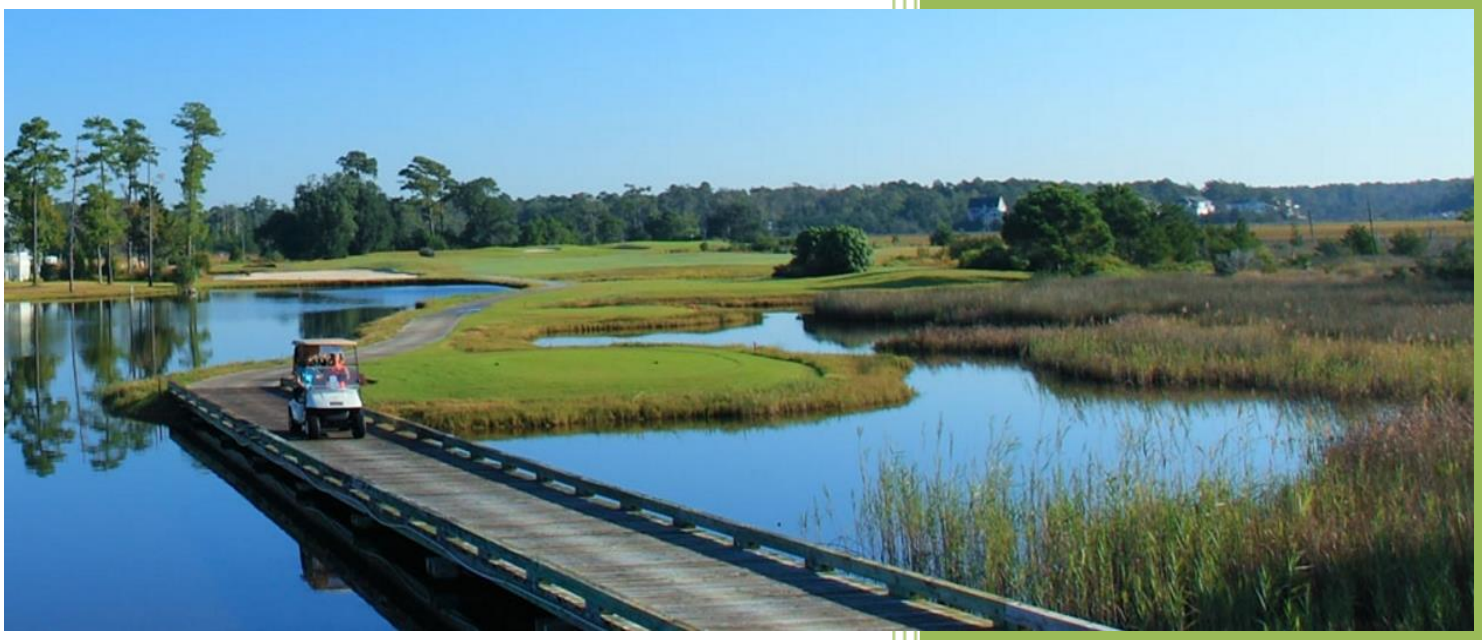
2017

ST. JAMES POND & WATER SHED WATER QUALITY TIGER TEAM RECOMMENDATIONS FOR POND TESTING



St. James Pond & Water Shed Water Quality Tiger Team

St. James Property Owners Association

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BACKGROUND

Ponds in St James Plantation are an important and valuable amenity that enhance property values, provide recreational opportunities, create aesthetic sight lines for various property owners and many are an integral part of the community's overall storm water management system. Ponds were created primarily for lot construction & management of surface waters.

Members of the St. James Ponds Committee reported problem ponds in our community regarding chronic issues with algae blooms that did not respond to convention chemical treatment methods. It was noted by experts from the NC Cooperative Extension of NC State and by experts from UNCW that the likely cause of the algae blooms was from excessive nutrients in the water. It was further noted that the source of nutrients could be from fecal coliform contamination and/or from various other sources including run off of fertilizers into the ponds.

