St. Johns River Water Management District Comments on the Harris Chain of Lakes Restoration Council's 2008 Report to the Florida Legislature November 19, 2008

Excerpts from the Council's report appear in quotes followed by the St. Johns River Water Management District's (District's) respective comments.

1. **Page ii:**
   "The Council concludes the estimated 25 additional years to complete the restoration of Lake Apopka is not an acceptable target, given the hundreds of millions of dollars that have already been spent on the restoration efforts. Further reduction of phosphorus inputs will not achieve the goal of restoring the once world-renowned fishery at Lake Apopka. The Council concludes that annual expenditures for phosphorus control at Lake Apopka shall rise considerably over the next 25 years and the restoration techniques currently employed are not economically sustainable."

   District Comment
   The degradation of Lake Apopka occurred over a period of several decades. Restoration should be given a reasonable amount of time for completion. The complete restoration of Lake Apopka depends on the response of a complex ecosystem to adaptive management, and the timing of that response cannot be accurately predicted. The Council missed two important facts. Lake Apopka already has begun to improve due to reduced loading of phosphorus. Second, improvement is not all-or-nothing but is incremental.
   The Council is wrong to conclude that annual expenditures for phosphorus control at Lake Apopka will continue to rise and that the restoration techniques are not economically sustainable. The opposite is true. Expenditures for phosphorus control currently are at a maximum and will decline as greater areas of the former farms are flooded. The restoration techniques are sustainable because the major infrastructure investments already have been made or will be made in the next two years. Total costs will decline from that point forward when the only remaining expenses are for operation, monitoring and adaptive management.

2. **Page iii**
   "*The Council supports the efforts of the Florida Department of Environmental Protection (FDEP) to improve water quality in the Harris Chain of Lakes by implementing the Total Maximum Daily Load program.*"

   District Comment
   The District agrees that the Total Maximum Daily Load (TMDL) program is an essential part of water quality improvement in the Harris Chain of Lakes. However, throughout its report, the Council contradicts itself with the above statement because major components of the Upper Ocklawaha River Basin – TMDL Basin Management Action Plan (UORB-BMAP) are projects it no longer supports, according to its report. The UORB-BMAP

includes the Lake Apopka Marsh Flow-Way, gizzard shad harvesting, the Harris Bayou project, and the Lake Apopka North Shore Restoration. The District has determined that these projects contribute significantly to nutrient reductions throughout the basin.

3. **Pages iii and 35**

"The Council no longer supports gizzard shad harvest as a possible method for improving water quality in the Harris Chain of Lakes. The Council further believes funding should cease and appropriations be directed to proven technologies or experimental techniques that offer greater promise of restoration."

District Comment

The Council concluded that the current level of gizzard shad harvest was insufficient to affect phosphorus concentrations in the Harris Chain of Lakes and that increasing the gizzard shad harvest would adversely affect populations of black crappie in the lakes (page 35). These conclusions apparently were based on the results of an experimental study of shad harvesting impacts over two years in Lake Dora conducted by the University of Florida/IFAS.

The Council misinterpreted the results from the UF/IFAS study in one lake (Lake Dora) as being representative of rough fish harvesting impacts in all basin lakes. The Executive Summary of the UF/IFAS report on this study included the statement: "We cannot conclude that biomanipulation is not a viable management tool for restoration of Florida lakes, but our study clearly shows that 40% biomass reduction over two years did not significantly influence lake nutrients and zooplankton abundance at Lake Dora."

District scientists would not have expected such an early water quality response in the Lake Dora study because drought conditions during the study period substantially extended water residence times in Lake Dora so that water quality improvements would be slow to occur. Under those conditions, gizzard shad would need to be removed longer than two years to affect water quality.

