

# Independent Scientific Peer Review

## Of the Steinhatchee River and Priority Springs MFL Technical Report

PREPARED FOR



**Suwannee River Water Management District**

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PREPARED BY

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# 1

## Introduction

The Suwannee River Water Management District (District) completed the draft Minimum Flows and Levels (MFL) technical report for the Steinhatchee River and associated springs in 2017. The District elected to proceed with a voluntary, independent scientific peer review under 373.042(5) Florida Statutes (F.S.). The District contracted with Vanasse Hangen Brustlin, Inc. (VHB) to assemble subject matter experts (peer reviewers) to conduct an independent, technical peer review of the draft MFL documents.

The goal of this peer review was to review the data, analyses, models, and other assessment and evaluation methods used by the District in determining proposed minimum flows for the river and springs. Individual peer reviewers used a standardized comment table form to document the results of their review. This report includes an executive summary that synthesizes the individual reviewer's results into a single review document for the river and associated springs. Responses and comments reflecting views shared by the panel members are presented collectively in the Chapter 3 summary. Substantial variances between the individual reviewers concerning responses and comments were identified separately.

This peer review document and the individual peer reviewers acknowledge the statutory constraints and conditions (Sections 373.042 and 373.0421, F.S.) affecting the District's development of MFLs. The peer reviewers also acknowledge that review of the certain assumptions, conditions, and established legal and policy interpretations of the Governing Board (referred to as "givens") were outside of the scope of this peer review. These givens include:

1. The selection of water bodies for which minimum flow and/or levels are to be set
2. The determination of the baseline conditions from which "significant harm" is to be determined
3. The definition of what constitutes "significant harm" to the water resources or ecology of the area

## 1.1 Background

The Florida Legislature directed the State's five water management districts to establish MFLs for streams, springs, rivers, lakes, and other priority water bodies within their boundaries through Chapter 373.042, (F.S.). Chapter 373.042 of the Florida Statutes specifies that:

- Within each section, or the water management district as a whole, the Department (Florida Department of Environmental Protection) or the (District) Governing Board shall establish the following:
  - a. Minimum flows for all surface watercourses in the area. The minimum flow for a given watercourse shall be the limit at which further withdrawals would be significantly harmful to the water resources or ecology of the area.
  - b. Minimum water level. The minimum water level shall be 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 of the area.

According to, Florida Statutes, MFLs shall be established using the best information available at that time, and that, where appropriate, MFLs may reflect seasonal variations in flows and levels (Chapter 373.042[1], F.S.). MFLs may also protect non-consumptive uses. Chapter 373.0421, F.S. lists factors that the Governing Board may consider when determining the appropriate reference point for MFL establishment. The statute recognizes that the historical hydrological condition of a waterbody may be an appropriate reference point for MFL establishment and allows certain exclusions if determining or returning to historical conditions is not be feasible.

The State Water Resource Implementation Rule (Chapter 62-40.473, Florida Administrative Code [F.A.C.]) gives additional policy guidance regarding MFLs stating:

*"...consideration shall be given natural seasonal fluctuations in water flows or levels, nonconsumptive uses, and environmental values associated with coastal, estuarine, riverine, spring, aquatic, and wetlands ecology."*

These environmental values, also called "water resource values," include:

1. Recreation in and on the water
2. Fish and wildlife habitats and the passage of fish
3. Estuarine resources
4. Transfer of detrital material
5. Maintenance of freshwater storage and supply
6. Aesthetic and scenic attributes
7. Filtration and absorption of nutrients and other pollutants
8. Sediment loads
9. Water quality
10. Navigation

Prior to the establishment of MFLs, SRWMD may voluntarily subject technical work to independent scientific peer review (Section 373.042, F.S.). The purpose of the peer review is to conduct an independent examination of the scientific or technical data, methodologies, and models, including all scientific and technical assumptions employed in each model, used to establish each minimum flow or level.

## **1.2 River and Watershed**

The Steinhatchee River runs a little over thirty-four miles from its headwaters in Lafayette County, Florida southwest of the Suwannee River to its mouth at Deadman's Bay at the border of Dixie and Taylor Counties. The river forms the border between these two counties. The Steinhatchee River watershed encompasses 562 square miles of Florida's Big Bend Region. Tree plantations and wetlands (primarily forested wetlands) occupy over 95% of the watershed (SRWMD 2017). Most of the developed land in the watershed is located at the mouth of the river. There are extensive seagrass beds offshore of the river mouth in the Gulf of Mexico

## **1.3 Scope of Review**

The District contracted VHB to assemble a panel of independent subject matter experts (peer reviewers) to conduct a technical peer review of the draft Steinhatchee MFL Technical report document and associated appendices. The peer reviewers were to review the data, analyses, models and methodologies used by the District in the determination of the proposed minimum flows for the Steinhatchee River and two springs that contribute significant flow the river. VHB then assembled the responses and comments reflecting views shared by the panel members and presented those views collectively in the Chapter 3 of this report. Substantial variances between the individual reviewers concerning responses and comments on each task were to be identified separately.

The specific tasks of this peer review were:

**Task 1. Determine whether the method used for establishing the minimum flows is scientifically reasonable.**

- a. Review the data and information that support the method and the proposed minimum flows, as appropriate. The panel shall assume the following:
  1. The data and information used were properly collected;
  2. Reasonable quality assurance assessments were performed on the data and information;
- b. Review the technical assumptions inherent in the methodology and determine whether:
  1. The assumptions are clearly stated, reasonable and consistent with the best information available; and
  2. Assumptions were eliminated to the extent possible, based on available information.
- c. 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;
  2. The procedures and analyses incorporate appropriate factors;
  3. The procedures and analyses were correctly applied;
  4. Limitations and imprecision in the information were reasonably handled;
  5. The procedures and analyses are repeatable; and
  6. Conclusions based on the procedures and analyses are supported by the data.

**Task 2. If a proposed method is not scientifically reasonable:**

- a. List and describe scientific deficiencies.
- b. Determine if the identified deficiencies can be remedied and provide suggested remedies.
- c. If the identified deficiencies cannot be remedied, then, if possible, identify one or more alternative methods that are scientifically reasonable, based on published literature to the extent feasible.

## **1.4 Peer Review Team**

The peer review team consisted of the five people listed below. Resumes and curriculum vitae documenting qualifications of individual peer review team members are given in

Appendix B. The peer review team (listed with their affiliations and areas of expertise) included:

- Robert D. Woithe, Ph.D. VHB. Peer Review Chairman. Water Quality, Seagrass, Wetlands, Habitat, MFL development
- Gary Serviss. VHB. Wildlife Habitat, Ecology, T & E Species, MFL Development
- Mehul J. Patel, P.E. VHB. Hydrodynamic Modeling
- John Coffin. Hydrologic Data Collection, Inc. .Hydrology
- Gary Zarillo. Ph.D. Florida Institute of Technology. EFDC Modeling

# 2

## Summary of the Recommended Minimum Flow for the Steinhatchee River and Associated Springs

### 2.1 MFL Report Outline

This section presents a brief synopsis of the Steinhatchee River and priority springs MFL Technical Report as background information for the peer review summary in Chapter 3 of this report and peer review comment tables in Appendix A of this report. The Steinhatchee River MFL Report is divided into the following seven chapters and four appendixes:

- Chapter 1 - Introduction
- Chapter 2 - Description of the Steinhatchee River System
- Chapter 3 - Ecological Characteristics of the Steinhatchee River and Watershed
- Chapter 4 - Conceptual Model and Approach to MFL Establishment
- Chapter 5- Methodology and Approach for the Establishment of the Steinhatchee River MFL
- Chapter 6 - Proposed Steinhatchee River MFL
- Chapter 7 - References
- Appendix A – Development of the HEC-RAS Model

- Appendix B – Development and Calibration of the Hydrodynamic Model
- Appendix C – Use of SEFA Software for in an MFL Study of the Steinhatchee River
- Appendix D Additional Plots

## 2.2 Conclusions of the MFL Document

The MFL document established two protective flow metrics for the Steinhatchee River. Each metric applies to a different flow ranges. The most protective MFL metric (the metric with the lowest allowable flow reduction) is based on preserving sufficient Flood Plain Inundation. Because this metric only applies when the river is at or above flood stage (water levels are over bank) the critical flow for the Flood Plain Inundation metric was defined as 1794 cfs. During flows at or above 1794 cfs, the MFL allows flow reductions up to 5.5%.

The MFL found a critical flow control point for salinity habitat protection at a river flow of 858 cfs. During river flows at or below 858 cfs, the MFL allows flow reductions of up to 11.5%. Between 858 and 1794 cfs river flow, the MFL allows a flat withdrawal rate of 98.7 cfs. This equates to between 5.5% and 11.5% flow reduction when river flow is between 858 cfs to 1794 cfs.

The MFL assesses two “priority springs,” Steinhatchee River Rise and Beaver Creek Spring, that make significant contributions to Steinhatchee River flow. The MFL report defines allowable percent reduction flow from each of these springs at 11.5%. This range of flow reduction is designed to protect the estuarine resource.

# 3

## Executive Summary of the Peer Review Results

### 3.1 Introduction

Specific review comments regarding report issues are given in the Peer Review Forms from each reviewer (Appendix A). Individual reviews focused on data, data analysis methods, and on whether identified issues could materially affect the conclusions upon which the MFL determination was based. When an individual peer reviewer was not certain that an identified issue would not materially affect the basis of the MFL, a “yes” or “possibly” was entered in the third column of the review table. A “no” entry in this column generally indicates that the peer reviewer is requesting/suggesting clarification or more detail on a issue that does not appear to materially affect the MFL or is making editorial or stylistic corrections for sake of report clarity or consistency.

### 3.2 Peer Review Findings

The Steinhatchee River MFL peer reviewers generally found that the Steinhatchee River MFL Technical Report (MFL report) met the apparent intent of MFL related statutes and the State Water Resource Development rule. The peer review panel recommends several text, figure, and table revisions for consistency and clarity. The specific revisions are discussed in the individual peer review forms. These forms are given in Appendix A. Several peer reviewer comments requested that technical terms used in the report or the details of specific data analysis methods be defined better.

Review of analysis methods and conclusions that have been reviewed in previous District MFL peer reports (such as HSW 2004, HSW 2006, and Water and Air 2015) was outside the scope of this work effort. As a result, this review committee made numerous requests for additional and/or more detailed citation of sources. These included both the peer-reviewed sources for methods as well as sources for statements regarding river conditions and related data. One such request regarding Chapter 2 noted that the MFL report stated that much of the river flow is provided by surface water with baseflow being provided by springs and seeps. However, the MFL report did not cite previous studies or analyses performed for the FML report to support these conclusions.

The peer reviewers also noted that the MFL report describes estuarine fish communities in the River, but there was no discussion of freshwater fish communities. Several freshwater fish species were used in MFL analyses. The review committee assume there were no available studies of Steinhatchee River freshwater fish communities. If the choice of freshwater fish species for analysis was made based on previous MFL studies in other rivers, these studies should be cited. Similarly, the peer reviewers noted that there were no data or citations provided in the MFL report to support the Chapter 4 statement that the transfer of detrital material is “less important” for the river than the other water resource values (WRVs). The reviewers requested that either the results from other MFLs or data from similar river systems be used to support this statement. If this WRV could not be assessed because data were lacking, the reviewers asked that the text be revised to reflect this constraint.

Additional clarification was also requested for several items in Chapter 5. The reviewers asked for more detailed discussion about the stretch of the river where instream habitat assessments were performed and the results analyzed using System for Environmental Flow Analysis (SEFA) software. Reviewers requested a stronger narrative as to why this area of the river was representative of the remainder of the river and how it accurately characterized the entire freshwater reach of the river.

