TASK 4—FINAL TECHNICAL PEER REVIEW OF WATER BUDGET MODLEING FOR MINIMUM RECOMMENDED LEVELS: LAKES ALTO AND SANTA FE, FLORIDA

PREPARED FOR

Suwanee River Water Management District

PREPARED BY

DSV
DUNN, SALSANO & VERGARA CONSULTING, LLC
HELPING CLIENTS MEET THEIR WATER RESOURCE NEEDS

BFA Environmental Consultants
Barnes, Ferland and Associates, Inc.

JUNE 29, 2018

TABLE OF CONTENTS

EXECUTIVE SUMMARY

The Suwannee River Water Management District (District) has included Lake Santa Fe, located in Alachua and Bradford counties and with its watershed also extending into Clay and Putnam counties, Florida; and Lake Alto, located in Alachua County, Florida, on its current priority list and schedule for the establishment of minimum flows and levels (MFLs). based on the provisions of Subsection 373.802, Florida Statutes (F.S.). Also, based on the provisions of this subsection, the District has identified these two lakes as water bodies for which the District will undertake independent scientific peer review.

Recommended MFLs have been developed for these lakes. These recommended MFLs are described in documents titled *Minimum Recommended Lake Levels: Lake Alto, Florida. Draft Report April 24,* 2018, and *Minimum Recommended Lake Levels: Lake Santa Fe, Florida. Draft Report April 24,* 2018. Both documents were prepared for the District by Greenman-Pedersen, Inc. (GPI). In support of development of these recommended MFLs, the District contracted with the consulting firm of Environmental Consulting &Technology, Inc. (ECT), for performance of water budget modeling. The work performed by ECT is described in a document titled *Lake Alto and Lake Santa Fe Water Budget Modeling, Technical Report-Draft*, dated November 2017. This ECT document is the focus of the peer review discussed in this document.

The District has engaged the services of two experts with collective expertise in the fields of hydrology, limnology, and biology to serve as a peer review panel (panel) to review and evaluate information used for development of recommended MFLs for Lakes Alto and Santa Fe. These panel members are from the water resources consulting firm of Dunn, Salsano & Vergara Consulting, LLC (DSV), which is acting as a sub consultant to the environmental consulting firm of Barnes, Ferland and Associates, Inc. These panel members include

- Donthamsetti Rao, Ph.D., P.E.,
- William J. Dunn, Ph.D.

These two panel members have worked extensively together in matters concerning the development, peer review, and implementation of MFLs in Florida for more than 25 years and have collective professional experience that exceeds 75 years in Florida. Dr. Donthamsetti Rao, P.E., performed the peer review of the water-budget modeling work performed by ECT as well as peer review of the ECT report.

This report utilizes a tabular template for the peer reviewer to address the District's peer review requirements. Included as appendices are two summary tables to capture the two key elements of the technical review. The first, the review comments table, summarizes the reviewer's individual general and specific review comments along with any recommended actions (Appendix A, Table 1). Each comment is treated as a separate row in this table. The second table, (the peer review assessment criteria table) includes the reviewer's comments concerning the District's specific peer review assessment criteria, (Appendix B, Table 2).

Dr. Rao's review indicates that ECT's SWMM modeling work of Lakes Alto and Lake Santa Fe is highly complex modeling work requiring understanding and application of innumerable modeling concepts and procedures and ECT has done an excellent job in producing the required report.

INTRODUCTION

OVERVIEW

The Suwannee River Water Management District (District) has included Lake Santa Fe, located in Alachua and Bradford counties, Florida, and with its watershed also extending into Clay and Putnam counties, on its current priority list and schedule for the establishment of minimum flows and levels (MFLs). based on the provisions of Subsection 373.802, Florida Statutes (F.S.). Also, based on the provisions of this subsection, the District has identified these two lakes as water bodies for which the District will undertake independent scientific peer review.

Recommended MFLs have been developed for these lakes. These recommended MFLs are described in documents titled *Minimum Recommended Lake Levels: Lake Alto, Florida. Draft Report April 24,* 2018, and *Minimum Recommended Lake Levels: Lake Santa Fe, Florida. Draft Report April 24,* 2018. Both documents were prepared for the District by Greenman-Pedersen, Inc. (GPI). In support of development of these recommended MFLs, the District contracted with the consulting firm of Environmental Consulting &Technology, Inc. (ECT), for performance of water budget modeling. The work performed by ECT is described in a document titled *Lake Alto and Lake Santa Fe Water Budget Modeling, Technical Report-Draft*, dated November 2017. This ECT document is the focus of the peer review discussed in this document.