Recent analysis has shown high levels of fecal coliform in some of the ponds across St. James Plantation. In prior years, the Storm Water Committee has tested the water quality of the main watershed areas of St. James, showing high levels of fecal coliform in some samples. Since fecal coliform can be derived from all warm-blooded animals, DNA testing was conducted by the Storm Water Committee. The results indicated that some of the fecal coliform was attributable to human sources. Additional testing was conducted in selected ponds to further identify potential contaminate sources. In addition to fecal coliform, this testing included tests targeted specifically to identify human contribution through the presence of Ammonia, Optical Brighteners and Caffeine.

While some tests indicated the presence of human DNA, it is infeasible to know the amount attributable to humans, nor definitively indentify all point sources. This is because St. James resides in a coastal region with extensive coastal and inland wetlands and highly permeable soils. Areas of St. James are impacted by tidal changes in the coastal wetlands, which may bring various contaminants into St. James during periods of high tide and tidal surges. Additionally, the vast acreage of inland wetlands woven throughout St. James host many warm-blooded animal species that contribute to the fecal coliform found in ponds and often abut or are immediately proximal to ponds. Also, the ~120 miles of low pressure waste water sewage lines that rely solely on observance of soil surface breakouts to identify failures cannot be excluded from consideration. Finally, portions of St. James reside down gradient from potential "off-site" contaminant sources outside of St. James.

Water samples from a limited number of ponds in St. James were recently tested for fecal coliform over a period of several weeks. While the results were variable throughout the test period, discussions with outside experts have indicated that due to the high level of fecal coliform counts in some of the test results, human contribution is likely. Based upon limited testing performed, it was observed that ponds proximal to more densely developed areas generally had significantly higher levels of fecal coliform (up to 120,000 colony forming units per 100 mls and above) than ponds surrounded predominantly by wooded areas and inland

wetlands. (The results from these ponds ranged from 23 to 273 colony forming units per 100 ml.) These test results have led members of the Tiger Team and outside experts to conclude that the fecal infestation of our problem ponds are more likely to come from humans than from wild warm blooded animals.

Both Brunswick County Public Utility Authority (BCPUA) and Southeast Brunswick Sanitary District (SBSD) service St. James. BCPUA records indicate that St. James has had 300 incidents of grinder pump failures during the 18 month period of Jun-2015- Dec 2016, some of which have spilled raw sewage onto the ground. Additionally, there have been breaks in various main service lines across St. James. The exact number of sewage spills is impossible to determine based upon reporting by BCPUA and SBSD that is not to the level of detail needed. By current law, the utilities are only required to report spills greater than 1,000 gallons to State regulatory authorities. However, to gain a clearer understanding of the scope and severity of the problem, reporting of all failures and associated spills to the Town of St. James and the POA has been implemented and must be monitored. We know that low pressure sewer lines from residential grinder pumps to the street main sewer lines have also leaked causing raw sewage spills onto the surface and into the sub-surface soils. The number of such occurrences are, again, impossible to determine from current BCPUA and SBSD record keeping practices. It is equally important to note that currently the only way of determining leaks across over 120 miles of low pressure piping installed throughout St. James is by observation of surface contamination. However, given the high permeability of the sandy loom soils predominate across St. James, it is possible for leaks to not reach the surface and go unnoticed.

Test results show high levels of fecal coliform after a significant rainfall. The resulting contamination can introduce high levels of fecal coliform in these water bodies; potentially representing a health risk, especially if it is from human sources. Such contamination can also negatively affect the pond health by the forming algae blooms, which decrease the oxygen levels in the water, potentially creating a hypoxic environment, which has been attributed to fish kills and the reduction of other sea life.

GOAL

On September 3, 2016 a joint Town of Saint James & St. James Property Owners Association (POA) Team was established to investigate this problem and provide recommendations for improvement. The St. James Pond & Water Shed Water Quality Tiger Team; hereafter referred to as the "Tiger Team" was formed. The Tiger Team is working on various deliverables. In this deliverable the Tiger Team's goal is to specifically:

- Summarize the results of the recent pond water quality testing
- Establish the considerations and objectives for future pond testing
- Provide the Tiger Team's recommendations for future pond testing

In-turn it is believed that these actions will improve monitoring of St James Plantation water quality and generate data necessary to facilitate actions as required.