Finally, in its conclusion not to support further harvest of gizzard shad, the Council seems not to have considered information presented to it that points to benefits of gizzard shad removal. The Principal Investigator for a Virginia Wesleyan College (VWC) study of impacts of gizzard shad on nutrient cycling in basin lakes presented his work to the Council (page 36). The overview of this presentation stated that the shad biomass harvested from Lake Apopka in a typical year (1 million pounds) would excrete about 7.8 metric tons of phosphorus (nearly equal to the phosphorus loading from the former farms in a typical rainfall year). Other statements in the Council overview were that the mechanisms of excretion, bioturbation and algal resuspension are all important (to the nutrient budget of the lake) and that fish removals can greatly reduce nutrient and phytoplankton concentrations by preventing excretion and bioturbation. The results of the VWC study showed clearly that the presence of a large population of this fish can have major impacts on nutrient cycling in basin lakes. These findings are consistent with numerous other published scientific studies about lakes in Europe and the United States.

4. **Pages iv and 48**

"The Council can no longer, unconditionally endorse the modified lake level fluctuation schedule previously approved by the St. Johns River Water Management District. Council support can only be provided after the establishment of minimum flows and levels for the Harris Chain of Lakes. The Council also does not support the direct withdrawal of surface water from Lake Apopka until the impacts on the restoration efforts are addressed…"

District Comment

On September 9, 2008, in response to a petition to initiate rulemaking filed by the Lake County Water Authority (LCWA), the District's Governing Board directed District staff to include the adoption of minimum levels in the Minimum Flows and Levels (MFLs) Priority List and Schedule for 2008. The staff's recommendation is to complete adoption of the rule by 2013. The Governing Board's September 9, 2008, Final Order explains in detail the interrelationship between the adoption of minimum levels for Lake Apopka and the Harris Chain of Lakes and the District's ongoing programs to revise the regulation schedules for these lakes and complete restoration of the north shore of Lake Apopka. Additionally, any consumptive use permit applications that seek to withdraw water from Lake Apopka will be evaluated in accordance with the District's applicable consumptive use permitting rules, including the criterion that a consumptive use must not cause unacceptable harm to the environment, and that a use not cause a surface water flow or level- to fall below a minimum flow or level that has been established pursuant to subsection 373.042(2), F.S., or section 40C-8.031, F.A.C.

5. **Pages 34-35**

"*Additionally, it was determined that increasing the gizzard shad harvesting efforts would adversely affect populations of black crappie (specks), which is one of the major sport fish in the Harris Chain of Lakes"*

District Comment

Neither growth nor recruitment overfishing of black crappie stocks has been documented to occur in any basin lake and, in fact, recreational fish stocks have improved in other basin lakes where shad have been harvested. In stating that increased harvest of gizzard shad would adversely affect populations of black crappie in the lakes (page 36), the Council may also have misinterpreted the results of the research relative to the black crappie by-catch impacts from shad harvesting. The UF/IFAS report Executive Summary included the statement; "Black crappie is the primary sport fish targeted by recreational anglers at Lake Dora, and our results show that the population could be negatively impacted by increases in exploitation from either the recreational fishery or by-catch from the commercial gill net fishery for gizzard shad." The Council report overview of a March 2007 presentation by the Principal Investigator of the UF/IFAS study included the statements: "Recruitment overfishing [of black crappie stocks] in Lake Dora is unlikely based on two years of [shad] harvest data" and "Gill net harvests have had a minimal impact on black crappie populations as compared to impacts by recreational fishing" (page 29).

6. **Page iii**

"*The Council no longer believes the marsh flow-way can be relied upon as a primary management technique for restoring Lake Apopka or the Harris Chain of Lakes. Furthermore, the Council believes public funding should cease and appropriations be redirected to proven technologies or other experimental techniques that offer greater promise of restoration. Alternatives such as hydraulic dredging need to be implemented.*"

District Comment

The marsh flow-way at Lake Apopka is not the "primary" management technique to restore Lake Apopka or the Harris Chain of Lakes. The District's restoration of Lake Apopka depends upon "pollution abatement combined with a cost-effective program for phosphorus removal" (Lowe et al., 1992). Restoration of Lake Apopka includes reducing phosphorus inputs from its watershed. The marsh flow-way is one management technique that will help accelerate removal of phosphorus that is already in Lake Apopka water.