The District has engaged the services of two experts with collective expertise in the fields of hydrology, limnology, and biology to serve as a peer review panel (panel) to review and evaluate information used for development of recommended MFLs for Lakes Alto and Santa Fe. These panel members are from the water resources consulting firm of Dunn, Salsano & Vergara Consulting, LLC (DSV), which is acting as a sub consultant to the environmental consulting firm of Barnes, Ferland and Associates, Inc. These panel members include

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These two panel members have worked extensively together in matters concerning the development, peer review, and implementation of MFLs in Florida for more than 25 years and have collective professional experience that exceeds 75 years in Florida.00000 Dr. Donthamsetti Rao, P.E., reviewed the water-budget modeling work performed by ECT and his findings are reported in this document.

This report utilizes a tabular template for the peer reviewer to address the District's peer review requirements. Included as appendices are two summary tables to capture the two key elements of the technical review. The first, the review comments table, summarizes the reviewer's individual general and specific review comments along with any recommended actions (Appendix A, Table 1). Each comment is treated as a separate row in this table. The second table, (the peer review assessment criteria table) includes the reviewer's comments concerning the District's specific peer review assessment criteria, (Appendix B, Table 2).

PEER REVIEW PANEL'S SCOPE OF WORK

This document provides a summary of the panel's completion of its contracted scope of work, covering the following three major tasks.

> Task 1—Participate in project kick-off meeting and attend a field inspection of data collection sites on and adjacent to Lake Alto and Lake Santa Fe.

Task 2—Perform review of relevant documents and publications.

Task 3--Develop a single draft peer review panel report for submission to the District.

The kick-off meeting was completed on May 7, 2018, as a webinar hosted by District staff. This meeting provided the reviewers with an overview of the District's approach to setting MFLs, data collection and data analysis methods, results, and recommended minimum levels. The required field inspection took place on May 11, 2018. The field inspection included an extensive tour of the two lakes by boat conducted by District staff involved in development of the recommended minimum levels. The field inspection allowed the reviewer direct observation of aquatic, wetland, and upland communities; vegetation and soil sampling transects; and other monitoring locations. The inspection trip also allowed the reviewer an opportunity to ask questions of staff regarding: methods of data collection and analysis, rationale for selection of sampling locations, types and nature of uncertainty, and any needs for additional data collection that could be useful for implementing the minimum levels and assessing compliance in future.

PEER REVIEW APPROACH

Section 373.042, Florida Statutes (F.S.), provides that minimum flows for a given watercourse represent the limit at which further withdrawals would be significantly harmful to the water resources or ecology of the area and the minimum water level is the level of groundwater in an aquifer and the level of surface water at which further withdrawals would be significantly harmful to the water resources or ecology of the area.

Section 373.042, F.S., also provides that MFLs shall be calculated using the best information available, that the Governing Board shall consider and may provide for non-consumptive uses in the establishment of MFLs, and when appropriate, MFLs may be calculated to reflect seasonal variation. The law also requires that when establishing MFLs, changes and structural alterations to watersheds, surface waters, and aquifers shall also be considered (Section 373.0421, F.S.). The State Water Resource Implementation Rule (Chapter 62-40, Florida Administrative Code) includes additional guidance for the establishment of MFLs, providing that:

> "…consideration shall be given to the protection of water resources, natural seasonal fluctuations in water flows or levels, and environmental values associated with coastal, estuarine, aquatic, and wetlands ecology, including:
>
> a. Recreation, in and on the water;
> b. Fish and wildlife habitats and the passage of fish;
> c. Estuarine resources;
> d. Transfer of detrital material;
> e. Maintenance of freshwater storage and supply;
> f. Aesthetic and scenic attributes;
> g. Filtration and absorption of nutrients and other pollutants;
> h. Sediment loads;
> i. Water quality; and
> j. Navigation."

Section 373.042, F.S., also addresses independent scientific peer review of MFLs, specifying the review of all scientific or technical data, methodologies, and models including all scientific and technical assumptions employed in each model, used to establish a minimum flow or minimum water level. In addition, the law requires that the Florida Department of Environmental Protection (FDEP) or the Governing Board shall give significant weight to the final peer review panel report when establishing the minimum flow or minimum water level.

Report

This report utilizes a tabular template for the peer reviewer to meet the District's peer review requirements. Included as Appendices are two summary tables to capture the key elements of the technical review. The first set of tables, the review comments tables, summarizes the reviewer's individual general and specific review comments along with any recommended actions (Appendix A, Table 1). Each comment is treated as a separate row in these tables. The second table, the peer review assessment criteria table, includes the reviewer's comments concerning the District's peer review assessment criteria, which are described in the following outline (Appendix B, Table 2).

The District's peer review assessment criteria, addressed by the reviewer in Table 2, are as follows:

(A) Determine whether the conclusions in the ECT report are supported by the analyses presented.