Recent Pond Water Quality Test Results

From July 2016 through February 2017, 91 water samples were taken from 28 different ponds on 10 different dates. The ponds sampled included 12 ponds identified for fishing and model sailboat activity, 10 ponds proximate to a beta test site, and 6 other selected ponds. The ponds were all tested for fecal coliform (FC) levels. In some cases, the ponds were tested for source indicators including optical brightners (OB), ammonia (A), and caffeine (C). Optical brightners and caffeine are not found in nature and their presence is believed to be an indicator of human contribution.

The test results vary significantly by pond, and within the same pond over time. High levels of FC were reported in some ponds at certain times (>120,000 colony forming units/100 ml). There was no direct correlation between FC and source indicators (OB, A, C). Test results also appear to be affected by rainfall levels and temperature variations with higher levels after significant rainfall and during warmer temperatures. The complete test results are shown in Appendix A.

Future Pond Water Quality Test Considerations and Objective

Local experts have indicated that the high levels of FC found at times in some ponds are an indication of human contribution. Pond water quality is an extremely complex and challenging issue that is impacted by many factors inherent in our coastal region and inland wetlands environment. Contributing factors include potential off-site origins, soil types, pond maintenance and weather, as well as possible leakage from waste water and treatment systems.

Because of this complexity, we have been unable to determine the definitive source for high FC levels in some of our ponds. Periodic sewage breaks and overflows are known to occur in the community, and potential leaks in the waste water handling systems are suspected. However, testing to date has not proved those factors to be the cause, or major contributor, to high FC levels in our ponds.

We concluded that additional team-directed testing for source indicators of high FC levels would not be productive. Discussions with representatives from the two public utility companies that service St James indicate that further team-directed water quality testing would likely not be sufficient to drive extensive and costly actions on their part.

We further concluded that contracting with an acknowledged expert to perform more comprehensive testing and analysis of the pond water quality would not be cost effective or productive. While the results could provide a more authoritative view than our team-directed approach, it would be very costly and likely not reveal a solution or provide sufficient evidence to indicate waste water systems as the major contributor.

We believe it is important that the St James Storm Water Committee continue their water quality testing of the major watersheds flowing into, within, and out of St James. This provides a broad overall assessment of surface water quality across the community and an ongoing monitoring program with continuity of reporting.

In general, we do not feel that additional broad or extensive testing of ponds at this time would be effective in bringing about significant additional insight or drive meaningful change.

However, given the high levels of FC found at times in some community ponds, we recommend a targeted water quality testing plan focused on the higher risk ponds. In this case, risk is identified in terms of ponds that people are most likely to come in direct contact with and ponds that have substantial water quality problems that have not responded to traditional treatment.

The overriding objective on the pond testing plan is to protect the St James community and residents by reducing the risks of direct contact with harmful contaminants while enhancing property values by preserving our ponds as a valuable community amenity. The testing is designed to monitor contaminants and trigger action.

Recommendations for Future Pond Testing

The Tiger Team recommends the following dual test approach:

***Recommended Test 1*:** Test the 12 ponds that have been enhanced for fishing and model sailboat racing for FC on an annual basis. If high levels of FC are detected, a second sample could be taken and analyzed for human DNA as an indicator of source. This testing should be done in conjunction with the water quality testing performed by the Town of St James Storm Water Committee.

Rationale: The POA has invested funds to augment 12 ponds through activities such as fish stocking, habitat improvements, buoy markers, and shoreline improvements. This includes 11 fishing ponds and 1 pond that has been set up for model sailboat racing (See Appendix B). These ponds are broadly publicized to residents and prospective homeowners in a variety of POA and Developer publications and online resources. They serve as a valuable amenity and enhancement to property values across the St James community. Given the funds invested and public endorsement of these ponds, as well as the popularity of the programs, we believe the POA should protect and preserve them as amenities and monitor them for high levels of harmful contaminants.

Proposed Actions: The ongoing test process should be managed by the POA Ponds Committee with the testing performed by the POA pond maintenance contractor. The 12 ponds should be tested for fecal coliform only (not source indicators) in the Spring. If high levels of FC are detected, the Ponds Committee would recommend actions to the POA Board. These actions could include, community warnings, selected pond closures, or follow-on testing and analysis. If continued or severe water quality issues are detected, these ponds would likely move into the "Problem Pond" category (See Recommended Test 2).

