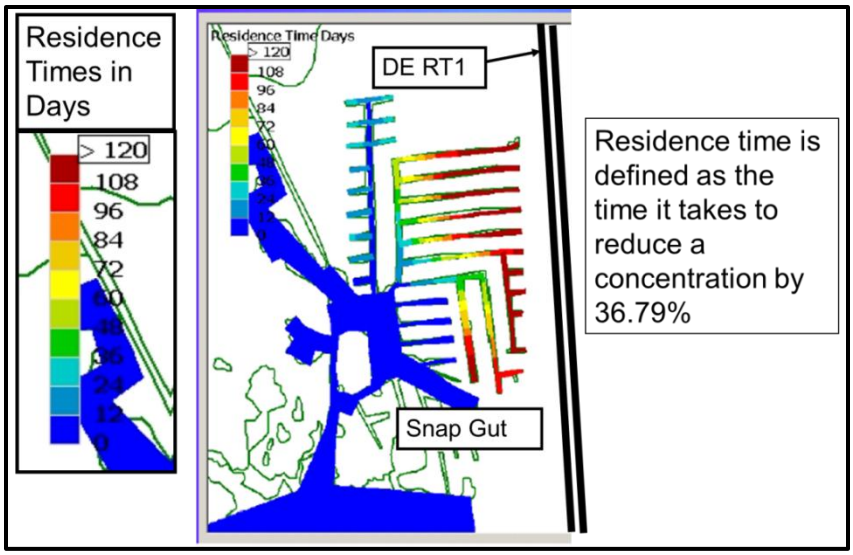
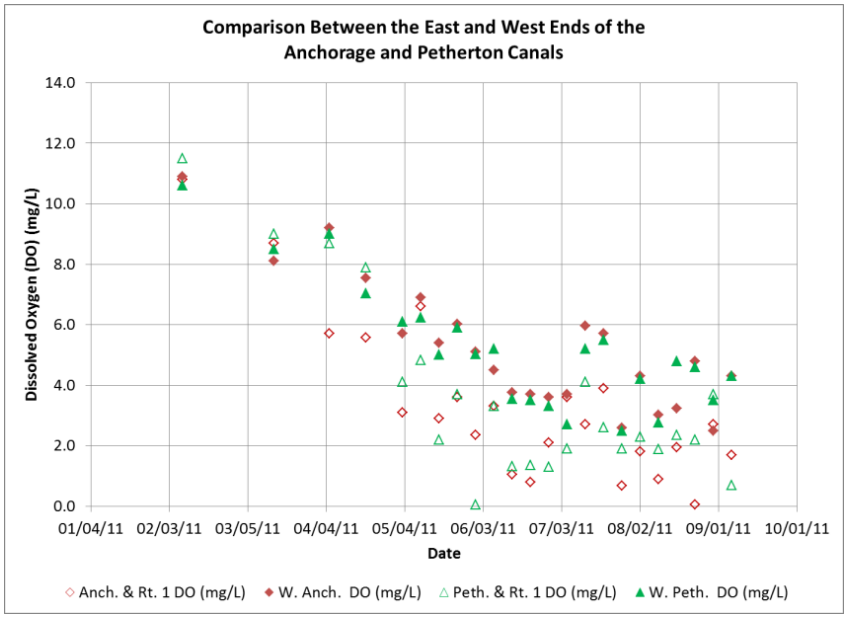
George's Thoughts on Stormwater Management Ponds and Our Canals

Introduction

Whether we want to admit it or not, the closer we are to the dead ends of our canals the more they act as stormwater management ponds. This is supported by the residence time analysis (see chart at right) reported in *South Bethany Canals Flushing Study – Proposed Tidal Pump System Residence Time Analysis* by Mike Fichera of Entrix, Inc., 2005. It is also supported by water quality monitoring data that has been collected since 2007 as shown by the chart to the right showing that dissolved oxygen in the dead ends (east ends) of Anchorage and Petherton is consistently worse than at the open ends (west ends) of the same canals.





EPA document EPA-833-B-09-00, *Stormwater Wet Pond and Wetland Management Guidebook*, February 2009 states in Section 1: *Wet Pond and Wetland Challenges and Opportunities Challenges, Water Quality Impacts:*

"Stormwater ponds and wetlands are designed and constructed to contain and/or filter pollutants that flush off of the landscape. Without proper maintenance, nutrients such as nitrogen and phosphorus that are typically found in stormwater runoff can accumulate in stormwater ponds and wetlands leading to degraded conditions such as low dissolved oxygen, algae blooms, unsightly conditions and odors.