7. **Page iv**

"The Council no longer supports the Lake Apopka north shore restoration activities of the St. Johns River Water Management District, unless they are placed in the context of reconnecting the restored wetlands to the lake. The Council recommends to the Legislature that the agreement with Natural Resources Conservation Service (prohibiting reconnection to the lake) be examined to determine if it can be modified, rewritten, or if needs to be voided. The Council now strongly believes the approaches currently being used by the St. Johns River Water Management District are not adequate to restore Lake Apopka in a timely manner and alternative approaches need to be developed."

District Comment

Restoration of the former farms on the north shore of Lake Apopka is key to restoration of the Lake because that area was the source of excess nutrient loading in stormwater runoff for 50 years. To date, the District has safely converted about 3,500 acres of former farmland to wetlands. The District expects approval soon to flood an additional 1,400 acres. Because of residual organochlorine pesticides in the soils and the potential risks to fish-eating birds, all restoration activity on the North Shore Restoration Area must be done with deliberation and planning. The District expects to flood the majority of the north shore property (about 12,000 acres) within the next 5 years. This action will not only result in important wetland habitat, but it also will allow greater flexibility in water management and greatly decrease nutrient discharges into Lake Apopka. Reconnection of portions of the former farm area to Lake Apopka will be considered first when pesticide residues in fish in the restored wetlands reach levels that are safe for human consumption.

8. **Page v**

"The Council concludes the restoration of Lake Apopka must involve dredging at least some portion of the bottom sediments. Dredging becomes especially important because of the amount of phosphorus that can be removed per dollar expended exceeds other restoration strategies and deposition of the dredged Lake Apopka sediments into the north shore area would raise the marshes sufficiently to permit reconnection of Lake Apopka, which would act as a "kidney" for the lake."

District Comment

Dredging has been discussed by the District and other agencies several times and abandoned because of cost. A dredging study contracted by the District 20 years ago estimated it would take five 24-inch dredges 5.9 years to dredge sediments from Lake Apopka. It is estimated that such a dredging project would cost $791,000,000 in 2007 dollars. The District disagrees with the Council's assertion that dredging is the most cost-effective means of phosphorus removal from Lake Apopka since other restoration strategies remove more phosphorus per dollar. At the cost cited above, dredging Lake Apopka would remove about 7 grams of phosphorus per dollar. In contrast, removal of gizzard shad from Lake Apopka removes about 12 grams of phosphorus per dollar and has other benefits to reduce nutrient recycling. Operation of the marsh flow-way has removed at least 9 grams of phosphorus per dollar and has additional benefits for wetland habitat restoration. Furthermore, dredging removes not only phosphorus that is available for algal growth but also phosphorus that was unavailable because it was bound to minerals or buried. If this fact is considered, the efficiency of removal of available phosphorus by dredging decreases to less than 1 gram of phosphorus per dollar.

The dredging study cited above also calculated the total amount of dried material dredged from the lake. Assuming that this material was spread evenly over one-half (6,000 acres) of the north shore, the material would raise the surface elevation only by 0.9 feet. Soil subsidence over 50 years of farming has resulted in a surface elevation that is on average 4 to 5 feet below the mean water level in the lake. An increase of less than 1 foot would not raise the marshes sufficiently to permit reconnection to Lake Apopka and still sustain a healthy marsh. Restored marshes will act as a "kidney" for the lake by preventing nutrient loading even if these marshes are behind levees. As these marshes are established, less water will need to be pumped back into the lake for management purposes, further improving water quality in the lake.

When the District was developing the restoration plan for Lake Apopka, it was determined that control of external nutrient loading was the critical component of the restoration strategy and that any restoration plan that did not include control of external nutrient loading would fail. Dredging of the lake would not have reduced external nutrient loading and would not have resulted in a permanent improvement in lake water quality. To be successful, a restoration strategy that included dredging of the lake also would have needed to include many, if not all, of the other restoration strategies that the District has been implementing over the last 10 years, all of which the Council now opposes. District scientists believe that implementation of the existing restoration strategy for Lake Apopka will improve the water quality to the lake to meet the TMDLs and will result in restoration of a healthy lake, without extremely costly dredging of the lake bottom. Therefore, the District opposes lake dredging in Lake Apopka as an unnecessary and wasteful use of taxpayers' dollars.