Estimated Cost: The estimated annual cost is $900 assuming the testing of 12 ponds for FC with a small number of follow up tests.

***Recommended Test 2*:** Test Selected "Problem Ponds" for FC and human DNA if deemed appropriate:

Rationale: It is inevitable that we will run into a small number of ponds that exhibit problems such as algae growth or poor water conditions even after treatment by our ponds maintenance vendor. On an "as needed" basis, these "problem ponds" should be tested for FC as a possible contributing factor. If FC levels are high, additional analysis, including human DNA tests, could be performed to determine if human contribution through waste water disposal is present. Identification of high levels of FC and human DNA would aid in assessing and mitigating the problem. This could also lead to further inspection and potential discovery of other contributing issues such as waste water contamination.

Proposed Actions: The POA Ponds Committee, in partnership with the POA engineer and pond maintenance company, would be responsible for identifying "problem ponds" and recommending further testing. The following protocol is recommended, in sequence, for ponds that have not responded to conventional water treatment:

1. Schedule an onsite visit by representatives from the Ponds Committee and POA ponds contractor.
2. Assess the need to implement additional water treatment and test for FC
3. If the FC level is high, a second sample could be tested for human DNA
4. If high levels of FC and human DNA are detected, the POA Ponds Committee would recommend actions to the POA Board. This could include working with the town and appropriate public utility company to determine the source, circumstances, and appropriate corrective actions.

Estimated Cost: The estimated annual cost is $3,100 assuming testing up to 5 ponds for FC and human DNA once per year.

To maintain the integrity of the test results for any water sampling, it is important that the proper test protocols are followed in collecting the samples. The current POA ponds contractor (Dragonfly) has been trained on this process and, is working with the local certified test lab, Envirochem for FC testing. For DNA testing, the process currently used by the St James Storm Water Committee with a lab located in Miami will be followed. The two committees should coordinate the sampling and testing activities for efficiency and cost savings when possible.

By year-end 2017, the ongoing responsibility for pond testing should transfer to the POA Ponds Committee. They will work in conjunction with the POA office and the Town of St James Storm Water Committee to manage the ongoing pond testing plan.

Summary

In this deliverable, the Tiger Team has provided information to inform the St. James POA Board what the Tiger Team has learned and recommendations, which upon implementation will lead to improved surface water quality and simultaneously a decrease in the cost to maintain ponds across St James. The recommendations will lead to the enhancement of the health and the aesthetic beauty of ponds across St. James.

The results of water sample testing since July 2016 indicate high levels of fecal coliform in some of the St James community ponds. The results have been inconsistent and the source indicator tests have been inconclusive.

The Town of St James Storm Water Committee regularly tests the major water sheds throughout St James. This provides a broad overall assessment of surface water quality across the community and an ongoing monitoring program with reporting continuity.

To supplement this testing, the Tiger Team recommends the POA implement a dual approach to future pond testing to monitor ponds that have been funded and promoted as community amenities, and to test selected ponds that have been identified as having significant water quality problems. The estimated annual cost of $4,000 is to:

1. Test the 12 ponds for FC that have been enhanced by the POA for fishing and model sailboats activities.
2. Test a small number of selected problem ponds for FC and human DNA if deemed appropriate. This would be done on a limited basis (estimate 5) following a prescribed protocol.

The ongoing responsibility for pond testing should be assumed by the POA Ponds Committee. They will be responsible for recommending actions to the POA Board based upon test results along with input from the POA office and Town Storm Water Committee. Therefore, the recommendations provided herein are strongly recommended for immediate implementation.