Elsewhere in Chapter 5, fifty-percent inundation of the floodplain swamp was defined as the critical elevation. The peer reviewers asked that other studies where this percentage has been shown as acceptable for habitat protection be cited in support of this choice of critical elevation. The MFL document identified the juvenile life stage of channel catfish (*Ictalurus punctatus*) and the juvenile, spawning, and fry life stages of spotted sunfish (*Lepomis punctatus*) as critical species relative to changes in area weighted suitability. The reviewers requested that this narrative be revised to more clearly state that these were the only life stages where changes in area weighted suitability exceeded fifteen-percent and reference discussion elsewhere in the MFL report regarding the use of a 15% change threshold.

The peer reviewers asked that a summary of revisions to the Taylor Engineering HEC-RAS model be added to the MFL report. For example, showing a table for the Manning’s Equation Friction Factors ( $n$ ) that have been changed in the current model. The reviewers also noted that the HEC-RAS model calibration appears to be based on one gage (USGS Gage 02324000) and asked for a more detailed narrative as to why this flow representative of the entire river upstream of Steinhatchee Falls. The discussion of the HEC-RAS model

should also include a provide a description of the confidence in calibration per river section upstream of the falls (i.e. at the falls, springs, shoals, sink, rise, etc.). The peer reviewers also request that the HEC-RAS model be verified by running it through the FEMA cHECK-RAS program (<https://www.fema.gov/check-ras-hec-ras-validation-tool>) if this was not already done.

The role of the two priority springs in the Steinhatchee River MFL was confusing. The term “main stem” of the river was not defined in the MFL report. It was difficult to understand why the Steinhatchee River Rise was a not considered to be within the main stem of the river, but a definition of “main stem” may clarify this. There was also no explicit justification of the springs MFL determination in the MFL document. The peer reviewers note that it appears there are no unique resources in the spring pools or the Beaver Creek Spring run. Therefore, the first critical flow point reached with declining spring flow is that for salinity habitat. The springs MFL seems to have the same 11.5% reduction in flow threshold as the river because the two springs comprises a significant portion of river flow at certain times. The peer reviewers recommend a more detailed discussion of the springs MFL.

In an additional need for documentation and more detailed descriptions, the peer reviewers recommend that the description of water level data related to EFDC model boundary conditions should acknowledge non-tidal sea level shifts over the period of record. The peer reviewers conclude that the EFDC model appears to be well calibrated for the 2015-2016 period. The peer reviewers also acknowledge that model boundary conditions are an ongoing issue in models of this type.

The Gulf of Mexico boundary conditions used in the MFL report were reviewed and accepted during prior peer reviews for earlier MFLs in near-by rivers. As such, review of these conditions may be outside the scope of the current peer review. Therefore, the discussion of boundary condition issues is provided as an appendix to this report (Appendix C) and not discussed in detail in this summary.

### **3.3 Peer Review Conclusions**

The Steinhatchee River MFL peer reviewers determined that the methods used for establishing the minimum flows were scientifically reasonable. The reviewers also found that the data and information used to support the MFL determination method and the proposed minimum flows were generally appropriate. The reviewers recommend improved documentation, increased citation of method and data sources, and the addition of more detailed narratives in order to clarify perceived uncertainties or weakly supported assumptions used in the MFL development process. The peer reviewers generally believe that the perceived uncertainties and weakly supported assumptions are the result of limited documentation and narrative rather than actual deficiencies in MFL development that could material affect the conclusions of the MFL report.

The peer reviewers evaluated the technical assumptions inherent in the MFL determination methodology. The majority of assumptions appear to be clearly stated and consistent with

the best information available. Where assumptions were not clearly stated, the peer reviewers provided suggestions for report revisions to improve the narrative.

The procedures and analyses used to develop quantitative measures appeared to be generally appropriate, reasonable, and based on the best available information. As with previous findings, the peer reviewers made several requests for more source citations and more detailed explanations regarding the sources and methods used to develop certain quantitative measures.

# 4

## References Cited

- HSW. 2004. Final Report of the Scientific Peer Review Panel on the Data and Methodologies Supporting the Proposed Minimum Flow from Madison Blue Spring. Report Prepared for the Suwannee River Water Management District. HSW Florida. HSW. Tampa, Florida.
- HSW. 2006. Final Report of the Scientific Peer Review Panel on the Data and Methodologies in MFL Establishment for the Waccasassa River Estuary and Levy (Bronson) Blue Spring. Report Prepared for the Suwannee River Water Management District. HSW Florida. HSW. Tampa, Florida.
- Water and Air Research. 2015. Final Report of the Scientific Review Panel on the Data and Methodologies in MFL Establishment for the Aucilla River, the Wasisa River, and Associated Springs. Report Prepared for the Suwannee River Water Management District. Water and Air Research, Inc. Gainesville, Florida.
- Suwannee River Water Management District. 2017. Minimum Flows and Levels, Steinhatchee River, Florida. Draft Report. Suwannee River Water Management District. Live Oak, Florida.

## Appendix A – Peer Review Comment Forms

**PEER REVIEW FORM**  
**SUWANNEE RIVER WATER MANAGEMENT DISTRICT**



**Project or Report Name:** Technical Report – MFL Establishment for the Steinhatchee River

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**Name and Affiliation of Reviewer:** John Coffin

**Discipline specialty covered by this review:** Hydrology

This document is for the use of project peer reviewers retained by the Suwannee River Water Management District (District) for the purpose of providing a technical peer review of a District report, including manuscripts prepared by District staff and consultants.

**SCOPE OF REVIEW REQUIRED BY THE DISTRICT:**

**Task 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. The reviewer shall assume the following:
1. The data and information used were properly collected;
  2. Reasonable quality assurance assessments were performed on the data and information;

*Note: The reviewers are not expected to provide independent review of standard procedures used as part of institutional programs that have been established for the purpose of collecting data, such as the USGS and SRWMD hydrologic monitoring networks.*

- B. Technical Assumptions: Review the technical assumptions inherent in the methodology and determine:
1. If the assumptions are clearly stated, reasonable and consistent with the best information available; and
  2. Assumptions were eliminated to the extent possible, based on available information.

# PEER REVIEW FORM

## SUWANNEE RIVER WATER MANAGEMENT DISTRICT



**Project or Report Name:** Technical Report – MFL Establishment for the Steinhatchee River

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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;
2. The procedures and analyses incorporate appropriate factors;
3. The procedures and analyses were correctly applied;
4. Limitations and imprecision in the information were reasonably handled;
5. The procedures and analyses are repeatable;
6. Conclusions based on the procedures and analyses are supported by the data.

**Task 2. If a proposed method used in the MFL report is not scientifically reasonable, the CONTRACTOR shall:**

- A. Deficiencies: List and describe scientific deficiencies;
- B. Remedies: Determine if the identified deficiencies can be remedied and provide suggested remedies;
- C. If the identified deficiencies can be remedied, then describe the necessary corrections and, if possible provide an estimate of time and effort required to develop and implement; and
- D. If the identified deficiencies cannot be remedied, then, if possible, identify one or more alternative methods that are scientifically reasonable, based on published literature to the extent feasible.

### REVIEW CONSTRAINTS

CONTRACTOR and Peer Reviewers shall acknowledge the statutory constraints and conditions (Sections 373.042 and 373.0421, Florida Statutes) affecting the DISTRICT's development of MFLs. CONTRACTOR and Peer Reviewers shall also acknowledge that review of certain assumptions, conditions, and established legal and policy interpretations of the Governing Board (hereinafter referred to as "givens") is not included in the scope of work. These givens include:

1. The selection of waterbodies or aquifers for which minimum flow and/or levels are to be set;
2. The determination of the baseline from which "significant harm" is to be determined;
3. The definition of what constitutes "significant harm" to the water resources or ecology of the area

**PEER REVIEW FORM**  
**SUWANNEE RIVER WATER MANAGEMENT DISTRICT**



**Project or Report Name:** Technical Report – MFL Establishment for the Steinhatchee River

**Instructions:**

1. The results of this review are for the use of the District and they are not to be revealed to others without the express permission of the District.
2. By signing this form, the reviewer certifies that the peer review was conducted according to the guidelines listed above and that the opinions and recommendations included in the review constitute an independent review per Chapter 373.042(5), in the discipline noted above.
3. The reviewer also certifies that the review was conducted according to the Scope and Conditions specified above.

**Signature of Reviewer:** John E. Coffin

A handwritten signature in blue ink, appearing to read 'John E. Coffin', written over the printed name.

**Date of Peer Review:** September 12, 2017

**Responders Certification:** The comments and criticisms provided by the Peer Reviewer have been addressed as noted in column C in a separate response document, which is attached, and in the report.

**Name and Affiliation of Responder to Peer Review Comments:**

Steven J. Peene, Principal, Applied Technology and Management, Inc.

**Signature of Responder:**

A handwritten signature in blue ink, appearing to read 'S. Peene', written over the printed name.

**Date of Response:** May 21, 2018

# PEER REVIEW FORM

## SUWANNEE RIVER WATER MANAGEMENT DISTRICT



**Project or Report Name:** Technical Report – MFL Establishment for the Steinhatchee River

Comment No.	Figure, Table, or Page and Paragraph Number	Does Comment Directly and Materially Affect Conclusions of	To be completed by Reviewer(s)		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	List of Figures	No	Fig. 15 was skipped causing the descriptions for Figs. 15-33 to be in error.	Correct Figure Listing	Figure numbers corrected.
2	P1-2 Last para	No	Consider adding an apostrophe to MFLs. I find 42 occurrences in the text. Some have it and some do not. Be consistent.		Where any of the MFL references that are plural have an apostrophe, it was removed.
3	P2-21 3 <sup>rd</sup> para last sent	No	Comma not required in et al.,	Remove the comma	Text revised.
5	P2-22 Table 2-2	No	Under 1950s "Percen" on one line and the "t" is on another	Open the column to fit on one line	Table adjusted.
6	P2-25 2.2.3	No	Is a reference needed for Soils para?		The source of the soils data layer (NRCS) is provided on Figure 2-21. As such, a reference is not needed.
7	Figs 2-23, 2-24 and 2-25	No	No Legend.	Add a Legend to each figure. Blue reps annual totals for POR and red reps annual mean of 57 inches	Added a legend to each figure.

# PEER REVIEW FORM

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Comment No.	Figure, Table, or Page and Paragraph Number	Does Comment Directly and Materially Affect Conclusions of	To be completed by Reviewer(s)		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
8	Figs 2-23, 2-24 and 2-25	No	On Y-axis Inches is spelled out. Subsequent figure 2-26 and others show inches abbreviated. Inches is spelled out 6 times on p.25, 4 times on p.29	Abbreviate for consistency. Here and in text as well.	Altered the figures to be consistent and abbreviated the inches on each and put them in parentheses
9	P2-29, 1 <sup>st</sup> sent	No	The reference (Daly et al. 2008) does not conform with other references.	See page 2-10 reads, Scott et al. (2004)	Revised the references throughout the report to make them consistent with the format (AUTHOR YEAR) without a comma.
10	P2-29	No	Period-of-record spelled out here and approx 19 times throughout report.	Define acronym here as POR and change throughout report.	Text revised.
11	P2-29 3 <sup>rd</sup> line	No	Term Water Year not defined at this point.	Add USGS definition of water year as published in any of their reports.	Text revised.
12	P2-29 3 <sup>rd</sup> line	No	Text reads "WY 1951 to WY 2015". "To" indicates it stops at WY 2015.	Use "through rather than "to" indicating 2015 is included.	Text revised.
13	P2-29, 1 <sup>st</sup> para, last	No	WY2015 needs a space.	Insert space WY 2015	Text revised.

