Appendix E – Peer Review of Gemini Springs MFLs, Volusia County, FL

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To: Andrew Sutherland, Ph.D.

From: Lee Wilson, Ph.D.

Date: 13 March 2017

Re: Minimum Flows Determination for Gemini Springs, Volusia County, Florida

This memorandum reflects my ongoing assignment from SJRWMD to review reports related to MFLs development for water bodies within the District. The subject report, for Gemini Springs, was authored by Jane W. Mace and is dated February 20, 2017.

I continue to hold the opinion that the SJRWMD MFL program is scientifically sound and at the forefront of the application of ecological principles to protection of instream flows, spring flows and lake water levels. The fact that certain of my comments are critical of certain aspects of this report is a reflection of my assignment to identify issues and find possible problems, and should be read in that spirit.

<u>Primary comments</u>

1. I support the recommended MFL.
2. The most significant technical issue is to explain how >20 mgd pumping in the springshed can cause only a 1 cfs reduction in springflow; several specific comments address this issue.
3. Many of my comments are editorial; the report needs a good edit, especially for Appendix C.

Specific comments

4. P. i. The mention of further study here and elsewhere (and additional monitoring – see p. 27) is not supported by the report. Once one concludes that the system is in as good shape as can be expected, proposing an MFL which allows minimal change is assuredly protective. Moreover, the report clearly establishes that the combined impact of the retention dam and Lake Monroe backwater would overwhelm the effects of a small change in flow. Thus the value of "further study" is unclear. More data are always good, but I'd temper these recommendations so that they don't imply this is a priority for expenditure of scarce District funds. Response: *Recommendations for monitoring have been adjusted. We instead recommend coordinating with resource agencies specializing in faunal surveys to facilitate studies at Gemini Springs (e.g. for USGS to update their 2004 fauna survey (Walsh et al 2009)). Periodic algae sampling by appropriate agencies will be encouraged to quantify any changes in algal biomass over time.*
5. P. iii. The table of contents has an incorrect page number for Appendix C. Response: *Corrected*
6. P. iv-v. As written this includes figures and tables for some of the appendices but not all. Please be consistent one way or the other (inclusion is best). Response: *The Table of Contents lists figures and tables for the appendix to Mace 2017, not for appendices of additional documents such as the model report (Xiong and Zhang 2017). Page numbers for sections within Appendices are in the Table of Contents for each Appendix.*
7. P. 3. Should Padgett Creek be included as part of Gemini Springs run? In other locations the run is just that water course fed only by the spring and above its discharge to a larger stream. Response: *Prefer Gemini Springs Run nomenclature because it ties the water course to the Springs and there is no flowing water course that drains into Gemini Springs Run, rather the Run traverses a large shallow marsh with sloughs and a borrow pit connecting to the Run.*
8. I suggest a close-up map of the actual spring area should follow Figure 2. Response: *Added a map showing a close up of spring vents, reservoir, weir, and outlet.*
9. P. 9. Where is the method for developing discharge values from well records documented? Response: *Discharge calculations were documented in the model report appendix (*Xiong and Zhang 2017*).*
10. Figure 6: is the one outlier 'minimum discharge" data point based on reliable data and/or otherwise explained? Response: *Based on reliable data.*
11. P. 12. Need to explain more about the groundwater pumping assessment. Pumping has been over 20 mgd since 1999, which is a lot for a small springshed; please add something to explain what accounts for this large number. More critically, this pumping is in excess of 30 cfs, which I can't reconcile with a groundwater model impact of about 1cfs. If this is confirmed, it needs to be

explained. Response: *A detailed explanation of why we think 1 cfs of impact is reasonable is added to Appendix D and groundwater impact assessment section in the main report. In short, there are more than 45 springs in the area that potentially interact each other (overlapping springsheds). Because of this, groundwater wells within Gemini springshed do not only withdraw water from Gemini springshed but also from other overlapping springsheds. So, their impact spreads over many springs and possibly other water bodies in the area.*