1. Supporting Data and Information: Review the relevant data and information that support the conclusions made in the report to determine:

   (a) the data and information used was properly collected;

   (b) reasonable quality assurance assessments were performed on the data and information;

   (c) exclusion of available data from analyses was justified; and

   (d) the data used was the best information available.

   Note: The peer review panelist is not expected to provide independent review of standard procedures used as part of institutional programs that have been established for collecting data, such as the USGS and District hydrologic monitoring networks.

2. Technical Assumptions: Review the technical assumptions inherent to the analysis used in the ECT MFLs report to determine whether:

   a. the assumptions are clearly stated, reasonable and consistent with the best information available;

   b. the assumptions were eliminated to the extent possible, based on available information; and

   c. other analyses that would require fewer assumptions but provide comparable or better results are available.

3. Procedures and Analyses: Review the procedures and analyses used in the ECT report to determine whether:

   a. the procedures and analyses were appropriate and reasonable, based on the best information available.

   b. the procedures and analyses incorporate all necessary factors;

   c. the procedures and analyses were correctly applied;

   d. limitations and imprecisions in the information were reasonably handled;

   e. the procedures and analyses are repeatable; and

   f. conclusions based on the procedures and analyses are supported by the data.

(B) If a proposed method used in the ECT report is not scientifically reasonable, the peer reviewer shall:

1. List and describe scientific deficiencies and, if possible, evaluate the error associated with the deficiencies;
2. Determine if the identified deficiencies can be remedied.
3. If the identified deficiencies can be remedied, then describe the necessary remedies and an estimate of time and effort required to develop and implement each remedy.
4. If the identified deficiencies cannot be remedied, then, if possible, identify one or more alternative methods that are scientifically reasonable. If an alternative method is identified, provide a qualitative assessment of the relative strengths and weaknesses of the alternative method(s) and the effort required to collect data necessary for implementation of the alternative methods.

(C) If a given method or analyses used in the ECT report is scientifically reasonable, but an alternative method is preferable, the peer reviewer shall:

1. List and describe the alternative scientifically reasonable method(s) and include a qualitative assessment of the effort required to collect data necessary for implementation of the alternative method(s).

SUMMARY OF REVIEW PANEL COMMENTS/ QUESTIONS

As described, the reviewer's detailed comments are included in appendices as a set of two summary tables that capture the two key elements of technical review. The first table, the review comments tables, summarizes the reviewer's individual general and specific review comments on the MFL's water-budget modeling document prepared by ECT along with any recommended actions (Appendix A, Table 1). Each comment is treated as a separate row in this table. The second table provides the reviewer's conclusions for each of the District's peer review assessment criteria (Appendix B, Table 2).

SUMMARY OF COMMENTS/QUESTIONS SUBMITTED BY DR. DONTHAMSETTI RAO, P.E.

ECT's SWMM modeling work of Lakes Alto and Lake Santa Fe is highly complex modeling work requiring understanding and application of innumerable modeling concepts and procedures and ECT has done an excellent job in producing the required study results. The text, however, may need some re-writing for clarity at some places. Some suggestions have been made for improvement.

SRWMD and ECT selected EPA's Storm Water Management Model (SWMM) to assess long-term hydrologic changes at Lake Alto and Lake Santa Fe. The model's emphasis is on storm water and water quality assessment, but it is essentially a general hydrology model and is suitable for meeting the present needs.

ECT calibrated the model for the period 2006- 2015 assuming the 2006 basin hydrologic and land use conditions, which did not show major variation through 2015. It performed long-term simulation for a total of 32.7 years from May 1, 1983, through Dec 31, 2015, because model input data were available for this period. Use of similar procedures is common in hydrologic model studies, and the reviewer agrees with these methods.

Lake Santa Fe has recorded stage data, with some gaps, from July 11,1957, to the present day. Model simulations, however, were performed only for the period May 1,1983 to December 3, 2015, because the required model input data, especially the Floridan aquifer potentiometric surface elevation data, were not available for the period prior to May 1,1983. The 32.7-year model period includes three significant droughts, including the 2000-2002, 2006-2008, and 2011-2012 drought periods. It is very likely that these low water levels would negatively impact the MFLs analyses and impart a negative bias to the results. To come up with a more representative historic record, a "hybrid" lake stage data set was used that combined the 32.7-year model period with the historical lake stage data prior to May 1, 1983, for Lake Alto and Lake Santa Fe.

The assessment of existing hydrologic conditions is the crux of the report and some additional work by ECT is suggested by the reviewer. The hybrid data method described in the report has major significance and should be explained more precisely. The necessity of using the hybrid method should be fully 'traced' and strongly supported and defended. The following additional work is suggested to address this concern:

- For hydrologic frequency analysis, a data length of 30 years or greater is normally deemed satisfactory. This condition is satisfied by the 32.7 years of simulation period. Develop MFLs graphs similar to Figures 5-9 and 5-12 series, using the simulated data. Probably some of the MFLs would be tripped. Then examine the prior years' data and

enumerate the differences in data (e.g., the simulation period has lower rainfall). Give the reasons why the model could not be extended for the past years (e.g., lack of model input data. The recorded data (1957-1983) is invaluable data and should be used in the analysis to provide a further means of assessing the accuracy of the simulation model.