# PEER REVIEW FORM

## SUWANNEE RIVER WATER MANAGEMENT DISTRICT



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Comment No.	Figure, Table, or Page and Paragraph Number	Does Comment Directly and Materially Affect Conclusions of	To be completed by Reviewer(s)		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
14	P2-29 2 <sup>nd</sup> para, 1 <sup>st</sup> line	No	period-of-record (WY 1951 to WY 2015)	Change to "POR (WY's 1951-2015)	Text revised
15	P2-30 – 3 <sup>rd</sup> line	No	"...WY 1951 through WY 2015."	Use format " WY's 1951-2015" here and throughout report for consistency	Text revised but did not include the apostrophe because this is a plural not a possessive.
16	P2-30 – end of last sent	No	....2000-2001, 2008, and 2011.	Insert "WY's" and drop comma to read, ....WY's 2000-2001, 2008 and 2011.	Text revised but did not include the apostrophe because this is a plural not a possessive.
17	P2-32, Table 2-4	No	<p>1-There is no legend for the Figure</p> <p>2-(FDC)</p> <p>3- No Thousands separator here or in other areas of the report.</p>	<p>1-Add legend indicating what the red and blue lines represent. 2- Remove (FDC) since it is redundant. 3-Add Thousands separator throughout report for consistency.</p>	<p>Assumed this comment was directed at Figure 2-28 and Table 2-4. In response to recommendations:</p> <p>1 – a legend was added</p> <p>2 – removed FDC</p> <p>3 – put in thousands separator here and throughout report</p>

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Comment No.	Figure, Table, or Page and Paragraph Number	Does Comment Directly and Materially Affect Conclusions of	To be completed by Reviewer(s)		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
18	P2-32, Table 2-4	No	The reference to Kelly (2004) is repeated at the bottom of the page but in different format (Kelly 2004)	Change 2 <sup>nd</sup> reference to Kelly (2004) for consistency with previous references.	Text was altered so that references are consistent throughout the report
19	P2-34, Fig 2-30	No	Caption reads" ....WY1951 to 2015." Sounds like one long WY.	Change to "...WY's 1951-2015"	Text revised but did not include the apostrophe because this is a plural not a possessive.
20	P2-34, Fig 2-30	No	Y axis label "cfs/sq. mi" has not been defined in text.	For your use USGS defines runoff as: Cubic feet per square mile (CFSM) is the average number of cubic feet of water flowing per second from each square mile of area drained, assuming the runoff is distributed uniformly in time and area.	Text changed to reflect the definition provided and the figure was modified to provide the months rather than the Julian days.
21	P2-47, 2nd sent	No	A lot going on in this section. Referring to upstream station and downstream station is good but station numbers were used and not used.	Recommend inserting the station numbers in parenthesis i.e., mid-station (02324170) upper station (02324100).	Station numbers were put in parenthesis where different station locations were discussed.

# PEER REVIEW FORM

## SUWANNEE RIVER WATER MANAGEMENT DISTRICT



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Comment No.	Figure, Table, or Page and Paragraph Number	Does Comment Directly and Materially Affect Conclusions of	To be completed by Reviewer(s)		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
22	Figs 3-5 through 3-12	No	The y-axis label is in the top of left corner of all plots.	Move to the y-axis for consistency.	Figures changed to make the y-axes consistent with the label and units on the y-axis
23	Figs 3-5 through 3-8 Re graphs and	No	Would be much easier reading if the text and associated graph were on the same page.	<u>Consider</u> re-formatting to allow text and associated plot on the same page.	In each case the figures have been placed in the document immediately following the discussion in the text. The nature of the report text does not always allow figures and text to be on the same page.
24	P3-24, Fig 3-18	No	The italicized text is out of place.	Fig 3-18 is referenced on the previous page. Insert the italicized text as the second sentence and it flows. Spell out right of way.	The text was moved into the paragraph as recommended.
25	P3-34, Table 3-5	No	Two ?'s in the description of Table 3-5. The one at the end is probably meant to be a year.	Remove and correct ?'s. Here and in Table listing	The table title was corrected.
26	P3-35, 2nd para	No	"...WAR site.." not sure that abbreviation is defined anywhere.	Define acronym WAR if that is what is meant to be used.	The WAR was removed as it was not needed to define the stations in the figure.

# PEER REVIEW FORM

## SUWANNEE RIVER WATER MANAGEMENT DISTRICT



**Project or Report Name:** Technical Report – MFL Establishment for the Steinhatchee River

Comment No.	Figure, Table, or Page and Paragraph Number	Does Comment Directly and Materially Affect Conclusions of	To be completed by Reviewer(s)		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
27	P3-37, Fig 3-29	No	Fig 3-37 Explanation of data in last 2 sentences of caption belongs in text not in Figure title.	Move/incorporate last two sentences into text under Benthos on previous page. Remove explanation from List of Figures also	The text in the figure caption was moved to the appropriate location in the main text.
28	P3-40, 2nd para	No	Open parenthesis on FWC	Close parenthesis on FWC	The parentheses were closed.
29	P3-45, Table 3-8	No	Fig caption states " <u>Eleven</u> common taxa...", only 10 are listed?	Correct caption	Figure caption was changed.
30	P4-1, Last para	No	Reference is made to WRVs but the definition of the term was given back on p. 1-4.	Suggest re-stating what the WRV acronym stands for in the last sent .	Added definition into the text ahead of the acronym.
30	P4-5, last sent top of p	No	It appears " . in addition..." was added as an afterthought	This statement could be smoothed out. Maybe lead the section off with " While an important metric there are no data available to assess this WRV."	Changed the last sentence to flow better.
32	P4-6, Fig 4-1	No	Station name is incorrect. Should be Steinhatchee River near, not at, Cross City	Change caption to "Total dissolved solids versus flow from the USGS gage Steinhatchee River at Cross City	Changed the figure caption to reflect the recommendation.

# PEER REVIEW FORM

## SUWANNEE RIVER WATER MANAGEMENT DISTRICT



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				(02324000)." The remainder of the text "...between the dates of 2/12/1990, and 9/16/2009 (n=134)." belong in as a legend or in the 4.8 paragraph where the figure is discussed.	Kept the dates in the caption but put them in parenthesis.
33	P4-12, para at the top of the page.	No	"...in- or out-of-channel." Is not followed chronologically.	It should be followed by the in-channel explanation not the out-of-channel explanation.	The explanations were moved the text modified to flow smoothly.
34	P4-12,	No	Order of bullets	Change steps to the same order which methodology is discussed in following pages.	Text revised.
35	P5-1, last sent on page	No	Sentence begins with Also,	Remove Also, thus making it a statement and not an afterthought.	Text revised.

# PEER REVIEW FORM

## SUWANNEE RIVER WATER MANAGEMENT DISTRICT



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36	P5-2, 1st bullet, 2nd sent	No	"While there is a general lack of data for both WRV 1 and WRV 5, can be expected to be protected by the flows that protect WRV 2 and WRV 3." Something is missing after WRV 5, can...	Correct text	Text revised.
37	P5-5 and P5-7 last para each page	No	WY 1951 to WY 2015	Change all to WY's 1951 to 2015 for consistency throughout the report.	Have changed all of the references to multiple WYs to WYs 1951-2015. The apostrophe is not included because this is a plural not a possessive.
38	P5-8, Figures 5-2 and 5-3	No	Station name on plot incomplete	Use the full and proper station name on the plots, Steinhatchee River near Cross City (02324000)	Station Name changed on the figures per the recommendation.
39	P5-8, Figures 5-2 and 5-3	No	Y-axis labels, upper shows just (cfs) lower shows Flow (cfs).	Add Flow to upper. Add thousands separator to Y-axis here and throughout report for consistency.	Y-axis label changed per recommendation, thousands separator added also.
40	P6-18, Fig 6-12 –	No	Explanation of graph data in figure title	Delete "The red dot represents the cross-section where the critical depth was reached." from figure title	This explanation was already in the text so it was removed

# PEER REVIEW FORM

## SUWANNEE RIVER WATER MANAGEMENT DISTRICT



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				and add as legend/explanation in graph. Correct List of Figures if done.	from the figure caption. No need to put in a legend.
41	P6-18, Fig 6-13	No	Explanation of graph data in figure title	Delete "Blue line represents the 0 percent flow reduction condition; green line represents the flow reduction scenario." from figure title and add as legend/explanation in graph. Correct List of Figures if done.	A legend was put on the figure.
42	P6-19, Fig 6-14	No	Explanation of graph data in figure title	Delete "Red line represents a 15 percent change in the number of days of exceedance of the critical flow." from figure title and add as legend/explanation in graph. Correct List of Figures if done.	A legend was put on the figure.
43	P6-24, 2nd para, 2nd sent	No	WY1951-2015	Change to WY's1951-2015 throughout report for consistency.	This change was made, but the apostrophe was not included as it is a plural and not a possessive.

# PEER REVIEW FORM

## SUWANNEE RIVER WATER MANAGEMENT DISTRICT



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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
16					

**PEER REVIEW FORM**  
**SUWANNEE RIVER WATER MANAGEMENT DISTRICT**



**Project or Report Name:** Technical Report – MFL Establishment for the *\*Insert Water Body Name Here\**

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**Name and Affiliation of Reviewer:** Mehul J. Patel, P.E.

**Discipline specialty covered by this review:** Hydrodynamic Modeling

This document is for the use of project peer reviewers retained by the Suwannee River Water Management District (District) for the purpose of providing a technical peer review of a District report, including manuscripts prepared by District staff and consultants.

**SCOPE OF REVIEW REQUIRED BY THE DISTRICT:**

***Task 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. The reviewer shall assume the following:

1. The data and information used were properly collected;
2. Reasonable quality assurance assessments were performed on the data and information;

*Note: The reviewers are not expected to provide independent review of standard procedures used as part of institutional programs that have been established for the purpose of collecting data, such as the USGS and SRWMD hydrologic monitoring networks.*

B. Technical Assumptions: Review the technical assumptions inherent in the methodology and determine:

1. If the assumptions are clearly stated, reasonable and consistent with the best information available; and
2. Assumptions were eliminated to the extent possible, based on available information.

**PEER REVIEW FORM**  
**SUWANNEE RIVER WATER MANAGEMENT DISTRICT**



**Project or Report Name:** Technical Report – MFL Establishment for the *\*Insert Water Body Name Here\**

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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;
2. The procedures and analyses incorporate appropriate factors;
3. The procedures and analyses were correctly applied;
4. Limitations and imprecision in the information were reasonably handled;
5. The procedures and analyses are repeatable;
6. Conclusions based on the procedures and analyses are supported by the data.

**Task 2. If a proposed method used in the MFL report is not scientifically reasonable, the CONTRACTOR shall:**

- A. Deficiencies: List and describe scientific deficiencies;
- B. Remedies: Determine if the identified deficiencies can be remedied and provide suggested remedies;
- C. If the identified deficiencies can be remedied, then describe the necessary corrections and, if possible provide an estimate of time and effort required to develop and implement; and
- D. If the identified deficiencies cannot be remedied, then, if possible, identify one or more alternative methods that are scientifically reasonable, based on published literature to the extent feasible.

**REVIEW CONSTRAINTS**

CONTRACTOR and Peer Reviewers shall acknowledge the statutory constraints and conditions (Sections 373.042 and 373.0421, Florida Statutes) affecting the DISTRICT's development of MFLs. CONTRACTOR and Peer Reviewers shall also acknowledge that review of certain assumptions, conditions, and established legal and policy interpretations of the Governing Board (hereinafter referred to as "givens") is not included in the scope of work. These givens include:

1. The selection of waterbodies or aquifers for which minimum flow and/or levels are to be set;
2. The determination of the baseline from which "significant harm" is to be determined;
3. The definition of what constitutes "significant harm" to the water resources or ecology of the area

**PEER REVIEW FORM**  
**SUWANNEE RIVER WATER MANAGEMENT DISTRICT**



**Project or Report Name:** Technical Report – MFL Establishment for the *\*Insert Water Body Name Here\**

**Instructions:**

1. The results of this review are for the use of the District and they are not to be revealed to others without the express permission of the District.
2. By signing this form, the reviewer certifies that the peer review was conducted according to the guidelines listed above and that the opinions and recommendations included in the review constitute an independent review per Chapter 373.042(5), in the discipline noted above.
3. The reviewer also certifies that the review was conducted according to the Scope and Conditions specified above.

<b>Signature of Reviewer:</b> 	<b>Date of Peer Review:</b>
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**Responders Certification:** The comments and criticisms provided by the Peer Reviewer have been addressed as noted in column C in a separate response document, which is attached, and in the report.

