areas To Berkeley Shores Lagoons:

Besides the 265 acres of residential Berkeley Shores draining directly into the lagoon system, there is an additional 160 acres to the west draining directly into the lagoon system. This area consists of residences, an elementary school, a little league complex and a commercial shopping center. This area is bounded on the north by Veeder Lane, on the east by Moorage Avenue, on the south by Anchorage Avenue, and on the west by State Highway Route 9.

This 160 acre area collects storm water runoff with a series of catch basins that are piped to the very last lagoon, farthest from Barnegat Bay. This is the worst possible place because this lagoon experiences the least amount of circulation and flushing action from the tide.



48" Outfall pipe at 102 Moorage Ave. that carries most of the effluent from the 160 acres to the west of Berkeley Shores

Solutions Investigated:

Some of the solutions we investigated to substantially improve the water quality of our lagoon end ecosystems include the following:

- Catch Basin Retrofits.
- Lagoon end aeration devices.
- Installing circulation pipes from lagoon ends to adjacent tidal marshes.
- Diverting storm water outfall pipes from directly dumping into the lagoons.

We systematically investigated each of the four solutions above and determined the pros and cons of each and finally, its appropriate value to Berkeley Shores.

Catch Basin Retrofits:

Catch basin retrofits include new casting tops and curb pieces with smaller openings to prevent larger debris from entering our waterways. Retrofits also include a deeper sump (space between the bottom of the basin and invert of the outfall pipe) to trap smaller debris and silt. And finally a retrofit includes a hood over the outfall pipe to prevent floating debris from entering our waterway. One of the negative factors of retrofitted catch basins with sumps is that they require a minimum of biannual maintenance (e.g. vacuuming), and they are only partially effective at eliminating pollutants.

An inventory was taken by the committee and it was found that all of the catch basins on the municipal side streets and many on County Roads Veeder and Bayview already had been retrofitted with new casting tops. The double grated catch basins without curb pieces on Veeder Lane do not have new retrofitted tops. None of the catch basins were retrofitted with deeper sumps or outfall hoods. It is noted by the committee that deeper sumps are impractical and ineffective in areas that have high water tables which include most of the catch basins in our area. Mostly all of the municipal catch basins pipe their effluent directly into the lagoons. One pair of catch basins on Allen Road empty directly into the adjacent spartina salt marsh to the south.

An inventory was taken of the County catch basins along Veeder Lane. These catch basins had interconnections that ultimately emptied their effluent directly into the lagoon ends. All of these catch basins were half filled with silt and debris. In most cases the outfall pipes were half filled with silts. The silts are accumulating in the lagoon ends from storm water runoff to such an extent that boat navigation is a problem. It is noted by the committee that several lagoon end residents have been complaining to various governmental entities for a number of years now.

Although many of the catch basins on Veeder Lane are high enough above the water table to have sumps, it is highly unlikely that they would receive the required biannual maintenance given the current maintenance schedule.

Noting the factors above, it is determined by this committee that catch basin retrofits given the cost benefit ratio is not a practical or sustainable solution to improving our water quality.

Lagoon End Aeration Devices:

Without going into advanced theories, there is no question that introducing oxygen via aeration is one of the most effective ways to treat polluted water containing high amounts of nitrates and phosphorous.

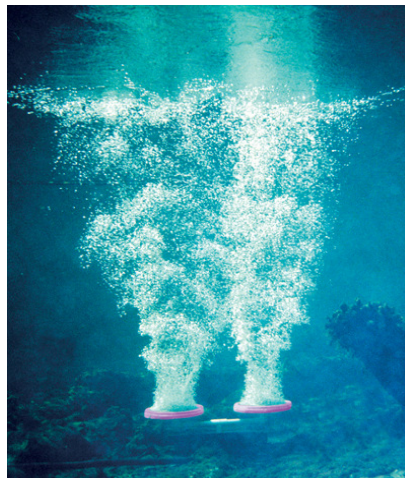
There are many different types of aeration devices. Two types of devices our committee looked at are the floating or bulkhead mounted propeller driven circulation motor, and the diffuser that rest on the bottom of the lagoon that is pumped air via tubing from a pump on the surface.



Triton O2 propeller type aerator in operation in a typical lagoon



Bubbles from an air difuser resting on the bottom of a lagoon



Air diffuser as seen underwater



Above ground air pump and housing for diffuser

The propeller driven aeration system poses navigation and safety problems especially with children swimming in the area. The diffuser system along with the propeller driven system are only effective in the immediate area of the devices and both require maintenance and outside energy sources to operate. It is for these reasons our committee found that aeration devices are not a viable option for our solutions.

Installing circulation pipes from lagoon ends to adjacent tidal marshes:

Investigation by our committee has discovered a vast degree of difference between the water quality in the lagoons closest to Barnegat Bay and those lagoons farthest from Barnegat Bay. As one would expect, the water quality of the lagoons farthest from Barnegat Bay are far more degraded. We have found that circulation pipes from lagoon end to lagoon end have little or no effect on circulation (e.g. the pipe connecting lagoon end to lagoon end under Carlyle Drive 150 feet south of Amherst Dr.) This is because there is no hydraulic gradient created by tidal forces.