9. **Page 7**

"*The Council has reviewed seven years of water quality data provided by the SJRWMD which included total phosphorus, algal biomass as measured by chlorophyll, and water clarity as measured by Secchi disk. Additionally, after the review of recent data provided*

by other agencies including the University of Florida and published historical data from the 1970s and 1980s; the Council has determined there have been no major improvements in lake water quality, which can be directly attributed to the restoration efforts of the SJRWMD."

District Comment

A complete review requires consideration of the full 20 year data set from the District. A complete review shows that pre-1995 (dating back until 1987) average total phosphorus concentrations in Lake Apopka water were 0.22 mg L^{-1}, chlorophyll-a was 99 µg L^{-1}, and water clarity as measured by Secchi depth was 0.22 meters. Recent data (between 2003 and April 2008) indicate that average concentrations for total phosphorus, chlorophyll-*a* and Secchi depth are 0.11 mg L^{-1}, 59 ug L^{-1}, and 0.33 meters, respectively. This represents a decrease of 50% in total phosphorus concentrations, a 40% decrease in chlorophyll-*a*, and a 50% increase in water clarity. These improvements in Lake Apopka water quality conditions due to restoration efforts of the District have been published in peer-reviewed international scientific journals.

10. Page 7

"*Measured changes in the water quality parameters are more closely related to changes in regional rainfall, with improvements occurring during wet periods and degradations being seen during periods of drought (low lake levels).*"

District Comment

This statement is incorrect. Since the start of the District's water quality monitoring efforts in 1987, there have been wet periods, normal rainfall periods, dry periods, and drought periods. Overall water quality has improved significantly in those 20 years during high, normal, and low rainfall periods. The only exceptions were two extreme droughts, when Lake Apopka lost up to 70% of its volume and water quality worsened. The Council uses these temporary periods of declining water quality due to extreme drought to misrepresent the overall pattern of improvement.

11. Page 13

"*After reviewing the long-term water quality database compiled by the SJRWMD for the Harris Chain of Lakes, the Council is led to conclude the sole reliance on reducing phosphorus inputs to improve overall water quality in Lake Apopka and the downstream lakes is no longer a cost-effective or near-term successful restoration strategy.*"

District Comment

This statement is incorrect. As stated earlier, the District is not solely relying on reducing phosphorus inputs to improve water quality in Lake Apopka and the downstream lakes. The District depends upon pollution abatement combined with a cost-effective program for phosphorus removal.

12. Page 13

"*At Lake Apopka, the compiled water quality database provides evidence there is no relationship between the reductions in phosphorus inputs and in-lake water quality.*"

District Comment

This statement is incorrect. The compiled water quality database for Lake Apopka shows that pre-1995 (dating back until 1987) average total phosphorus concentrations in Lake Apopka water were 0.22 mg L^{-1}, chlorophyll-a was 99 µg L^{-1}, and water clarity as measured by Secchi depth was 0.22 meters. Recent data (between 2003 and April 2008) indicate that average concentrations for total phosphorus, chlorophyll-*a* and Secchi depth are 0.11 mg L^{-1}, 59 ug L^{-1}, and 0.33 meters, respectively. This represents a decrease of 50% in total phosphorus concentrations, a 40% decrease in chlorophyll-*a*, and a 50% increase in water clarity. The improvement in Lake Apopka water quality coincides with reduced phosphorus inputs to the lake. The District published these results in peer-reviewed international scientific journals.