<b>Name and Affiliation of Responder to Peer Review Comments:</b> Steven J. Peene, Principal, Applied Technology and Management, Inc.	
<b>Signature of Responder:</b> 	<b>Date of Response:</b> May 21, 2018

# PEER REVIEW FORM

## SUWANNEE RIVER WATER MANAGEMENT DISTRICT



**Project or Report Name:** Technical Report – MFL Establishment for the “*Insert Water Body Name Here*”

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)		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	p. 2-1, Figure 2-1	No	Clearly label the Counties, Swamp and Bay in Figure to follow description on p. 1-4.	Please update Figure.	The Counties and Mallory Swamp area are clearly marked. No need to change figure.
2	p. 2-3, Figure 2-2	No	Clearly label RM stations on figure to follow descriptions of river gages and locations.	Please update Figure.	This figure is for illustrative purposes no need to include river miles on this figure. They are provided in other figures.
3	p. 2-22, Table 2-2	No	Adjust the 4 <sup>th</sup> column in the table to bring the word “Percent” all on one line in cell.	Please update Table.	Table adjusted.
4	p. 5-1, sec. 5.0,	No	MFL states that the MFL is based on the relationships between river flow and following WRVs. But should also include	Please revise paragraph.	Paragraph revised.

# PEER REVIEW FORM

## SUWANNEE RIVER WATER MANAGEMENT DISTRICT



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	para. 2		the spring flow along with the river flow compared to the WRVs.		
5	p. 5-1, sec. 5.1	No	The bulleted list of the general approach should match the order as listed in the last paragraph of sec. 4.13, p. 4-12	Please correct the order of the bullets to match sec. 4.13.	Text revised
6	p. 6-23, sec. 6.6, para. 1	No	Sections 4.13 and 5.1 present five (5) steps in the general approach to the development of the MFL. Only three are stated summarized in this sections.	Please revise this section to include summary of the other two approach criteria.	The three steps listed in Section 6 at the beginning of the Section are not needed here as a reiteration because this section presents the MFL recommendations. The steps were removed and the only reference to the steps is consistent with

# PEER REVIEW FORM

## SUWANNEE RIVER WATER MANAGEMENT DISTRICT



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					the 5 presented in Sections 4 and 5.
7	Appendix A, p. 3-3, para. 1	No	The units used to describe the USGS underground flow criteria is ft/sec. It appears that the units should instead be in cfs, as it will better correlate to the 80% flows shown in table 3-2.	Please revise this paragraph to reflect the correct units.	Text Corrected
8	Appendix A, p. 1-2, Figure 1-1	No	Please revise the figure to include labels for reference. The current map is difficult to read. Consider increasing the size of the figure or adding an additional figure.	Please revise or add additional figures, with labels, to reflect the HEC-RAS narrative.	Figure was split into two figures to provide more detail. Roads and other identifying areas were included.
9	Appendix A	No	Please provide explicit summary of revisions to the Taylor Engineering HEC-RAS model. For example, show a table for the Manning’s Equation Friction Factors	Please add additional narrative, tables and figures, as applicable, displaying the	Additional narrative was added along with tables comparing the Manning’s n values in the Taylor

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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
			(n) that have been changed in the current model.	changes to model in Appendix A	Engineering HEC-RAS model and the Steinhatchee MFL HEC-RAS Model
10	Appendix A	No	The HEC-RAS model calibration appears to be based on one gage (USGS Gage 02324000). Is this flow representative of the entire river upstream of the falls? Please provide a description of the confidence in calibration per river section upstream of the falls (i.e. at the falls, springs, shoals, sink, rise, etc.).	Please add additional narrative describing the confidence in the calibration for each river section.	Text has been added describing the confidence in the calibration.
11	Appendix B, p. 1-2,	No	Please update the figure to include more description based on the narrative. For example, the narrative on p. 2-1 describes the project extents. It may benefit the	Please revise the figure to include more detail.	Figure revised.

# PEER REVIEW FORM

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	Figure 1-1		reader to see the extents on the figure as well as other landmarks, such as major roadways and cities, for reference. Consider using a full page so more detail can be added at a smaller scale.		
12	Appendix B, p. 2-2, sec. 2.2	No	This section describes the model grid and bathymetry. Please consider revising this section to better reflect how the model grid was established. Perhaps a step-by-step outline and figure with labels would provide the reader a more detailed approach to the analysis performed to develop the model grid.	Provide a more sequenced approach to the development of the model grid. Consider using an exhibit with labels to show which grid area the narrative is describing.	In reviewing the text on the model grid development, it was determined that for the purpose of reviewing the model and how the model was developed, the text was sufficient as it explained the data that went into the grid development. It was not deemed necessary to include an exhibit to show

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					the steps in the grid development as what matters is the final grid used in the modeling for the MFL assessment.
13	Appendix B, p. 2-3, Figure 2-1	No	Please update the figure to include more elevation labels in the elevation color legend. Please consider showing the study limits and major roadways and cities as reference points. Also, section 2.2, page 2-5, para. 1 contains reference to Figure 2-1. Please consider labeling the features described in the narrative in the figure.	Please update the figure.	Figure updated.
14	Appendix B, p. 2-4,	No	Please label the two insets shown in the figure (i.e. Inset A and B, respectively). Also, section 2.2, page 2-5, para. 1 contains	Please update the figure.	Figure updated.

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	Figure 2-2		reference to Figure 2-2. Please consider labeling the features described in the narrative in the figure.		
15	Appendix B, p. 2-5, sec 2.2, para. 2	No	This paragraph presents the bathymetric conditions for the model and it describes different sources of information used to develop the bathymetry. Please consider showing the limits of each source on Figure 2-3 so that the reader can better understand how they were combined to form the final condition used in the model.	Update narrative and Figure 2-3 to show where the different bathymetric sources are spatially located.	The text associated with the figure was revised to more clearly identify what data was used in each area. No modifications to the figure were made.
16	Appendix B, p. 2-6, Figure 2-3	No	Please label the two insets shown in the figure (i.e. Inset A and B, respectively).	Please update the figure.	The figure was updated to provide the insets.

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17	Appendix B, p. 2-8, Figure 2-4	No	The figure shows various stations along the river, however, does not label them. Please label the stations so that they can be compared to the narrative. Also, please show the project study limits and also reference points.	Please update the figure.	The labels were on the original figure. The figure has been updated to add more detail.
18	Appendix B, p. 2-9, sec. 2.4, para. 2	No	In the last sentence of section 2.4, the text refers to “graphs presented in the model calibration...” please reference the location of the graphs in the report.	Please revise the paragraph to reflect the location of the graphs.	The location of the figures (which are in Section 3.0) was input into the text.
19	Appendix B, p. 2-12,	No	The narrative describes “long-term fluctuations related to offshore mean water level variations.” Please define	Please revise the narrative to define “long-term fluctuations.”	The narrative was revised.

# PEER REVIEW FORM

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	sec. 2.4.3		these fluctuations, and also show how the corrections were applied (consider graphically).		
20	Appendix B, p. 2-13, sec. 2.4.3	No	The narrative describes four inflow points based on the basin delineations. Please show the four inflow points on a map and include the basin delineations.	Please provide figure to show the inflow points and basin delineations.	The locations of the freshwater inflows were put on Figure 2-2 and the text modified to reflect this. The inflow points do not necessarily reflect specific basin delineations so these are not shown.
21	Appendix B, p. 2-13, sec. 2.4.3,	No	Please explain or provide more detail of why the flow over the fall is multiplied by a factor of 1.3.	Please provide more detail in narrative.	Additional text was provided in the document to explain the 1.3 multiplier.

# PEER REVIEW FORM

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	para. 2				
22	Appendix B, General	No	We were not able to run the HEC-RAS model to verify inputs or boundary conditions. Was the HEC-RAS model verified by running it through the cHECK-RAS program? If not, it is recommended that the model be verified by running it through cHECK-RAS.	Please validate the HEC-RAS model by running through the cHECK-RAS program, which can be obtained at the following link. <a href="https://www.fema.gov/check-ras-hec-ras-validation-tool">https://www.fema.gov/check-ras-hec-ras-validation-tool</a>	It is assumed that this comment was referring to Appendix A which discussed the development of the HEC-RAS model. The Steinhatchee River HEC-RAS built on previously reviewed HEC models with the primary modifications being additional cross-sections included between River Stations 76472 and 69743. SRWMD staff identified these cross-sections as

# PEER REVIEW FORM

## SUWANNEE RIVER WATER MANAGEMENT DISTRICT



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					appropriate for analysis using SEFA. Manning’s “n” values were also adjusted in this area and down to US 19 during calibration to improve model performance at flows below 500 cfs when Steinhatchee River Sink is able to handle flows. Given the primary focus of the modifications was to allow model applicability at lower flows, it is felt that the use of cHECK-RAS is not appropriate as it’s use is typically incorporated into flood studies.

**PEER REVIEW FORM**  
**SUWANNEE RIVER WATER MANAGEMENT DISTRICT**



**Project or Report Name:** Technical Report – MFL Establishment for the Steinhatchee River

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**Name and Affiliation of Reviewer:** Gary M. Serviss, VHB

**Discipline specialty covered by this review:** Wildlife Habitat, Ecology, T & E Species, MFL Development

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**PEER REVIEW FORM**  
**SUWANNEE RIVER WATER MANAGEMENT DISTRICT**



**Project or Report Name:** Technical Report – MFL Establishment for the Steinhatchee River

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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;
2. The procedures and analyses incorporate appropriate factors;
3. The procedures and analyses were correctly applied;
4. Limitations and imprecision in the information were reasonably handled;
5. The procedures and analyses are repeatable;
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**REVIEW CONSTRAINTS**

CONTRACTOR and Peer Reviewers shall acknowledge the statutory constraints and conditions (Sections 373.042 and 373.0421, Florida Statutes) affecting the DISTRICT's development of MFLs. CONTRACTOR and Peer Reviewers shall also acknowledge that review of certain assumptions, conditions, and established legal and policy interpretations of the Governing Board (hereinafter referred to as "givens") is not included in the scope of work. These givens include:

1. The selection of waterbodies or aquifers for which minimum flow and/or levels are to be set;
2. The determination of the baseline from which "significant harm" is to be determined;
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**PEER REVIEW FORM**  
**SUWANNEE RIVER WATER MANAGEMENT DISTRICT**



**Project or Report Name:** Technical Report – MFL Establishment for the Steinhatchee River

**Instructions:**

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2. By signing this form, the reviewer certifies that the peer review was conducted according to the guidelines listed above and that the opinions and recommendations included in the review constitute an independent review per Chapter 373.042(5), in the discipline noted above.
3. The reviewer also certifies that the review was conducted according to the Scope and Conditions specified above.

<b>Signature of Reviewer:</b> 	<b>Date of Peer Review:</b> 10/18/17
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**Responders Certification:** The comments and criticisms provided by the Peer Reviewer have been addressed as noted in column C in a separate response document, which is attached, and in the report.

<b>Name and Affiliation of Responder to Peer Review Comments:</b> Steven J. Peene, Principal, Applied Technology and Management, Inc.	
<b>Signature of Responder:</b> 	<b>Date of Response:</b> May 21. 2018

# PEER REVIEW FORM

## SUWANNEE RIVER WATER MANAGEMENT DISTRICT



**Project or Report Name:** Technical Report – MFL Establishment for the Steinhatchee River

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)		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	Tbl 3-3 Pg i and 3-22	No	Remove sentence "Count indicates the number of sites where each occurrence was documented" from title and include at bottom of table denoted by *.	Recommendation	Recommended change made.
2	Tbl 3-5 Pg i and 3-34	No	Remove "?" in the title after "nearest" and replace ? at end with a date	Incomplete	Changed Table 3-5 caption based upon previous comment by other reviewer. Change addresses the issue.
3	Tbl 4-1, Pg 4-8 and i	No	Relocate 2 <sup>nd</sup> and 3 <sup>rd</sup> sentence from title to the bottom of the table with annotation	Recommendation	Recommended change made.
4	Tbl 4-2 pg 4-10 and i	No	Relocate 2 <sup>nd</sup> sentence from title to bottom of table with annotation	Recommendation	Recommended change made.
5	Table 6-4, Pg 6-20 and ii	No	Relocate 2 <sup>nd</sup> sentence from title to bottom of table with annotation	Recommendation	Recommended change made.