- Also, develop a set of MFLs graphs using the recorded stage data for 1957–2016, with gaps, if any, filled by the interpolated data. The first step in MFLs analysis is evaluating MFLs using the recorded data (Rao 2005). Due to land use and water use changes over the historic period this data may not be homogeneous, but the evaluations will give a good indication of whether the MFLs are being met.

Atlantic Multidecadal Oscillation (AMO) is regarded as indicative of the cyclical patterns of south and central Florida rainfall. AMO has warm and cool phases, the warm phase indicating generally higher rainfall and the cool phase lower rainfall (Enfield et al. 2001). The graphic presented in Figure 1 shows the historic phases of the AMO. AMO represents 10-year moving averages of North Atlantic Sea Surface Temperature. Thus, the last point on the graph is the midpoint of the current decade, 2011. Applicability of these concepts to the SRWMD lakes was discussed at length by Dr. Rao in the DSV report, *Technical Peer Review of Minimum Recommended Levels: Lake Butler, Florida*, January 23, 2017. Dr. Rao recommends performing the evaluations suggested in the preceding report with Lakes Alto and Santa Fe rainfall data.

Presently, there is some concern with the establishment and development of FH as discussed by Dr. Dunn in his comments on the GPI reports. Even with the Hybrid data, FH is met rather very marginally.

An assessment of hypothetical water resource development at Lake Alto and Lake Santa Fe should be performed. This involves determining maximum allowable drawdown in the Upper Floridan Aquifer System (FAS) near the lakes.

Even though not explicitly mentioned, the present analysis assumes that FAS elevations near Lakes Alto and Santa Fe are independent, which may not be correct. With this assumption, the study determined a maximum allowable potentiometric elevation decline of 7.0 ft in the Upper FAS for the Lake Alto region and 16.0 ft for the Lake Santa Fe region. FAS elevations may be regarded as interactive and Figure 4-3 of the ECT report shows the Lake Alto region elevation to be lower than that of the Lake Santa Fe region by about five ft. If the FAS elevation is lowered in the Lake Santa Fe region, FAS elevations may gradually decline also in the Lake Alto region and may attain the five-ft difference when the equilibrium is reached. Therefore, most likely, the lower FAS level that is allowed in the Lake Alto region will govern the lower FAS level in the Lake Santa Fe region. Further assessment of the likely scenarios should be performed.