13. Page 21

"*Throughout the 2008 reporting year, the Council has continued to review operational data of the Lake Apopka Marsh Flow-way. In August 2008, the Council heard updates on the value and performance of the flow-way. Information received from a LCWA review of recent operational data indicated an average phosphorus reduction of 8.4% over the past four years, with an average phosphorus concentration entering the system of 130 ppb and average concentration flowing out of 119 ppb. The LCWA review also indicated the Lake Apopka Marsh Flow-way provides approximately 10 – 12% reduction in phosphorus which is mostly in the particulate form.*"

District Comment

The use of average concentrations into and out of the marsh flow-way is an incorrect method to determine the amount of phosphorus removed by the flow-way. The District determines the amount of phosphorus removed by the system on a mass basis. This approach uses both flows into and flows out of the system, in addition to using total phosphorus concentrations into and out of the system. The median percent mass removal of total phosphorus since early operation (January 2004) until June 2008 is 30%. The median percent mass removal of particulate phosphorus since early operation (January 2004) until June 2008 is 53%.

14. Page 21

"*The original proposal by the SJRWMD said it would remove 30,000 kilograms of phosphorus per year and Lake Apopka would be restored in 60 years.*"

District Comment

The original proposal did state that the flow-way would remove 30,000 kilograms of phosphorus per year. However, the original proposal is not the system that was constructed and operated since late 2003. The original estimates were based upon a marsh flow-way system with 12 treatment wetland cells and an approximate area of 10 km^2. The District constructed and operates a marsh flow-way system that has four treatment cells with an approximate area of 3 km^2. After the District constructed these flow-way cells, the Legislature directed the District to purchase the farms on the north shore of Lake

Apopka. The District then determined that its water quality objectives could be achieved without constructing additional flow-way cells.

15. Page 24

"The establishment of a marsh flow-way is a centerpiece in the SJRWMD Lake Apopka restoration strategy to reduce phosphorus and sediments."

District Comment

The marsh flow-way at Lake Apopka is not the "centerpiece" in the District's Lake Apopka restoration strategy. The District's restoration of Lake Apopka depends upon preventing further pollution from entering the watershed. The marsh flow-way is a cost-effective method for removing phosphorus that is already in the lake.

16. Page 24

"It is now clear that the Lake Apopka Marsh Flow-way, like the Lake Griffin flow-way, is not performing according to the original expectations for phosphorus removal."

District Comment

The Lake Apopka marsh flow-way is performing to original expectations. The projected long-term removal efficiency was 30%. The median percent mass removal of total phosphorus since early operation (January 2004) until June 2008 is 30%.

17. Pages 24-25

"Even with the 2008 installation of alum treatment systems at the flow-way to enhance phosphorus removal, less than four metric tons are removed annually (30 metric tons per year was originally predicted)."

District Comment

The original predicted removal rate by the marsh flow-way was 30 metric tons of phosphorus per year. However, that original prediction was based on a larger proposed marsh flow-way system that had an approximate area of 10 km^2. The District constructed and operates a marsh flow-way system that has an approximate area of 3 km^2. This flow-way is functioning as designed.

18. Page 25

"Phosphorus returned to the lake after the water has been treated in the flow-way (up to 70% returned to the lake) is readily available for algal growth in Lake Apopka and the downstream lakes."

District Comment

This statement is incorrect. The marsh flow-way was not expected to operate at 100% efficiency. The flow-way was designed to remove 30% of the incoming total phosphorus load and the efficiency to date is 30%. The phosphorus returned to the lake after marsh flow-way treatment is not all readily available for algal growth. Of the total amount of phosphorus that is returned from the marsh flow-way back to the lake, less than one third is readily available for algal growth.

19. Page 25

"*The Council no longer believes the marsh flow-way can be relied upon as primary management technique for restoring Lake Apopka or the Harris Chain of Lakes.*"

District Comment

The marsh flow-way is not the primary management technique for restoring Lake Apopka or the Harris chain of lakes. The marsh flow-way is a management practice to help accelerate the removal of phosphorus from Lake Apopka. The District uses several other practices and techniques to control the amount of phosphorus reaching Lake Apopka. Overall, the restoration program includes acquiring land; restoring upland, wetland and lake habitat; stormwater treatment; and rough fish harvesting. These practices and techniques have both reduced the amount of phosphorus going into Lake Apopka and accelerated the removal of phosphorus from the lake.