# PEER REVIEW FORM

## SUWANNEE RIVER WATER MANAGEMENT DISTRICT



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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	Fig 2-28 Pg 2-32 and iv	No	Delete "(FDC)" from end of title	Recommendation	Recommended change made.
7	Fig 2-33 Pg 2-39 and iv	No	Add "Gage" after USGS	Recommended for Clarity/consistency	Recommended change made.
8	Figs 2-34 & 2-35, Pg iv, 2-41 & 2-42	No	Add "Stations" after SRWMD	Recommended for Clarity/consistency	Recommended change made.
9	Fig 2-38 Pg iv and 2-46	No	Add "Stations" after SRWMD in 2 places	Recommended for Clarity/consistency	Recommended change made.
10	Fig 3-5 Pg v and 3-7	No	Change "DO" to "dissolved oxygen" in the title	Recommended for Clarity/consistency	Recommended change made.

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11	Figs 3-7, 3-8 Pg v, 3-9, & 3-10	No	Change "TN" to "total nitrogen" in title	Recommended for Clarity/consistency	Recommended change made.
12	Figs 3-9 & 3-10 Pg v, 3-11, & 3-12	No	Change "TP" to "total phosphorus" in title	Recommended for Clarity/consistency	Recommended change made.
13	Figs 3-12 Pg v & 3-14	No	Add "a" after chlorophyll in title	Recommended for Clarity/consistency	Recommended change made for Figure 3-12, but Figure 3-14 did not have Chlorophyll in the title.
14	Fig 3-17, 3-19, 3-31, & 3-	No	Change leader to page number to avoid page number separation	Recommendation	List of figures revised.

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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
	33 Pg v, vi, vii				
15	Fig 3-29 Pg vi & 3-37	No	Remove 2 <sup>nd</sup> surface from title and clarify in text instead	Recommendation	Recommended change made.
16	Fig 4-1 Pg vi & 4-6	No	Change title to read "between February 12, 1990 and September 16, 2009"	Recommended for Clarity/consistency	Text revised.
17	Fig 5-2 Pg vi & 5-8	No	Delete "WY" prior to 2015 in title for consistency with previous titles	Recommended for Clarity/consistency	Text revised.
18	Figs 6-12, 6-13, 6-14, Pg vii, 6-18 & 6-19	No	Revise title capitalization consistent with other titles	Recommended for Clarity/consistency	Text revised.

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## SUWANNEE RIVER WATER MANAGEMENT DISTRICT



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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
19	Fig 6-15 Pg vii & 6-20	No	Add a hyphen after "catfish" in title	Recommendation	Text revised.
20	Fig 6-16 Pg viii & 6-23	No	Delete "rivers" before reduction in title	Recommendation	Text revised.
21	Pg 1-2 par 3, 2 <sup>nd</sup> sent	No	Recommend rewording to "Factors are provided in Chapter 373.021, F.S. which...."	Recommendation for clarity	Text revised.
22	Section 1-4, Pg 1-4, 2 <sup>nd</sup> sent	No	Delete the "s" from "makes"	Correction	Text revised.
23	Section 1-5, Pg 1-4	No	Under Chapter 4.0 description, replace "each" with "the" near the end of sentence	Correction	Text revised.

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24	Pg 2-2 1 <sup>st</sup> Par, 2 <sup>nd</sup> sent	No	Revise to read "southern boundary of Taylor County, separating it from Dixie County"	Clarification	Text revised.
25	Pg 2-21 1 <sup>st</sup> par, last sent	No	Change "present times" to "2010" for accuracy.	Clarification	Text revised.
26	Pg 2-21 last par, 2 <sup>nd</sup> sent	No	Recommended rewording of sentence for clarity "..restoring these pine plantation areas to their natural state prior to conversion."	Clarification	Text revised.
27	Fig 2-19 pg 2-23	No	It is difficult to discern the 1950 and 2010 acreages from each other. Please consider changing one to a different color for more contrast.	Recommendation	The colors defined for each land use type (where the align) were chosen to allow intercomparison. Changing one color versus another would not allow that. As such no changes made. Figure revised to

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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
					provide different colors for the two years.
28	Pg 2-25 1 <sup>st</sup> par, 3 <sup>rd</sup> sent	No	Previous sections discuss data in the present tense. As such, "made" should be changed to "make".	Consistency	Text revised.
29	Pg 2-12 last par, 1 <sup>st</sup> sent	No	Add "River" behind Steinhatchee for consistency.	Consistency	Text revised.
30	Figs 2-19, 2-20 Tbl 2-3 Pg i, iii, 2-23 to 2-25	No	Capitalize "Basin" in the titles for consistency with the text.	Consistency	Text revised.
31	Pg 2-25 2 <sup>nd</sup> par	No	Capitalize "Basin" in the titles for consistency with the text.	Consistency	Text revised.

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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
32	Pg 2-29 1 <sup>st</sup> par  Throug hout Doc.	No	Be consistent with the spacing between WY and the year. Use one space on none throughout the document	Consistency	Text revised.
33	Pg 2-30 1 <sup>st</sup> par, 3 <sup>rd</sup> sent	Yes	This paragraph states that much of the river flow is provided by surface water with baseflow being provided by springs and seeps, yet there are no studies cited or data analyzed to support these statements. Previous studies or analyses should be used to support these conclusions.	Cite studies, or reports that support these conclusions	A citation has been provided
34	Fig 2-30 Pg iv, 2- 34	No	Change title to read "WY <sub>s</sub> " instead of WY	Consistency	Text revised.
35	Pg 2-24 last par 2 <sup>nd</sup> to	No	Please clarify what is meant by the description of permit locations "by section". Also add "River" after Steinhatchee.	Clarification	The figure does not present the permits by section so that phrasing was removed.

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	last sent				
36	Pg 3-4 1 <sup>st</sup> par	No	Be consistent in use of hyphens for period-of-record. Check document	Consistency	Text revised.
37	Pg 3-4 2 <sup>nd</sup> par	No	Be consistent in description of the station identification. The initial discussion refers to their location, but not ID number, whereas the latter discussion uses ID numbers and not location	Clarity	Text revised.
38	Pg 3-5 2 <sup>nd</sup> sent	No	Add "values" after (90 <sup>th</sup> percentile) for clarity	Clarity	Text revised.
39	Pg 3-8 3 <sup>rd</sup> sent	No	Please add a citation or two to support the TN concentration variance moving downstream in tidal rivers. This will reduce potential questions	Strengthens results	Text revised.
40	Pg 3-10 5 <sup>th</sup> sent	No	Please include a definition and/or reference citation for the "Peninsula benchmark streams"	Clarity	Text revised.

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41	Pg 3-12 3 <sup>rd</sup> sent	No	Please add the calculated mean for the most upstream station inside the brackets. Also need a closed bracket after "(NTUs)".	Consistency	Text revised.
42	Pg 3-13 2 <sup>nd</sup> sent	No	Be consistent with italics for "a" in Chlorophyll a and Chl a. Check rest of document	Consistency	Text revised.
43	Pg 3-13 4 <sup>th</sup> sent	No	Capitalize "station" before identification number	Consistency	Text revised.
44	Fig 3-14	No	Please label at least the two WBIDs mentioned as impaired for fecal coliform (pg 3-16).	Clarity	Text revised.
45	Pg 3-18 2 <sup>nd</sup> par, 3 <sup>rd</sup> blt	No	Add "Classification System" after "Cover"	Completeness	Text was modified
46	Pg 3-22 1 <sup>st</sup> par, 1 <sup>st</sup> sent	No	Musclewood was the second most observed species in Table 3-3, yet is not included in the list of dominant canopy species. Should it be or did not reach the canopy?	Accuracy	Text revised.

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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
47	Pg 3-32 Par 3, last sent	No	Suggest rewording the portions of sentence discussions common species for clarity.	Clarity	Text revised.
48	Tbl 3-5 Pg 3-34	No	Delete scallops and add the next most abundant species. Scallops are not fish.	Accuracy	Text revised.
49	Sec 3.3.3	Yes	Why is there no discussion of freshwater fishes. Freshwater fish would be expected through a fair stretch of the river and could be negatively impacted by reduced flow. They are also discussed in later chapters	Incomplete discussion	Text revised.
50	Pg 3-35 1 <sup>st</sup> par, 1 <sup>st</sup> sent	No	Delete or replace "significant" in this sentence as it usually implies a statistical significance in these types of documents.	Recommendation	Text revised.

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51	Fig 3-15 Pg v and text	No	This figure number was skipped in the List of Figures and all subsequent Figures are off from the text in this Table.	Accuracy	Figure numbers corrected.
52	Fig 3-28 Pg vi & 3-36	No	After "salinity" add "and benthic macroinvertebrate" in title. This figure was referenced relative to the benthos, so title change is more appropriate.	Accuracy	Text revised.
53	Pg 3-35 2nd par	Yes	<p>This paragraph should be rewritten as it is difficult to follow and confusing. Specific areas to clarity/correct.</p> <ul style="list-style-type: none"> <li>• Were macroinvertebrates collected during all salinity sampling events. Define better.</li> <li>• Change "WAR site" to sampling site</li> <li>• Remove __ from period after "September 2016".</li> <li>• Change "largest sample" to densest or sample with the most individuals, because largest could also imply the volume of sediment sampled.</li> <li>• Correct spelling of "predominately"</li> </ul>	Clarify	Text revised.

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			<ul style="list-style-type: none"> <li>Any idea what the other factors were that affected species richness at STN336 and STN085? Was there any sediment detected (rock, mud) or DO information that could explain?</li> </ul>		
54	Pg 3-38 4 <sup>th</sup> sent	No	Rhodes misspelled in sentence	Correction	Text revised.
55	General	No	Citations reference in text are inconsistent when there are three or more authors. The capititation often leaves off the et al for multiple authors	Consistency	Text revised.
56	Pg 3-44 1 <sup>st</sup> par, 2 <sup>nd</sup> sent	No	Abundance should be defined as the "total number of <u>individuals</u> of a species in a sample"	Correction	Text revised.
57	Pg 4-3 4 <sup>th</sup> par 1 <sup>st</sup> sent	No	The State recently delisted some wading bird species. The number of listed birds and wading birds should be updated and the most recent FWC reference in 2017 should be included.	Accuracy	Text revised.
58	Pg 4-4 last sent	Yes	There are no data or citations provided in this document to support the statement that the transfer of detrital material is "less important" for the river than the preceding WRVs. Use other	Statement is important so it needs to be supported	The sentence was removed that stated this is a less important WRV. The statement in the text that

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			MFL's or data from similar systems to support, soften this conclusion, or just site lack of data to analyze.		followed did identify that insufficient data were available to address this WRV. This sentence was added to.
59	Fig 2-36 Pg 2-44	No	The dashed line for the bottom should be made red in the legend for the middle graph	Clarity	Figure changed per recommendation
60	Fig 3-27 Pg 3-34	No	The center photo is a spottail pinfish, not the pigfish it references. Please change at photo with the appropriate species	Accuracy	Figure revised.
61	Pg 5-2 1 <sup>st</sup> Par 3rd sent	No	Something is missing after the comma	Clarity	Text modified.
62	Pg 5-13 2 <sup>nd</sup> par	No	Please include a citation/reference substantiating the 0.8-ft depth as the fish passage criterion.	Support of criterion	Text revised.
63	Pg 5-14 2 <sup>nd</sup> par	Yes	Please clarify why this particular 0.6 mile stretch of the river was analyzed by SEFA and not other stretches. Describe why it is representative of the remainder of the river. How does this one short	Need justification that the sampling was sufficient and the results accurately protect the	The SEFA work was conducted by the District. As such, the locations and their

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## SUWANNEE RIVER WATER MANAGEMENT DISTRICT



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			stretch and its 14 transects accurately characterize the freshwater reach of the river?	remainder of the freshwater section of the river	representative nature were also defined by the District.
64	Pg 5-19 1 <sup>st</sup> par	Yes	Why was 50% inundation of the floodplain swamp defined as the critical elevation versus another percent inundation? Note other studies where this percentage has been shown as acceptable for habitat protection.	Need to defend basis for this elevation for results to be meaningful.	In looking at flood plain inundation, it is important to define a representative percent of flooding. As 50% represents a median condition of the range of potential flooding, i.e., 0 to 100 percent, it was chosen.
65	Pg 6-7 last par and pg 6-8	No	The term significant is used in several places to discuss the change from the baseline condition. The term "significant" usually implies a statistical significance in these types of documents. If that is the case, please make it clearer, if it is more of a qualitative description then another term (e.g., substantial) would be less likely to be misinterpreted.	Recommendation	Text revised.
66	Pg 6-20 Table 6-4	Yes	Why were only 4 of the species/life stages chosen for analysis out of the 40 referenced on page 5-15? Why were only these deemed critical?	Support needed to justify the use of this limited data set.	The species/life changes were defined by the District who performed the evaluation.