Pond Testing

St James Plantation POA

Pond #	Location	Size	2016 7/11	8/24	8/31	9/16	10/7	10/27	11/15			12/7				12/20			2017 2/10
			FC	FC	FC	FC	FC	FC	FC	OB	A	FC	OB	A	C	FC	OB	A	FC
Beta Test Site																			
124	**Newhall Ct off Ridgecrest**	**0.24**	**>60,000**		**8,000**	260	**4,400**	**10**	**1,910**	11	0.2	<20	10	<0.2	<5.0	19	11	<0.2	
126	Marshfield Dr	0.18							>60,000	20	9.4	163	18	<0.2	<5.0	181	20	<0.2	
127	Baynard	0.36							819	15	0.2	55	16	<0.2	<5.0	307	16	<0.2	
129	Ridgecrest	2.34							1,730	10	0.2	<20	9	<0.2	<5.0	73	10	<0.2	
130	Fallon Ct	0.16							4,100	11	0.2	91	*	<0.2	<5.0	546	*	<0.2	
132	Wyndmere & Traemore	0.43							>60,000	9	0.2	199	8	<0.2	<5.0	217	*	<0.2	
135	Ridgecrest	0.96							>60,000	8	0.2	10,200	7	<0.2	<5.0	728	8	<0.2	
138	**Baynard**	**1.57**	**16,000**	**91**	**24,000**	**>60,000**	**5,200**	**10**	**637**	95	0.2	37	15	<0.2	<5.0	253	14	<0.2	
185	Baynard	0.39							>60,000	20	0.2	181	19	<0.2	<5.0	1,640	18	<0.2	
186	**Marshfield Dr**	**0.2**	**38,000**		**1,550**	**64**	**361**	**28**	**>60,000**	7	0.2	20	8	<0.2	<5.0	<20	8	<0.2	
Recommended Fishing/Sailing Ponds																			
4	Regency Circle SW	0.9																	<10
42	Founders/Lakeside Villas	1.9																	<10
147	Regency Crossing	2.5																	<10
150	Regency Crossing	1.4																	<10
212	Woodlands Amphitheatre	2.6			182	127	73	28											<10
216	Oceantic	1.5																	<10
10	Prince Regent	0.8																	<10
148	Regency Lakes Gazebo	6.8					325	73											<10
181	Woodlands Circle	0.5			273	73	127	28											<10
250	Sandy Cove	0.6																	<10
92	Loblolly Circle	0.6						145											199
110	Gauntlet Dr.	0.6						4,400											<10
Other Community Ponds																			
44	Georgetown Entrance Canal	0.3			16,000	>60,000	>120,000	200											
72	Haskell Ln	0.2	>60,000		17,000	21,000	54,000	55											
76	Members #6	0.6			370	1,820													
139	Waterway Park to Marina	1.5			>60,000	47,000	72,000	310											
180	Oak Forest	0.2	1,800																
228	Members #10, Fairway Village Dr	0.8	>60,000		8,000	2,360	48,000	2,500											
Days Since last Rainfall			0	4	0	1	0	**19 ****	1			1				3			**1**
Amount of precipitation in prior 4 days			1.31	0.00	0.86	1.10	0.36	0.00	1.04			1.42				0.31			0.51
Tester			State		Dragonfly	Dragonfly	Dragonfly	Dragonfly	Dragonfly			Dragonfly				Dragonfly			Dragonfly

* **Optical Brightner bottles for one sample on 12/7 and two samples on 12/20 were broken in the lab before analysis**

** **There was no rainfall for 19 days prior to the test sample on 10/27, and manditory water restrictions were in place since 10/13**

Notes:

FC = Fecal Coliform Levels in CFU/100ml
OB = Optical Brightner Units
A = Amonia mg/L
C = Caffine Units

Test Results with
> 4,000 Colonies of FC (Fecal Coliform/100 ml)
>20 units of OB (Optical Brightener)
> 0.5 A (Ammonia mg/L)

APPENDIX A

APPENDIX B

Ponds Recommended for Testing

Pond #	Location	Acres	Notes
10	Prince Regent	0.8	Fish Stocked November 2015
4	Regency Circle SW	0.9	Recommended Fishing Pond
42	Founders/Lakeside Villas	1.9	Recommended Fishing Pond (Troon)
92	Loblolly Dr	0.6	Fish Stocked November 2016
110	Gauntlet Dr.	0.6	Fish Stocked November 2016
147	Regency Crossing	2.5	Recommended Fishing Pond
148	Regency Lakes Gazebo	6.8	Fish Stocked November 2015
150	Regency Crossing	1.4	Recommended Fishing Pond
181	Woodlands Circle	0.6	Fish Stocked November 2015
212	Woodlands Amphitheatre	2.6	Recommended Fishing Pond (Youth Derby)
216	Oceantic	1.5	Sailing Pond
250	Sandy Cove	0.6	Fish Stocked November 2015