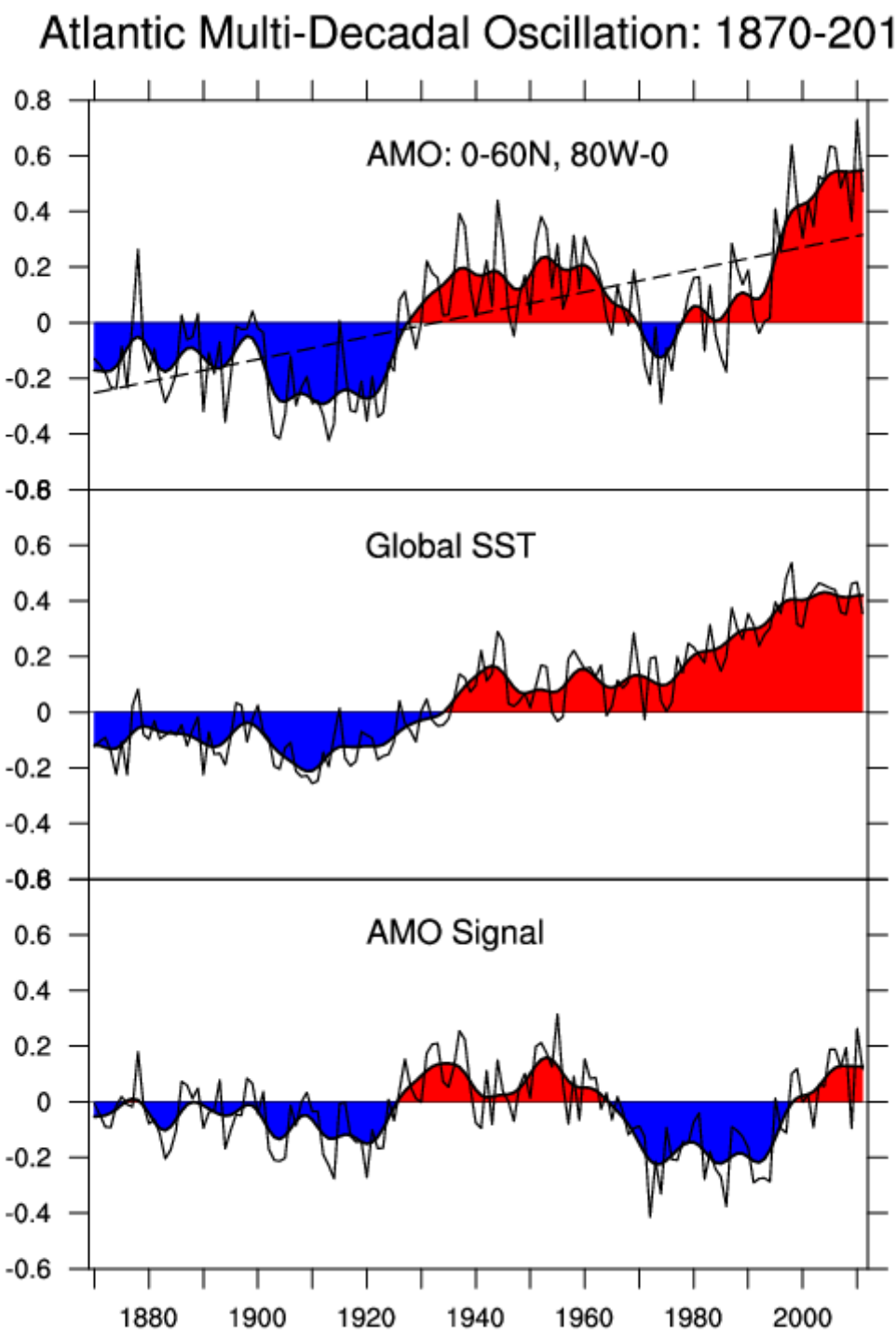

Figure 1—Atlantic Multidecadal Oscillation

REFERENCES

Rao, D. V., 2005 Draft. *Verification of Minimum Surface Water Levels for Lakes in the Minimum Flows and Levels Program of the St. Johns River Water Management District*. Palatka, Fla.: St. Johns River Water Management District.

Enfield, D.B., A.M. Mestas-Nunez, and P.J. Trimble, 2001: *The Atlantic Multidecadal Oscillation and its relationship to rainfall and river flows in the continental U.S*. *Geophysical Research Letters*, *28*: 2077-2080.

Dunn, Salsano & Vergara Consulting, LLC. *Technical Peer Review of Minimum Recommended Levels, Lake Butler, Florida*, January 23, 2017.

APPENDICES

APPENDIX A – TABLE 1. DONTHAMSETTI RAO, PH.D., P.E.'S, REVIEW COMMENTS ON ECT WATER-BUDGET MODELING DOCUMENT

Table 1. Donthamsetti Rao, Ph.D., P.E.'s, Review Comments on ECT Water-Budget Modeling Document

Comment No.	Figure, Table, or Page and Paragraph Number	Does Comment Directly and Materially Affect Conclusions of Report? (Yes/No)	To be completed by Reviewer(s) Table 1, Rao		To be completed by Report Author(s)
			A. Reviewer's Specific Comments	B. Reviewer's Specific Recommended Corrective Action	C. Action to be Taken in Response to Comment
1	Page 1-1 Executive Summary	No	General Comment: ECT's SWMM modeling work of the Lake Alto and Lake Santa Fe basin is highly complex modeling work requiring understanding and application of innumerable modeling concepts and procedures and ECT has done an excellent job in producing the required study results. The text, however, may need some re-writing for clarity at some places. Some suggestions were made for Improvement, but practically all of the text is untouched. SRWMD and ECT selected EPA's Storm Water Management Model (SWMM) to assess long-term hydrologic changes at Lake Alto and Lake Santa Fe. The model emphasis is on storm water and water quality assessment, but it is essentially a general hydrology model and is capable of meeting the present needs. Other well-known models such as, HSPF and SWAT, also serve the same purpose, therefore, I agree with selection of SWMM for the present modeling work.	No changes recommended.	