12. P. 13. Figure 10 does not tie the bar colors to the labels. This would also be a good place to include a map of the springshed. See also comments on Appendix D. Response: Figure 10/11 is upadated
13. P. 17. Did visitor use dramatically decrease with swimming prohibited? Response: *Visitor use data is unavailable. However, Gemini Springs Park is notably increasingly popular due to its location on the Springs-to-Springs Trail, as well as connecting to other urban trails. Also, Gemini Springs Park is adjacent to a "new" SunRail train station, further improving access to the Park.*
14. P. 23. The linking of residence time to phytoplankton would benefit by some discussion of whether there are any plans to manage nutrient inputs. Response: *Volusia County is scheduled to install storm water treatment boxes near Gemini Springs in FY 2017-18 to remove nutrients. Additionally, the County has recently upgraded their wastewater treatment plants as part of a plan to shift residences from septic tanks to municipal treatment.*
15. P. 25. Table 4 should explicitly include the discharge values. Response: *Added discharge values in Table 4.*
16. P. 26. Need a map showing transect locations. Response: *Added Figure 18, which shows transect locations.*
17. P. 34. Need to delineate the springshed area for Gemini Springs. Response: *Springshed has been added to the figures.*
18. P. 35. Implies a huge capture zone for Gemini Springs (e.g. all that is not in the Volusia Blue Spring and Wekiva River capture zones. Response: *Illustrates that other spring capture zones are mapped in close proximity to Gemini Springs.*
19. Appendix B: why are there no other springs where the recommended flow reduction is 15%? Response: *All other springs had at least one environmental criteria or resource that when changed 15% resulted in less than a 15% flow reduction. In addition, many springs with multiple metrics, had at least one criterion that resulted in allowable flow changes greater than 15%. In those cases, either the lowest flow change was recommended or the change in flows from several metrics were averaged, to calculate the recommended change in flow.*
20. Appendix C: I spent considerable time trying to make sure I understood the model report even though, in the end, it contributes little to the resolution of the MFL. A close review by a good technical editor is definitely in order. Response: *Comment noted.*
21. The page numbers in the Appendix C table of contents have no relationship to the page numbers in the body of the Appendix. Below I cite numbers on the physical pages printed from the document. Response: *Will correct when Appendix C is finalized*.
22. The appendices to this appendix are denoted by letters, as is the appendix itself. Consider some other approach, such as using the term "Attachments" to those documents that are incorporated into Appendix C. Response: *Comment noted*.

23. In Appendix C, Figure 2.1 could be improved. For example the word “weir” seems unnecessary if reference is being made to the dam; or a symbol for a weir should be located on the map. The “steps” also include a dock. Response: *We will edit Figure 2.1.*

24. I have no clue as to what Figure 2.2 in Appendix C is trying to show. Response: *To show location of US 17-92 gage station, which was used to obtain water elevation for GSP model boundary.*

25. At the top of Appendix C page 7, reference is made to a “sedimentation problem”. I found no other discussion of this problem or its cause. Response: *It is not directly related to Hydrodynamic Modeling, rather a factor that changed GSP bottom elevation after dam was built.*

26. P. 7 is an example of text that is hard to follow. Response: *Not clear which part.*

27. P. 9. Figure 6 contradicts the statement that the difference between the measured minimum and maximum discharge is 9.1 cfs. In particular, there is no 15.3 cfs in 2005 on that figure. A table summarizing the gaging history would be useful. Response: *Maximum discharge should be at 13.0 cfs on August, 1996*

28. P. 10. A table summarizing the sampling history would be useful. Response: *Data collection period was included in the table*.

29. P. 10. Is there a reason or hypothesis that accounts for the relatively high salinity of this spring? Response: *Mineralized water in the Upper Floridan aquifer near the St. Johns River is a mixture of freshwater and relict seawater that entered the aquifer system during a higher stand of sea level in the geologic past. Movement of this mineralized water is relatively slow, particularly beneath the St. Johns River from Lake Harney northward beyond Gemini Springs (Reference: Hydrogeology, water quality, and simulated effects of ground-water withdrawals from the Floridan Aquifer syste, Seminole County and vicinity, Florida. By Rick M. Spechler and Keith J. Halford, 2001. USGS Water Resources Investigations Report 01-4182. Tallahassee FL. 125 p.).*

30. P. 16. The infill of the discharge data probably should be discussed in the context of Figure 6. Response: *It is not necessary. The watershed discharge was calculated using simple rational method based on rainfall and it was used for model calibration only. The long term average is trivial compared to springs discharge (0.02 cfs .vs. 10.15 cfs).*

31. P. 19. Note that “data is” and “data were”. Need consistency (I use data as a plural.) Response: *Will edit in the report*

32. P. 22. Figure 4.1 is described as showing a good match between model results and calibration – I don’t see it. The modeled water level never goes below the weir, whereas the data do. The data have a trend, the model does not. Only the two peaks in the data are actually in agreement with the model. Response: *The reviewer was confused about the two gage data. Gage 00410494 (dark blue triangles) was the one inside the pool and it agreed well with model (light blue line). Gage 03710493 was located at model open boundary.*