However, we have found a tremendous amount of circulatory flow between the pipe at the end of the lagoon between Bayview Drive and Amherst Drive and the salt marsh on the north side of Bayview Ave. This approximately 5 foot diameter pipe runs under Bayview Ave. 400 feet east of Veeder Lane. Because of the hydraulic gradient created by tidal forces, vast amounts of water flow back and forth between the 150 acre salt marsh and the lagoon. On a daily bases, the water from the lagoon flows into the salt marsh where it is treated better than any man made treatment facility could provide. The water is denitrified, oxygenated and purified by the 150 acres of *spartina alterniflora*. It is then returned back into the lagoon in a purified state with no turbidity or algae. This occurs twice a day.



Intake pipe sending purified water from the salt marsh back to the lagoon between Bayview Ave. and Amherst Drive 400 east of Veeder Lane



Water purified from the 150 acre salt marsh being returned to the lagoon



Notice the water quality color between the lagoon on the top compared to the bottom lagoon

The committee has found that circulation pipes between lagoons are not effective. But, circulation pipes from lagoons to tidal salt marshes are highly effective; so much so, it is the **most effective** method to improving the water quality of Berkeley Shores. Not only that, it is the most cost effective (cost/benefit ratio) of all the solutions.

This solution should be encouraged in all places where possible. Some prospective locations include the lagoons north of, and adjacent to, Allen Road and the 92 acre salt marsh to the south. In all cases, existing drainage easements are already in place.



Possible locations for tidal circulation pipes to purify lagoon water



The three lagoons between Bayview Ave. and Yardarm Ct. is another location utilizing existing drainage easements.



Another possible location for a tidal circulation pipe is between the lagoon ends on the west side of Bowsprit Drive and 46 acre salt marsh on the east side of Bowsprit Drive. Notice the water quality color between the lagoons to the left and the salt marsh lagoon.



Another possible location for a tidal circulation pipe is between the lagoon on the west side of Amherst Drive and Barnegat Bay at Amherst Beach (recently installed groin not shown).



Another possible location for tidal circulation pipes is just west of the Landings Condominium complex, connecting the ends of the uninhabited manmade lagoons with the 92 acres of salt marsh to the south. This solution would be very inexpensive and provide extensive lagoon cleaning. The hydraulic gradient due to tidal forces at this location would be quite significant in treating a large volume of water twice daily.

The lagoon ends from Yardarm Court to Moorage Ave. do not have direct access to tidal marsh. although, these are the lagoons that are most in need of circulation and flushing. Perhaps engineering ingenuity can devise a way, from piping and/or ditching, to connect the tidal marsh to the northeast with sufficient hydraulic gradient to flush and circulate the most polluted water in Berkeley Shores.

Diverting storm water outfall pipes from directly dumping into the lagoons:

Of greatest significance to the committee was the location of the 48” outfall pipe located at 102 Moorage Ave. This pipe carries storm water runoff along with a variety of pollutants from Route 9 and the neighboring streets to the west and pours them directly into the lagoon for a prime example of point pollution.

In some cases the outfall pipe diversions would be relatively easy, and in some cases rather difficult. This committee believes that the highest priority in diverting the outfalls are the outfall pipes with the largest diameter as is the case with the Moorage Ave location.

The solution to this problem is diverting outfall pipes to “constructed storm water wetlands” in accordance with “NJ STORM WATER BEST MANAGEMENT PRACTICES MANUAL CHAPTER 9.2”.

This committee has investigated several potential sites to construct “storm water wetlands retention/detention sites.

A potential “constructed storm water wetlands” site is at the end of Anchorage Ave. to the east of Elm Street adjacent to the Public Works Garage (shown below).



Other potential sites for “constructed storm water wetlands”, especially for diverting outfall pipes dumping into lagoon ends are the Ocean County owned property on the north side of Veeder Lane (shown below).



Summary:

The committee feels that catch basin retrofits and lagoon end aeration devices will do little to significantly improve the water quality of Berkeley Shores lagoons and more importantly Barnegat Bay.

We have determined through investigation that the single most effective, in both cost/benefit ratio, and total impact is tidal circulation pipes placed at the suggested locations.

We have also determined that the second best solution to improving the water quality in Berkeley Shores lagoons and Barnegat Bay is diverting storm water outfall lines from directly entering the lagoons and rerouting them to “constructed storm water wetlands” in accordance with NJ STORM WATER BEST MANAGEMENT PRACTICES MANUAL CHAPTER 9.2.

Currently, Berkeley Township ranks 59th on the NJDEP’s Clean Water Barnegat Bay Watershed Project List, recommending the purchase of a street sweeper. It is our hope that this proposal will be given serious consideration, attracting attention sufficient to move us up on the priority list. And further, that this proposal places our situation in the proper perspective with the Township, County and State officials in the context of Governor Christie’s Ten Point Plan to clean Barnegat Bay.

It would seem logical that a waterfront community such as Berkeley Shores with over 15 miles of waterfront and significant stagnant and polluted waters due to storm water effluent and lack of circulation, would require corrective action to protect this valuable natural resource.