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67	Fig 6-5 Pg 6-7	No	It is very difficult to discern the difference in the present reduction lines in this figure. It would be good to investigate other color or line styles to make it more legible.	Recommendation	The point of the figure is that there is little difference between the results for this salinity range over the full flow range of the CFD. Altering the colors or line styles would not change that. No change made to the figure.

**PEER REVIEW FORM**  
**SUWANNEE RIVER WATER MANAGEMENT DISTRICT**



**Project or Report Name:** Technical Report – MFL Establishment for the Steinhatchee River

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**Name and Affiliation of Reviewer:** Robert D. Woithe, VHB

**Discipline specialty covered by this review:** Water Quality, Estuaries, Seagrass, Riverine Habitat, MFLs

This document is for the use of project peer reviewers retained by the Suwannee River Water Management District (District) for the purpose of providing a technical peer review of a District report, including manuscripts prepared by District staff and consultants.

**SCOPE OF REVIEW REQUIRED BY THE DISTRICT:**

**Task 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. The reviewer shall assume the following:

1. The data and information used were properly collected;
2. Reasonable quality assurance assessments were performed on the data and information;

*Note: The reviewers are not expected to provide independent review of standard procedures used as part of institutional programs that have been established for the purpose of collecting data, such as the USGS and SRWMD hydrologic monitoring networks.*

B. Technical Assumptions: Review the technical assumptions inherent in the methodology and determine:

1. If the assumptions are clearly stated, reasonable and consistent with the best information available; and
2. Assumptions were eliminated to the extent possible, based on available information.

**PEER REVIEW FORM**  
**SUWANNEE RIVER WATER MANAGEMENT DISTRICT**



**Project or Report Name:** Technical Report – MFL Establishment for the Steinhatchee River

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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;
2. The procedures and analyses incorporate appropriate factors;
3. The procedures and analyses were correctly applied;
4. Limitations and imprecision in the information were reasonably handled;
5. The procedures and analyses are repeatable;
6. Conclusions based on the procedures and analyses are supported by the data.

**Task 2. If a proposed method used in the MFL report is not scientifically reasonable, the CONTRACTOR shall:**

- A. Deficiencies: List and describe scientific deficiencies;
- B. Remedies: Determine if the identified deficiencies can be remedied and provide suggested remedies;
- C. If the identified deficiencies can be remedied, then describe the necessary corrections and, if possible provide an estimate of time and effort required to develop and implement; and
- D. If the identified deficiencies cannot be remedied, then, if possible, identify one or more alternative methods that are scientifically reasonable, based on published literature to the extent feasible.

**REVIEW CONSTRAINTS**

CONTRACTOR and Peer Reviewers shall acknowledge the statutory constraints and conditions (Sections 373.042 and 373.0421, Florida Statutes) affecting the DISTRICT's development of MFLs. CONTRACTOR and Peer Reviewers shall also acknowledge that review of certain assumptions, conditions, and established legal and policy interpretations of the Governing Board (hereinafter referred to as "givens") is not included in the scope of work. These givens include:

1. The selection of waterbodies or aquifers for which minimum flow and/or levels are to be set;
2. The determination of the baseline from which "significant harm" is to be determined;
3. The definition of what constitutes "significant harm" to the water resources or ecology of the area

**PEER REVIEW FORM**  
**SUWANNEE RIVER WATER MANAGEMENT DISTRICT**

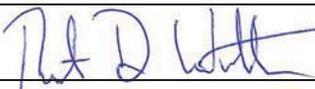


**Project or Report Name:** Technical Report – MFL Establishment for the Steinhatchee River

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**Instructions:**

1. The results of this review are for the use of the District and they are not to be revealed to others without the express permission of the District.
2. By signing this form, the reviewer certifies that the peer review was conducted according to the guidelines listed above and that the opinions and recommendations included in the review constitute an independent review per Chapter 373.042(5), in the discipline noted above.
3. The reviewer also certifies that the review was conducted according to the Scope and Conditions specified above.

<b>Signature of Reviewer:</b> 	<b>Date of Peer Review:</b> October 26, 2017
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**Responders Certification:** The comments and criticisms provided by the Peer Reviewer have been addressed as noted in column C in a separate response document, which is attached, and in the report.

<b>Name and Affiliation of Responder to Peer Review Comments:</b> Steven J. Peene, Principal, Applied Technology and Management, Inc.	
<b>Signature of Responder:</b> 	<b>Date of Response:</b> May 21, 2018

# PEER REVIEW FORM

## SUWANNEE RIVER WATER MANAGEMENT DISTRICT



**Project or Report Name:** Technical Report – MFL Establishment for the Steinhatchee River

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1	Page 2-2 Paragraph 2	No	River locations are described in terms of "River Miles" but a map of river miles does not appear until Chapter 3	Add river miles to one of the river maps in Chapter 2 and add reference that Figure in this paragraph	A new Figure 2-2 has been added showing the river miles.
2	Page 2-10 Paragraph 2	No	Define the term "priority springs" and explain why these two springs are included on the District's priority list for the establishment of MFLs relative to the requirements of F.S. 373.042 (2)	Define the term "priority springs" and explain why these two springs are on the District's MFL priority list	The District provided ATM the list of priority springs and these springs were included on the list.
3	Page 2-10, last paragraph	No	It appears that the MFL for Steinhatchee River Rise was chosen to protect Steinhatchee River main stem flow. If so, a discussion of River Rise spring discharge as a percentage of	Add discussion of the magnitude of discharge from Steinhatchee River Rise relative to Steinhatchee River main stem flow	Text has been added that discusses the magnitude of discharge from Steinhatchee River Rise to Steinhatchee River main stem flow

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			mainstem river flow at this location and at Steinhatchee Falls is appropriate		
4	Page 2-14, paragraph 1	No	It appears that the MFL for Beaver Creek Springs was chosen to protect the volume of spring discharge to the Steinhatchee River main stem. If so, a discussion of spring discharge as a percentage of mainstem river flow is appropriate	Add discussion of the magnitude of discharge from Beaver Creek Spring relative to Steinhatchee River main stem flow	Text has been added that discusses the magnitude of discharge from Beaver Creek Spring to Steinhatchee River main stem flow
5	Figures 3-3, 3-4, 3-5, 3-6, 3-7	No	This is a purely editorial comment. Each of these figures is on a page with text that discusses a different water quality parameter. This results in unnecessary difficulty when	Group figure and corresponding text narrative on one page	This is difficult to do as each description is of its own length and doesn't always line up to a single page. We put each figure immediately after the text which should allow the

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			reading a single-sided paper or an electronic document.		reader to go to it from the text.
6	Page3-32	No	There is no text describing freshwater fish. I suspect this is because there are no available studies of freshwater fish communities for the Steinhatchee River.	Add sentence stating there are no available studies of freshwater fish communities for the Steinhatchee River if this is the case	Text revised.
7	Page 4-7 Section 4.10		There is a Federal ship channel in the mouth of the river and the size of commercial vessels using it cannot be assumed. The overall statement is correct however, as the minimum water depth in the Federal channel a is controlled by	Suggest rewording to "While navigation in the upper river is directly impacted by changes in flow, navigation is not a relevant WRV for the Steinhatchee River because minimum water depth in the	Recommended change made.

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			tide stage in the Gulf of Mexico, not river flow.	Federal ship channel is controlled by tide stage not river flow. Small boat traffic and commercial guide operations upstream of the Federal channel will be protected under WRV 1 (Recreation In and On the Water)."	
8	5-5, paragraph 3		The term "main stem" of the river is not defined in the report. It is difficult to understand why the Steinhatchee River Rise is a not considered to be within the main stem of the river. The definition of "main stem" should clarify this	Define "main stem of the river"	This section, and the reference to the main stem of the river is related to the hydrodynamic model grid. The grid does not extend beyond Steinhatchee Falls as there is no tidal influence beyond the falls. As the rise is above the falls, not

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					sure of its significance here. The main stem reference is related to the creation of storage areas along the grid, which extends up the main stem of the river.
9	Page 5-15 Table 5-2	No	Several freshwater fish species are used in this MFL analyses determination. It appears there are no available studies of Steinhatchee River freshwater fish communities and that species were chosen based on communities in similar rivers assessed in earlier MFLs. See comment 5 above.	Add sentence stating there are no available studies of freshwater fish communities for the Steinhatchee River and cite the MFLs used to determine the freshwater fish analyzed in this MFL.	Text revised.

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10	Pages 5-11, 5-17, 6-22, 6-25	No	Statements that wetted perimeter analyses were performed, but they were not utilized in the definition of the MFL are made several times (pages 5-11, 5-17, 6-22, and 6-25) prior to the explanation as to why wetted perimeter data were not used (page 6-25).	Either add text in earlier references referring to explanation (on Page 6-25). State that the wetted perimeter concept is not appropriate to the Steinhatchee River (see Section 6.6.1) in chapter 5 statements.	The explanation provided in Section 6 was moved up to Section 5 where wetted perimeter first brought up.
11	6-15, paragraph 3	No	Can this withdrawal schedule be applied to direct surface water withdrawals or can it only be applied to indirect river withdrawals via groundwater withdrawals? If it can be applied to surface water withdrawals paragraph 2 (page 6-15) should be corrected	Add sentence clarifying that these withdrawals are indirect river withdrawals resulting from ground water withdrawals or revise paragraph 2 (page-15) to discuss why a low flow cutoff is not being considered	The withdrawals presented in the MFL document are irrespective of how water is taken out. Low flow cutoff is not needed when withdrawal is predominantly groundwater withdrawals, only for surface water withdrawal. But since the

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					predominant water use in Steinhatchee is groundwater withdrawals, a low flow cutoff is not needed.
12	Figure 6-18	No	This important figure is hard to interpret. Suggest shading areas of the figure that correspond to each of the 3 flow ranges (see attached example)	Shade areas of the figure that correspond to each of the 3 flow ranges	The figure as presented is felt to be clear for its use. No changes were made.
13	Page 6-28, Section 6.6.2	No	No justification of the springs MFL determination is provided in this discussion. It appears that discharge from these two springs comprises a significant portion of river flow and the springs MFL was chosen to prevent main stem river	Provide justification for the determination of the springs MFLs	The rise, which comprises the bulk of the flow during low flow periods, is integral to the river flow (the MFL applies to the river), therefore, the MFL developed applies to the predominant spring. As in