33. P. 41 I wasn’t clear about the method by which pool residence time was “roughly estimated” to change as a result of spring flow reduction. Nor was it obvious why the EDAC simulation results in Table 6.4 suggested a “profound” influence of spring discharge reductions on water age. Response: *The pool residence time was “roughly estimated” based on pool volume V and discharge rate Q, or V/Q. With reduced spring flow, residence tim*

34. I did not closely review the appendices to Appendix C. Response: *Comment noted. Intera reviewed Appendix C.*

35. Appendix D does provide a springshed map, but it doesn't have a scale. As I noted above, need something to explain >20 mgd of pumping from such a small area. If flow reduction is 1 cfs, and the aquifer is not being depleted, a simple water balance would suggest <2mgd of pumping. In addressing this question, I suggest a complete water balance be presented. Response: *Will update figure.*

36. At the top of p. 70 reference is made to "adjusted" springshed; what does that mean? Response: *"Adjusted" means the springshed plus one-mile buffer. The text is revised so that it says springshed plus one mile buffer.*

37. Figure 6 in Appendix D has similar problems to the one in the text: appendices; in this case there are five labels for five colors, but two of them are both said to be PS and one is DSS, which is not otherwise explained. Response: *Figure 6 is revised to incorporate the comments.*

38. P. 71 and P. 72. Again, either I have my units messed up, or Figures 7 and 8 continue to show flow reductions that are a fraction of pumping. Please explain. Response: *A detailed explanation of why we think 1 cfs of impact is reasonable is added to Appendix D and groundwater impact assessment section in the main report.*

In short, there are more than 45 springs in the area that potentially interact each other (overlapping springsheds). Because of this, groundwater wells within Gemini springshed do not only withdraw water from Gemini springshed but also from other overlapping springsheds. So, their impact spreads over many springs and possibly other water bodies in the area.

39. I like the concept of Appendix E. Response: *Comment noted*.

<u>Items in scope of work</u>

I have reviewed the MFLs report with consideration given to four specific review items specified in the Scope of Work.

1. Assess adequacy of environmental data in terms of appropriateness, quality and length of record.

   a. Are there any deficiencies and/or errors regarding data availability? *None of significance.*

   b. Were appropriate analytical methods and field procedures used for data collection? *Yes.*

   c. Were reasonable quality assurance assessments performed on the data? *Yes.*

   d. Was relevant data available but discarded without appropriate justification? Would use of discarded information significantly affect the development of the MFLs? *I identified no problems regarding use or discarding of data.*

   e. Was "best information available" utilized in developing the MFLs? *Yes.*

2. Assess methods and procedures for data analysis, including, where appropriate, performing appropriate statistical analyses of data to ensure that each is statistically valid and is used appropriately

   a. Are there any deficiencies and/or errors in analytical methods and procedures? *No.*

   b. Were appropriate analytical methods and procedures used for data analysis? *Yes.*

c. Were the analytical methods and procedures appropriate given the "best information available"? *Yes.*

d. Do the analyses include all necessary factors? *Yes*

e. Were the analyses correctly applied? *Yes, but arguably far more technical than the circumstances require.*

f. Were any limitations and imprecisions in the information handled appropriately? *Yes.*

g. Are the analyses repeatable? *Yes.*

3. Evaluate the validity and appropriateness of all assumptions used and conclusions made in the development of the MFLs analysis.

a. Are the assumptions reasonable and consistent given the "best information available"? *Yes.*

b. Is there information available that could have been used to eliminate any of the assumptions? Would the use of this additional information substantially change the development of the MFLs? *No to both questions.*

c. Are the assumptions stated clearly? *Yes.*

d. What, if any, assumptions are implied or inherent in the methodologies? *None of significance.*

e. Are other analytical methods or procedures available that would require fewer assumptions but could provide comparable or better results? Are adequate data available to support using these alternative methods or procedures**? A much simpler hydrodynamic analysis would have been sufficient**.

f. Are there deficiencies and/or errors in the MFLs or application of findings and conclusions? N*o.*

g. Identify all sources of uncertainty and assess their impact on developing MFLs that will prevent significant harm to the ecological structure and/or function of the water resource. *This MFL is easily supported given the constancy of conditions at Gemini.*

4. Determine if the data, analyses, and interpretation of results support the recommended MFLs. *Yes.*