Comment No.	Figure, Table, or Page and Paragraph Number	Does Comment Directly and Materially Affect Conclusions of Report? (Yes/No)	To be completed by Reviewer(s) Table 1, Rao		To be completed by Report Author(s)
			A. Reviewer's Specific Comments	B. Reviewer's Specific Recommended Corrective Action	C. Action to be Taken in Response to Comment
2	Page 1-2 Model Calibration	No	ECT calibrated the model for the period 2006-2015 assuming the 2006 basin hydrologic and land use conditions, which did not show major variation through 2015. It performed long-term simulation for a total of 32.7 years from May 1, 1983 through Dec 31, 2015 because model input data were available for this period. Use of similar procedures is common in hydrologic model studies, and I agree with these methods.	No change recommended	
3	Page iii	No	Floridan aquifer is written as Florida Aquifer at a number of places.	Make the necessary correction wherever it occurs	
4	Page ix	No	Transfer Function is written as Tranfer Function at a number of places.	Make the necessary corrections wherever it occurs	
5	Page 1-2, Task 5	No	Long-term Model Simulation and 'Hybrid' Data Method The term 'Hybrid Data' has major significance in this report and the reader should understand it up front. Revise the second paragraph, 'The 32.7-year …' as shown in the next column. I am suggesting additional analyses in Section 5.4 later.	Lake Santa Fe has recorded stage data, with some gaps, from 7/11/1957 to the present day. Model simulations, however, were performed only for the period 5/1/1983 – 12/31/2015 because the required model input data, especially the Floridan Aquifer potentiometric surface elevation data, were not available for the period prior to 5/1/1983. The 32.7-year model period includes three significant droughts, including the 2000-2002, 2006-2008, and 2011-2012 drought periods. It is very likely that these low water levels would negatively impact the MFLs analyses and impart a negative bias to the results. To come up with a more representative historic record, a "hybrid" lake stage data set was used that combined the 32.7-year model period with the historical lake stage data prior to May 1, 1983, for Lake Alto and Lake Santa Fe.	

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			A. Reviewer's Specific Comments	B. Reviewer's Specific Recommended Corrective Action	C. Action to be Taken in Response to Comment
6	Page 1-3	No	Second paragraph, last three lines: Based on the analysis of results, the recommended MFLs would be met with a maximum potentiometric elevation decline of 7.0 feet for Lake Alto and 16.0 feet for Lake Santa Fe in the upper FAS beyond 2006 hydrologic conditions. FAS elevations at Lakes Alto and Santa Fe cannot be considered as independent but should be considered as interactive Typically there is a five-foot difference in the FAS levels between the regions of the two lakes as per Figure 4-3 of the report. If the Santa Fe region FAS is lowered, the Alto region FAS also may decline, eventually reaching a stage difference of five feet.	Provide your concepts and your discussion in Section 6.00. Mention that the two drawdown values evaluated were hypothetical assuming FAS is independent of the lake locations. In practice, it looks like Lake Alto will govern the maximum FAS potentiometric surface decline near Lake Santa Fe. If you reach a different conclusion, include it in the document.	
7	Page 2-1 through 2-9. Chapter 2.0 Watershed Description	No	The watershed features have been well covered, but I have one major question, and there are some minor corrections to take care of. Is there a firm divide/sill level between Lake Alto and Lake Santa Fe? This level will govern drawdown in Lake Santa Fe Page 2-1, Line 3: The reference (Alachua County, 2014) is not shown in the list of references.	Add to the list of References.	
8	Page 2-2	No	Section 2.2 Climate. Paragraph 1, last line. The reference 'USDA, 1991' is a Soil Survey report. Does it cover climate of the present basin? Same comment applies for Page 2-3, First Paragraph Line 5	Please verify whether this is the correct reference.	

Comment No.	Figure, Table, or Page and Paragraph Number	Does Comment Directly and Materially Affect Conclusions of Report? (Yes/No)	To be completed by Reviewer(s) Table 1, Rao		To be completed by Report Author(s)
			A. Reviewer's Specific Comments	B. Reviewer's Specific Recommended Corrective Action	C. Action to be Taken in Response to Comment
9	Page 2-3	No	Lines 1 and 2, the statement: These rains can be heavy and of long duration. As much as several inches of rain can fall in a 24-hour period. Give some examples with dates and location.		
10	Page 2-4	No	Section 2.4 Soils. The statement: The most current soils data of Alachua, Bradford, Clay, and Putnam counties was directly downloaded from the Natural Resource Conservation Service (NRCS). Not shown in the list of references. Which year? Or web address?	Add to the list of References	
11	Page 2-4	No	Table 2-1, foot note: Source: NRCS, 2016. Not shown in the list of references.	Add to the list of References	
12	Page 2-5	No	Table 2-2, foot note: Source: SRWMD, 2006; SJRWMD, 2004. Not shown in the list of references.	Add to the list of References	
13	Page 3-1	No	Statement in the second paragraph: It is important that the water budget model is able to perform long-term continuous simulation of a full hydrologic cycle, including rainfall, evapotranspiration, surface runoff, infiltration/percolation, and surface water/groundwater flow exchange. The model will not simulate rainfall, it is the input data to the model.	Omit rainfall in the sentence or explain why it is a component of the simulated items.	
14	Pages 3-2 to 3-9		SWMM model applications: Hydrology. The reviewer finds various hydrologic procedures used are satisfactory and acceptable. These processes are concisely described. Some clarification needed on Table 3-2, Page 3-7	No action necessary	