"Homeowners adjacent to stormwater ponds and wetlands sometimes complain about these issues. When nutrient concentrations exceed certain thresholds, the trophic state of the system can change. **These excess nutrients are often the result of human actions.** For example, the amount of fertilizer applied to lawns or the method for disposing of leaves and yard waste in residential and other developed land uses can affect nutrient loads delivered to ponds and wetlands. Excess sediment from the watershed above can also accumulate in wet ponds and wetlands. This sediment can smother the vegetation and clog any filtering structures in the BMPs thereby impacting the overall water quality effectiveness of the stormwater BMP. In addition, standing water in ponds can heat up during the summer months. This warmer water is later released into neighboring waters.

"Without proper maintenance, excess pollutants in ponds and wetlands may actually become sources of water quality issues such as poor water color/clarity/odor, low dissolved oxygen leading to plant die off, and prevalence of algal blooms. When these stormwater BMPs are "flushed" during a large rain event, the excess nutrients causing these problems may be transferred to the receiving waterbody."

Since 2007 when the Canal Water Quality Committee was formed there has been significant effort expanded to address the issue bolded above:

- ordinance restricting outside shower water from entering canals;
- ordinance restricting roof runoff stormwater from entering canals;
- ordinance restricting impervious surfaces;
- education of homeowners in newsletter relative to fertilizer and boat cleaning/maintenance;
- establishment of Bioretention areas in the Rt. 1 median;
- future establishment of rain gardens on the west side of Rt. 1;
- future grant to establish Bioretention areas on the east side of Rt. 1; and
- future retrofitting of stormwater drain basins to slow down water flow into the canals.

Below are some quotes from The Delaware Center for the Inland Bays 2011 report, *State of the Delaware Inland Bays*:

- "Nutrient loads from all sources have decreased. We expect all point sources to be fully addressed by 2014, goals for atmospheric sources have nearly been reached, and most cases non-point source load reduction is apparent. Nutrient management plans have been developed for nearly all farms. However, much progress on reducing non-point sources remains to be realized." (page 17);
- "Generally, as nitrogen and phosphorus levels increase, bay grasses become displaced by seaweeds, which in turn can be outcompeted by floating algae. **Dissolved oxygen** is placed at the end because it responds to all these parameters together, and **is an integrative indicator of Bay health**." (page 27);
- "However, decreases in nutrient concentrations were not observed as expected given the observed reduction in nutrient loads. The values of the water quality index in the Indian River have declined without good explanation." (page 27);
- "Only 2 stations had significant trends [in both water quality was degrading] in nitrogen or phosphorus concentrations, but no overall pattern of increase or decrease was apparent. This is somewhat surprising given the estimated reduction in nutrient loads entering the Bays." (page 28);
- "Of the sites with significant trends, only one showed improvement with increasing levels of oxygen on summer mornings, while four showed decline with decreasing oxygen levels during summer mornings. Low dissolved oxygen remains a severe problem for the tributaries of the Inland Bays and overall is not improving." (page 34); and
- "Approximately half of the groundwater moving through the watershed's aquifers takes 10 years or less to discharge to surface waters; some groundwaters may take decades to reach surface waters. This lag time between when nutrients enter the groundwater and when they enter measured streams or the Bays can obscure progress in the management of nitrogen in particular, which tends to be transported in groundwater." (page 20).

George's comments on the state of the bays report:

- Dissolved oxygen is a very good indicator of the Bay health and of the South Bethany Canal's health;
- Significant reduction of nutrient inputs to the Inland Bays has occurred over the last decade;
- Dissolved oxygen trends in the Bay have been holding steady at poor to terrible with 4 sites actually degrading and one site improving; and
- It may be another decade before we see any significant improvements as a result of all the good things that we are doing to reduce the nutrient inputs to the Bay.

EPA document EPA-833-B-09-00, *Stormwater Wet Pond and Wetland Management Guidebook*, February 2009 recognizes that even with reduced nutrient inputs a stormwater management pond

can become degraded and there are established corrective actions that can be taken to mitigate the degradation. Below is quoted from the above document.

"Water Quality Degradation - Problems to Inspect For

"Stormwater ponds and wetlands are susceptible to poor water quality when upland land uses are highly urbanized, deliver large quantities of nutrients, or contain illicit discharges with high concentrations of bacteria and other pollutants. Pond and wetland designs with inefficient turn over (i.e., poor flow circulation) also contribute to water quality degradation. Common indications of poor water quality include an off color (e.g., bright green sheen from algae) or unpleasant odor (e.g., presence of bacteria). Poor water quality, including low dissolved oxygen and organic over-enrichment can also undesirably promote mosquito production by reducing mosquito predators and providing food for mosquito larvae.