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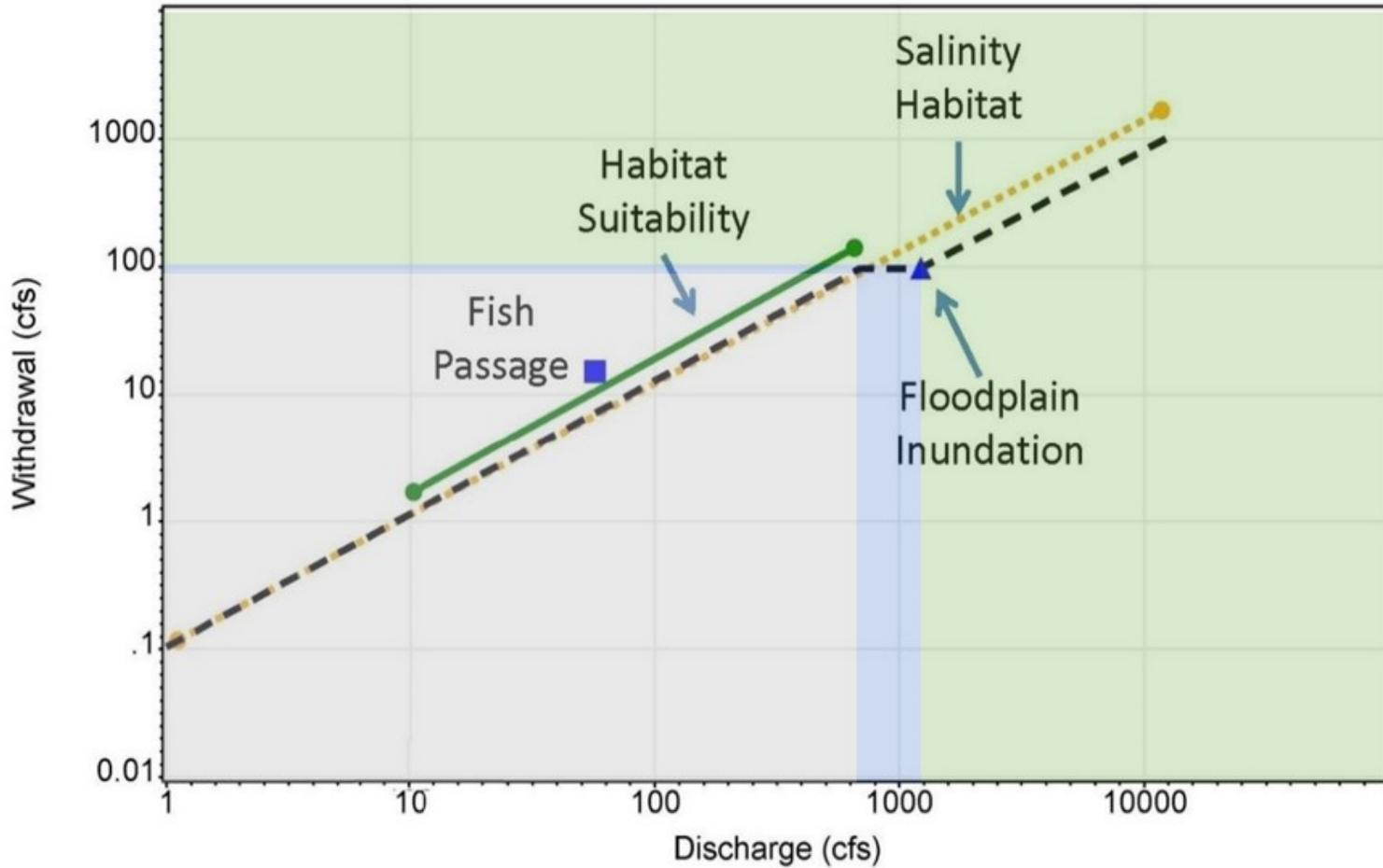
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			flow decreases of 11% or greater. If so, state this.		many other instances for similar MFLs, the same percent reduction applied to the river is applied to the spring. Data for Beaver Springs are very limited.

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Suggested revisions to Figure 6-18 discussed in Comment 12 (colors may vary)

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**Name and Affiliation of Reviewer:** Gary A. Zarillo, Ph.D. Florida Institute of Technology

**Discipline specialty covered by this review:** Geology and Physical Oceanography

This document is for the use of project peer reviewers retained by the Suwannee River Water Management District (District) for the purpose of providing a technical peer review of a District report, including manuscripts prepared by District staff and consultants.

**SCOPE OF REVIEW REQUIRED BY THE DISTRICT:**

**Task 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. The reviewer shall assume the following:

1. The data and information used were properly collected;
2. Reasonable quality assurance assessments were performed on the data and information;

*Note: The reviewers are not expected to provide independent review of standard procedures used as part of institutional programs that have been established for the purpose of collecting data, such as the USGS and SRWMD hydrologic monitoring networks.*

B. Technical Assumptions: Review the technical assumptions inherent in the methodology and determine:

1. If the assumptions are clearly stated, reasonable and consistent with the best information available; and
2. Assumptions were eliminated to the extent possible, based on available information.

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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;
2. The procedures and analyses incorporate appropriate factors;
3. The procedures and analyses were correctly applied;
4. Limitations and imprecision in the information were reasonably handled;
5. The procedures and analyses are repeatable;
6. Conclusions based on the procedures and analyses are supported by the data.

**Task 2. If a proposed method used in the MFL report is not scientifically reasonable, the CONTRACTOR shall:**

- A. Deficiencies: List and describe scientific deficiencies;
- B. Remedies: Determine if the identified deficiencies can be remedied and provide suggested remedies;
- C. If the identified deficiencies can be remedied, then describe the necessary corrections and, if possible provide an estimate of time and effort required to develop and implement; and
- D. If the identified deficiencies cannot be remedied, then, if possible, identify one or more alternative methods that are scientifically reasonable, based on published literature to the extent feasible.

### REVIEW CONSTRAINTS

CONTRACTOR and Peer Reviewers shall acknowledge the statutory constraints and conditions (Sections 373.042 and 373.0421, Florida Statutes) affecting the DISTRICT's development of MFLs. CONTRACTOR and Peer Reviewers shall also acknowledge that review of certain assumptions, conditions, and established legal and policy interpretations of the Governing Board (hereinafter referred to as "givens") is not included in the scope of work. These givens include:

1. The selection of waterbodies or aquifers for which minimum flow and/or levels are to be set;
2. The determination of the baseline from which "significant harm" is to be determined;
3. The definition of what constitutes "significant harm" to the water resources or ecology of the area

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**Instructions:**

1. The results of this review are for the use of the District and they are not to be revealed to others without the express permission of the District.
2. By signing this form, the reviewer certifies that the peer review was conducted according to the guidelines listed above and that the opinions and recommendations included in the review constitute an independent review per Chapter 373.042(5), in the discipline noted above.
3. The reviewer also certifies that the review was conducted according to the Scope and Conditions specified above.

<b>Signature of Reviewer:</b> <i>Gary A. Zarillo</i>	<b>Date of Peer Review:</b> December 30, 2017
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**Responders Certification:** The comments and criticisms provided by the Peer Reviewer have been addressed as noted in column C in a separate response document, which is attached, and in the report.

<b>Name and Affiliation of Responder to Peer Review Comments:</b> Steven J. Peene, Principal, Applied Technology and Management, Inc.	
<b>Signature of Responder:</b> 	May 21, 2018

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1	2.1.1	No	It would be useful to add a portion of the FGS geologic map of Florida for this area and include a legend showing the major units in vertical succession. This would support the explanation of the hydrogeology and geomorphology of the Steinhatchee basin	Go to FGS web site and acquire the GIS coverage of the Florida geologic map and legends.	It was deemed that the present figures in the report are sufficient to represent the geology as needed for the MFL document and reflects what has been presented in previous MFL documents. No figure was added.
2	2.1	No	Can the land use coverage be updates to 2016 or 2017? Seven years is a large gap.	Update land use using a recent aerial image set	The best available information for land use cover was the 2010 coverage. This was used.
3	2.2.3	No	Provide an explanation of the soil types listed in Table 2-3 and expand on the discussion of their significance in the Basins	Provide definition and characteristics of soils from NRCS and USDA	Definitions characteristics of the soil types has been added to the text.

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4	Fig. 2-31	No	Important to verify that the data on water use permits is current.	State the date of water use permit data mentioned in the report	The data on the water use permits was the most current at the time of the report and as provided by the District.
5	2.4.1	Yes	Description of water level data in this section and model boundary conditions in Section 5.2 should acknowledge non-tidal sea level shifts over the period of record. See my later discussion. Non-tidal sea level shifts can be more than 2 feet over a 7-day time period and there was a trend of sea level drop of about 1-foot over the period of data record. See later discussion of model application after calibration using measured	See later discussion. Calibration of EFDC looks good for 2015-2015 period but do not apply for 1995-1999 production runs to establish MFL. Possible remedy would be to check calibration of GCSM, which was used for offshore boundary conditions.	The 1995-1999 run is for the purpose of examining the relative change in salinity under varying freshwater inflow conditions. While it is recognized that non-tidal fluctuations exist in the Gulf, as long as the tidal conditions in general (range, phasing) are reasonable, the relative change analysis would be reasonable. While it would be best if actual fluctuations in tides in the offshore for that period were available, the best available

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			sea level and model production runs that apparently applied only water level based on tidal constituents. Could be an issue that propagates through the final MFL analysis		data were the GCSM simulations so these were used.
6	3.3.2 Paragraph 2	No	Second paragraph a bit unclear. Who completed the 2006 GIS coverage of seagrasses. Paragraph states that annual monitoring is conducted. Were annual monitoring results included to update the 2006 seagrass map?	More specifics on the content of Figure 2-6. How were does the figure represent present seagrass coverage	Text revised.
7	Table 3-5	No	Why the question marks in the title of Table 3-5	Date the period of time represented in the fish counts listed in table 3-5	The text was modified based upon previous reviewers' comments.

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8	5.2.1 EFDC model	possibly	Among the air-sea boundary conditions Evapotranspiration is missing. This could be an important term for calibration as well as production runs.	Finding adequate boundary conditions is always an issue. If no ET data or predictions are available test the model sensitivity to the ET term	Evaporation is not a key item in this type of system and was not deemed necessary to achieve model calibration and do the relative change analyses for salinity. The calibration results bear this out.
9	Appendix B Hydro model development Fig 2-2	Probably not	Interesting application of storage areas to adjust the tidal prism for calibration. Assumed to be an alternative to actually including all of tidally influenced watershed in the model grid?	Provide references for use of storage areas in other EFDC applications	Storage areas are frequently used in hydrodynamic model development where there is tidal flooding and drying. Specific ones include St. Johns River modeling by SJRWMD, Charleston Harbor and others.
10	Appendix B Hydro model	Probably not but needs	Model validation usually requires model calibration followed by a verification	Divide model comparisons with data into calibration and verification time periods	For hydrodynamic models due to the inherent repeatability of the results, calibrating to a data set

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	development  Section 3 Model calibration	improvements	comparison with measured data without further adjustments		of sufficient time frame is sufficient, no break apart of the data was deemed necessary.
11	Appendix B Hydro model development Section 3 Model calibration	possibly	The EFDC model is well calibration with respect to most industry standards with the possible exception of salinity. Whereas model calculated salinity compares well with measured data, is the comparison good enough for the purpose at hand, which is to apply a salinity threshold for the MFL analysis for estuarine resources (WRV-3)?	Possibly adding an ET time series to the atmospheric input file aser.inp for both the model calibration period and model production ruins would improve the model salinity comparison with data	The model is sufficient for doing the relative change analyses used in the MFL. The model captures the key aspects of stratification/destratification. When you have situations where there are sharp density gradients, such as are seen on the Steinhatchee, calibration is difficult when comparing to continuous bottom and surface data. The metrics presented are within industry standards and

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					the model captures the key dynamics, therefore it was determined the model was sufficient for the MFL evaluation purposes.
12	5.2.1 EFDC Model and Sections 6.0/6.1/6.1.3	Yes	The EFDC model seems to be well calibrated compared to 2015-2016 measured data. However, offshore model boundary conditions for the 1995-1999 model runs for the final MFL analysis depend on data from another model, the Gulf Coast Shelf Model (GCSM). Further, GCSM is also dependent, in part, on model boundary conditions for salinity and temperature	<b>See the attached discussion on this issue in Appendix C.</b> But generally, establishing model boundary conditions for hindcasting or forecasting in the coastal ocean and estuarine environment is problematic. In terms of using GCSM predicted water level, salinity, and temperature data at the outer boundary of the EFDC model could be	The 1995-1999 run is for the purpose of examining the relative change in salinity under varying freshwater inflow conditions. While it is recognized that non-tidal fluctuations exist in the Gulf, as long as the tidal conditions in general (range, phasing) are reasonable, the relative change analysis would be reasonable. While it would be best if actual fluctuations in tides in the offshore for that period were available, the best available

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			from the Navy Coastal Ocean Model (NCOM) This directly conflicts with the calibration of EFDC, which is dependent on measured water level, salinity and temperature	justified by demonstrating the calibration of GCSM against using the 2015-16 measured data at Station SRWMD 02324190, which should be within the GCSM model grid	data were the GCSM simulations so these were used.