Comment No.	Figure, Table, or Page and Paragraph Number	Does Comment Directly and Materially Affect Conclusions of Report? (Yes/No)	To be completed by Reviewer(s) Table 1, Rao		To be completed by Report Author(s)
			A. Reviewer's Specific Comments	B. Reviewer's Specific Recommended Corrective Action	C. Action to be Taken in Response to Comment
15	Page 3-7	No	Table 3-2. Lookup Table of Monthly ET Coefficients – Preliminary Monthly ET coefficients are shown as 1.20 for Open Water and 1.10 for forested wetland. Define ET coefficient and explain why these values are high for these components.	Explain as requested.	
16	Pages 3-10 to 3-14	No	SWMM model applications: Hydraulics. The reviewer finds various procedures used concisely described, are satisfactory and acceptable.	No action necessary	
17	Pages 3-14 to 3-17	No	Preliminary Model Development and Simulation: This section, although brief, clearly and concisely describes the entire model set up, and very useful to the reader.	No action necessary	
18	Pages 3-18 to 3-31	No	These are the Tables of Hydrologic parameters for sub-basins and aquifers. Well prepared.	No action necessary	
19	Pages 4-1 to 4-40	No	Water budget model calibration: Various calibration procedures are well described and the relevant results are well presented.	No action necessary	

20	Pages 5-1 to 5-10	May be	Assessment of Existing Hydrologic Conditions. This is the Crux of the report and I am suggesting some additional work. The term 'Hybrid Data' has major significance in this report and the reader should understand it precisely, I have already added some material on it in reviewing the Executive Summary. The necessity of using the hybrid method should be fully 'traced' and strongly supported and defended. The following additional work is suggested. For hydrologic frequency analysis, a data length of 30 years or greater is normally deemed satisfactory. This condition is satisfied by the 32.7 years of simulation period. Develop MFLs graphs similar to Figures 5-9 and 5-12 series, using the simulated data. Probably some of the MFLs would be tripped. Then examine the prior years' data and enumerate the differences in data (e.g., the simulation period has lower rainfall). Give the reasons why you cannot extend the model for the past years (e.g., lack of model input data). The recorded data (1957-1983) is invaluable data and should be used in the analysis to provide a further means of assessing the accuracy of the simulation model. Also develop a set of MFLs graphs using the recorded stage data for 1957–2016, with gaps, if any, filled by the interpolated data. The first step in MFLs analysis is evaluating MFLs using the recorded data (Rao 2005). Due to land use and water use changes over the historic period this data may not be homogeneous, but the	Expand report to address the concerns expressed in comment 20. Dr. Rao recommends performing the evaluations suggested in the DSV report, *Technical Peer Review of Minimum Recommended Levels: Lake Butler, Florida*, January 23, 2017. with Lakes Alto and Santa Fe rainfall data.	

Comment No.	Figure, Table, or Page and Paragraph Number	Does Comment Directly and Materially Affect Conclusions of Report? (Yes/No)	To be completed by Reviewer(s) Table 1, Rao		To be completed by Report Author(s)
			A. Reviewer's Specific Comments	**B. Reviewer's Specific Recommended Corrective Action**	**C. Action to be Taken in Response to Comment**
			evaluations will give a good indication of whether the MFLs are being met. Atlantic Multidecadal Oscillation (AMO) is regarded as indicative of the cyclical patterns of south and central Florida rainfall. AMO has warm and cool phases, the warm phase indicating generally higher rainfall and the cool phase lower rainfall (Enfield et al. 2001). Applicability of these concepts to the SRWMD lakes was discussed at length by Dr. Rao in the DSV report, *Technical Peer Review of Minimum Recommended Levels: Lake Butler, Florida*, January 23, 2017. Presently, there is some concern with the establishment and development of FH as discussed by Dr. Dunn in his comments on the GPI report. Even with the hybrid data, FH is met rather very marginally.		
21	Pages 6-1 to 6-3	May be	Assessment of Hypothetical Water Resource Development at Lake Santa Fe. Even though not explicitly mentioned, the present analysis assumes that FAS elevations near Lakes Alto and Santa Fe are independent, which may not be correct. Very likely, FAS elevations will be the same for the two lake regions. Thus, most likely, the lower FAS level that is allowed for the Lake Alto region will govern the lower FAS level for the Lake Santa Fe region.	Provide your discussion. If you agree with the reviewer's comments, mention that the two FAS drawdown values evaluated were hypothetical.	