"Corrective Actions

"Maintaining water quality in stormwater ponds and wetlands is challenging, as they are designed to retain constituents in stormwater that can degrade receiving waters. However, a number of water quality related fixes are noted below:

"• Bacterial Improvements

"Excessive sediments in a pond can contribute to algae problems. If sediment layers become anaerobic, harmful chemicals, noxious odors, and phosphorus can be released into the water column. These conditions can be minimized through the introduction of bacteria in the pond. The bacteria, in The presence of adequate aeration, "digest" the muck layer without producing the harmful side effects, such as odor, associated with anaerobic decomposition. Through the reduction of available phosphorus, algae growth can be limited. Treatments usually start in early April and continue through September.

"• Diffusers and surface aerators

"Air can be introduced into the pond or wetland through various systems to facilitate biological decomposition of pond muck, de-stratify thermal layers in the water and improve the ecological health of the system. In general air promotes biological activity, which reduces the amount of available nutrients for algae.

"Diffusers use an air compressor and hoses to bring air into the water column of the pond or wetland. Diffuser systems are low maintenance and are often compared to aquarium compressors on a larger scale. They require annual maintenance and are not recommended for permanent pools less than eight feet deep.

"Aerators resemble fountains in their appearance. They require a motor mounted to an impeller or other type of agitator to "splash" the water. This physical action introduces air to the water. They should be removed from the pond in the late fall to prevent freeze damage and returned to the pond in the spring, after the last freeze. Trash, debris, algae, pond weeds and aquatic plants can bind up moving parts, causing excessive wear and generally cause motors to burn out prematurely. Because these aerators typically draw from the surface of the pond, they are generally not recommended for reducing algae bloom potential or increasing dissolved oxygen in the system, but may provide visual enhancement."

Local Homeowner Associations Successfully Use Diffusers in Their Degraded Stormwater Management Ponds:

1. Allan Garnaas - Villas at Bethany West Across from Wawa on the North side of 26
   - They have 3 diffusers in one tidal pond that is about 8 feet, maximum depth.
   - Diffusers in place for more than 15 months.

- They had fountains before that did not do the job.
- Diffusers are better than fountains – Less cost and more efficient. Here efficiency means the amount of oxygen that is supplied to the water per aerator horsepower. Diffusers get more oxygen into the water. They circulate the water from the bottom to the surface. They reduce the amount of "muck" on the bottom. See pictures on page 21. Fountains cannot make this claim.
- Diffusers do what they are publicized to do – **Improve water quality**.

2. Allan Garnaas - His home community in Alexandria, VA.
   - Diffusers in place for more than 22 years.
   - Diffusers do what they are publicized to do – **Improve water quality**.
3. Barry Mones - The Refuge on the north side of Route 54
   - They have at least two ponds, one is salt water and the deepest is 18 feet, maximum depth.
   - Diffusers in place for more than 5 years.
   - Diffusers are better than fountains – Less cost and more efficient.
   - Diffusers do what they are publicized to do – **Improve water quality**.
4. Greg Ferese - The City of Rehoboth
   - They have at least one pond that is less than 10 feet deep.
   - Diffusers in place for more than 7 years.
   - Diffusers are better than fountains – Less cost and more efficient.
   - Diffusers do what they are publicized to do – **Improve water quality**. Before the diffusers they had fish kills, odor and algae.
5. John Buono – Southampton Community on Beaver Dam Rd. just off of Muddy Creek Rd.
   - They have 5 ponds with diffusers in them and two ponds with fountains.
   - Their ponds are 2 to 6 feet deep.
   - The fountains were selected for aesthetic reasons and have been problematic.
   - Diffusers are better than fountains – Less cost and more efficient.
   - Diffusers do what they are publicized to do – **Improve water quality**. If the diffusers y go off line people quickly see degraded water, more algae forming and more odors. Homeowners are quick to call management when the water degrades if a diffuser shuts off.

Improve water quality means that the dissolve oxygen when measured early in the morning is higher than 4.0 mg/L. It means that algae on the surface is visually less than when the diffusers are not running. It means that there are no offensive odors coming from the pond.

George's Summary

- Our canals perform the functions of stormwater management ponds particularly at the dead ends where they contain and/or filter pollutants that flush off of the landscape.
- Since there is no circulation in the dead ends, whatever pollutants enter the canals stay there forever and cause the dead ends to be significantly degraded from a water quality point of view.
- EPA recommended corrective action should be taken for our dead end canals.
- It will be many years before we see a significant increase in dissolved oxygen if we do not install diffusers.