Comment No.	Figure, Table, or Page and Paragraph Number	Does Comment Directly and Materially Affect Conclusions of Report? (Yes/No)	To be completed by Reviewer(s) Table 1, Rao		To be completed by Report Author(s)
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22	Pages 7-1 to 7-3	May be	Conclusions and Limitations Revise this Chapter based on the additional results produced as suggested under Comments 20 and 21. Specifically, Revise Paragraph 4, Page 7-1, by comprehensively including, i) MFLs results based on just the simulated data, ii) MFLs results using the historic stage data with estimated missing data, and iii) MFLs results with hybrid data. Revise last paragraph, Page 7-1, based on the revisions made following the reviewer's Comment 21. Pages 7-2 and 7-3. Each modeler has his/her own insights into the modeling procedures. Comments of the modeler presented in these two pages may be regarded as pertinent.	Make revisions as suggested.	

APPENDIX B – TABLE 2. DONTHAMSETTI RAO, PH.D., P.E.'S, TASKS 1-4 DETERMINATIONS FOR ECT WATER-BUDGET MODELING DOCUMENT

Table 2. Donthamsetti Rao, Ph.D., P.E.'s, Tasks 1-4 determinations of whether the methods used by ECT for performance of water-budget modeling are scientifically reasonable as described in report titled *Lake Alto and Lake Santa Fe Water Budget Modeling, Technical Report-Draft*, dated November 2017

Task	Subtask	Sub-subtask	Reviewer's Specific Comments Table 2, Rao
1.Determine whether the methods used for establishing the minimum flows are scientifically reasonable	A. Supporting Data and Information: Review the data and information that supports the method and the proposed minimum flows, as appropriate	1. Data and information used was properly collected.	Reviewer assumes that the data and information used in the ECT report were properly collected.
		2. Reasonable quality assurance assessments were performed on the data and information.	Reviewer assumes that reasonable quality assurance assessments were performed on the data and information.
	B. Review the technical assumptions inherent in the methodology	1.Determine if the assumptions are clearly stated, reasonable and consistent with the best information available	Yes, reviewer found this to be true; recognizing that often tradeoffs must be made in selecting the best available source of data depending on the analytical method, tool, or model used.
		2. Assumptions were eliminated to the extent possible, based on available information.	Yes, the report and supporting material in the respective appendices included assumptions, which the reviewer generally found to be clear and reasonable. In the few cases where assumptions were not clear, the reviewer's concerns are expressed. (see Appendix A, Table 1).
	C. Procedures and analyses: Review the procedures and analyses used in developing quantitative measures and determine qualitatively whether:	1. The procedures and analyses were appropriate and reasonable, based on the best information available.	Yes, reviewer generally found this to be true. The reviewer however, makes recommendations for improving the strength of the underlying technical support of the recommended levels.
		2. The procedures and analyses incorporate all necessary factors.	Yes, reviewer found this to be true. The reviewer however, makes recommendations for improving the strength of the underlying technical support of the recommended levels.
		3. The procedures and analyses were correctly applied.	Yes, reviewer found this to be true. The reviewer makes recommendations for improving the strength of the underlying technical support of the recommended levels.

Task	Subtask	Sub-subtask	Reviewer's Specific Comments Table 2, Rao
		4. Limitations and imprecisions in the information were reasonably handled.	Yes, reviewer found this to be true. The reviewer, however, makes recommendations for improving the strength of the underlying technical support of the recommended levels.
		5. The procedures and analyses are repeatable.	Yes, reviewer found this to be true. The reviewer, however, makes recommendations for improving the strength of the underlying technical support of the recommended levels.
		6. Conclusions based on the procedures and analyses are supported by the data.	Yes, reviewer found this to be true. The reviewer, however, makes recommendations for improving the strength of the underlying technical support of the recommended levels. This is especially true regarding the management of the primary sources of uncertainty.
2. If a proposed method used in the report is not scientifically reasonable the reviewers shall identify:	A. Deficiencies: List and describe scientific deficiencies		Reviewer has identified the failure to discuss the management of uncertainty as a deficiency. In Appendix A, Table 1 reviewer notes several specific remedies to manage uncertainty.
	B. Remedies: Determine if the identified deficiencies can be remedied.		Yes, an integrated management plan for handling key sources of uncertainty should be developed. Specific recommendations as to how to do this using AM approach are provided in the summary comments in Discussion section of this report, and in specific comments in Appendix A, Table 1.
	C. If the identified deficiencies can be remedied, then please describe the necessary corrections and, if possible, an estimate of the time and effort required to develop and implement. .		Reviewer did not identify any major deficiencies. However, the reviewer recommends several improvements to the report. These are given in the Summary section of this report, and in Appendix A, Table 1.

Task	Subtask	Sub-subtask	Reviewer's Specific Comments Table 2, Rao
	D. If the identified deficiencies cannot be remedied, then, if possible, identify one of more alternative methods that are scientifically reasonable, based on published literature to the extent feasible.		It is expected that sources of uncertainty can be controlled to the extent that the District uses the best available information and best available analytical tools to develop MFLs. Specific recommendations as to how do this using an AM approach are provided in the summary comments in the Discussion section of this report.