## Appendix B - Resumes of the Peer Review Team

## Robert D. Woithe, PhD

Senior Scientist



### Education

PhD, Environmental Engineering Science & Systems Ecology, University of Florida, 1994

MS, Environmental Engineering Science & Systems Ecology, University of Florida, 1992

BA, Biology, Middlebury College, 1988

Graduate Certificate in Wetlands, University of Florida, 1992

### Registrations/ Certifications

Certified Senior Ecologist (The Ecological Society of America), 1996

Professional Wetland Scientist, 1998

### Affiliations/ Memberships

Ecological Society of America  
Society of Wetland Scientists  
Florida Association of Environmental Professionals

### Government Advisory Panel Membership

Gulf Coast Ecosystem Restoration Council: Independent Science Reviewer

Gulf of Mexico Fisheries Management Council Advisory Panel

FEMA Risk Index – Data Analysis Working Group

Robert Woithe, Ph.D., has extensive experience in large environmental project-management, coastal ecology, and natural resource monitoring, and habitat restoration and assessment. For nearly 20 years, Dr. Woithe's focus has been monitoring and assessment programs to determine status and trends in southeastern U.S. marine, aquatic, and terrestrial ecosystems with particular emphasis on water quality and habitat. He has been lead scientist and project manager for some of the largest, non-governmental, long-term monitoring programs in the Gulf which collected, process, and analyze several million measurements a year.

Dr. Woithe is a senior environmental scientist and VHB's Tampa environmental consulting lead managing contracts with state agencies, counties, cities, and public utilities. Bob has extensive experience from Florida to Texas in the design and implementation of environmental monitoring studies, environmental permitting, mitigation, habitat and wetland restoration projects, and public coordination for public, private, and non-profit clients. He has also managed the North American Headquarters office of an international engineering firm where he was responsible for business development, field and health and safety protocols, corporate branding, community/ political engagement, employee welfare, and facilities issues. Dr. Woithe has been a member of corporate scuba diving control boards, the U.S. Gulf of Mexico Fisheries Management Council Data Collection Advisory Panel and Coastal Migratory Pelagics Advisory Panel, the National Marine Fisheries Service SEDAR 49 panel, the FEMA Risk Index Data Analysis Working Group, the Manatee Chamber of Commerce Natural Resources Committee, and a Gulf Coast Ecosystem Restoration Council Independent Science Reviewer.

### *25 years of professional experience*

**Tampa Bay Water, Hydrobiological Monitoring Program for the Alafia, Palm, and Hillsborough Rivers, Hillsborough County.** As a principal investigator for this \$17 million, 20-year, water quality, hydrologic, and biological monitoring effort to determine effect of fresh water withdrawals on the Tampa Bay estuary, Dr. Woithe has overseen efforts to successfully verify that Tampa Bay Water operations result in very small, environmentally insignificant changes in estuarine resources. This project collected most of the field data used in determining MFLs for the Lower Alafia River, the Lower Hillsborough River, the Palm River/Tampa Bypass Canal, and Sulphur Springs. Dr. Woithe oversees hydrologic, water chemistry, benthic, fish, plankton, wildlife, and vegetation sampling and monitoring efforts as well as data interpretation, review, statistical analysis, and management, quality assurance and control, and subcontractors in this ongoing project.

**Tampa Bay Desalination Facility Hydrobiological Monitoring Program, Hillsborough County, Florida.** As principal investigator for the \$4.5 million, 18-year, water quality and biological monitoring effort, Dr. Woithe has overseen extensive estuarine monitoring for the largest seawater desalination facility in the U.S. since the plant's construction. The project includes water chemistry, hydrologic, benthic invertebrate, fish, and seagrass, sampling and/or monitoring efforts, data interpretation, review, analysis, and management, as well as quality assurance and control reviews. This project generated significant publicity. The project has found no impact as a result of facility operation and has been able to communicate this result in forms that can be conveyed to media outlets and the general public.

**Peace River/Manasota Regional Water Supply Authority, Hydrobiological Monitoring Program Continuous Recorders Program, Desoto County, Florida.** Project manager and

lead scientist for ongoing continuous, water quality monitoring in the Peace River for water use permit compliance. This monitoring element was implemented in 2006 at the recommendation of a scientific review panel and the Southwest Florida Water Management District to improve accuracy of existing statistical models by improving the data used by the models. The project collects continuous, salinity, temperature, dissolved oxygen, and water level data at eight continuous recorder stations in support of models used to predict salinity change due to current and future river water pumping by the Peace River Facility.

**Peace River/Manasota Regional Water Supply Authority, Chlorophyll Transect Monitoring, Desoto County, Florida.** Project manager and lead scientist for spatially-continuous, fluorometric measurements of chlorophyll over 25 kilometers of the lower Peace River. This ongoing project, implemented in 2013, uses field and laboratory measurements coupled with stepwise linear regression to determine the magnitude of both temporal and spatial variability of peak zones of high productivity in the lower river/upper harbor system. Determination of the seasonal influence of changes in river flow is then used to assess any potential influence of Authority withdrawals under the current Facility withdrawal schedule established pursuant to current MFL criteria.

**Peace River Pump Test Analysis. Desoto and Charlotte Counties, FL.** Project manager and lead technical professional for analysis and evaluation of pumping, salinity, wind, tide, and rainfall data collected during river pump tests performed by the Peace River Manasota Regional Water Supply Authority. This project screened data to determine which pump test events were valid with respect to actual river flow, tide, and wind conditions, as well as antecedent flow conditions affecting the location of the freshwater/saltwater interface. Screened data were used to analyze and interpret pump test day-pairs using various t-Tests and other quantitative methods to statistically determine the effect of freshwater withdrawals on river salinity measured at each of eleven continuous salinity recorders over 22 kilometers of the river. Make recommendations regarding the need for and value of additional pump tests.

**Lakes Tennessee, Buckeye, and Deer Water Quality Management Plans, Polk County, FL.** Project manager of this \$150,000 study to develop a plans for three Central Florida lakes to characterize water quality as relates to regulatory criteria such as impairment determinations; develop an understanding of the current conditions of the lakes and basins; develop a GIS-based map series of the lakes and watersheds; conduct analyses of water quality data and review existing studies to determine if nutrients are a likely cause of lake impairment; and examine other factors that may possibly affect lake conditions. Based on the results of the analyses, the project identified potential restoration, preservation, and/or treatment projects to address water quality issues, compared potential actions to determine those most likely to improve lake water quality, and provided recommendations to prioritize lake restoration, preservation, and/or treatment actions.

**Springs Coast Bay and Stream Flow Monitoring, Citrus County, FL.** Data analyst and quality control leader year-long Southwest Florida Water Management managed, FDEP funded, stream discharge and tidal current continuous monitoring study at six sites in Citrus County. Project used acoustic doppler current profilers to measure discharge, stage, cross sectional area, and velocity according to USGS standards. Data were stored in a project-specific database coded to output data in required Hydstra database input format.

**Homosassa MFL Continuous Recorders, Citrus County, FL.** Data analyst and quality control leader for Southwest Florida Water Management water quality and stage monitoring project in support of establishing minimum flows and levels for the Homosassa

River. The project developed a quality control and operations manual and deployed four sets of salinity, specific conductance, temperature, and water elevation continuous recorders. Data were stored in a project-specific database coded to output data in required Hydstra database input format. Collected data were used for improved downstream boundary conditions for a model development, calibration and verification of a hydrodynamic model that simulates circulations, salinity transport processes, and thermodynamics in the system.

**Withlacoochee MFL Continuous Recorders, Levy and Citrus Counties, FL.** Data analyst and quality control leader for year-long Southwest Florida Water Management water quality and stage monitoring project in support of establishing minimum flows and levels for the Lower Withlacoochee River. The project used six sets of salinity, specific conductance, temperature, and water elevation recorders. Data collected were used for improved downstream boundary conditions for a model development, calibration and verification of a hydrodynamic model that simulates circulations, salinity transport processes, and thermodynamics in the system.

**Sulphur Springs Algae Assessment, Tampa, Florida.** Data scientist assessing roles of current velocity, spring flows, water quality, and other factors (e.g., herbivory on macrophytes) on filamentous algae in Sulphur Springs Run to develop recommendations for managing algae within the spring run. Study objectives were to determine if the diversion of Sulphur Springs water to support the Lower Hillsborough River minimum flow recovery strategy was related to the observed increase in algae in the spring run and determine if the diversion of Sulphur Springs water was causing or otherwise associated with an increase in the salinity of the water discharging from the springs. Improved understanding of the factors contributing to the abundance of filamentous algae in the spring run was needed to develop strategies to reduce or otherwise manage algae within the spring run, as well as for management decisions regarding minimum flows for both Sulphur Springs and the Lower Hillsborough River.

**Haines City Water Supply Plan Update, Haines City, Florida.** Project manager and lead technical professional for the state-required 2017 update of the City of Haines City Water Supply Facilities Work Plan. Update work for 2017 to 2030 planning period and identify alternative and traditional water supply development projects, conservation activities, and reuse activities needed to meet the projected future water demands. Revise work plan to account for new CFWI regional water supply plan (RWSP) details, new SWFWMD Heartland Planning Region RWSP, and Polk Regional Water Cooperative participation. Incorporate future population and water supply projections and water demand projections as well as updated facilities and infrastructure information. Present water infrastructure capital improvements plan and timelines, phasing, and supply projections for proposed alternative water supply project.

**EPA Coal Mine BMP Monitoring, Kentucky & West Virginia.** Project manager, for this USEPA effort to test the relative effectiveness of different best management practices (BMP) on treating coal mine site runoff. The Project monitors 54 separate mined watersheds in Kentucky to determine runoff constituents and loading under different mining best practices and mine design configurations. Results are being used to generate recommendations on how the most effective management practices can be implemented.

**5-Year Wetland Assessment, Pasco, Hillsborough, and Pinellas Counties, FL.** Data analyst for the 2016 The Southwest Florida Water Management District assessment of regional wetland conditions in the Northern Tampa Bay Area, an ongoing scientific study to examine the effects of regional cutbacks in groundwater withdrawals since 1997. The main goal of this study was to compare wetland health in the NTBA since groundwater pumping withdrawal from the twelve wellfields began progressive reductions following

1998. Rainfall time-series were evaluated on an individual wetland basis using a method of cumulative departure from mean monthly rainfall to assess conditions preceding various monitoring events as well as shifting seasonal patterns of rainfall that could affect wetland plant recruitment and survival during wetland hydrologic recovery. Wetland condition scores were also statistically assessed to determine potential differences among assessment years, individual wellfields, wetland community type, wetland size, and wetland proximity to drawdown contours.

**Florida Wildlife Legacy Initiative Habitat Performance Measures and Monitoring, Florida Fish and Wildlife Commission.** Federal grant funding requirements mandated that Florida's Wildlife Legacy Initiative develop and implement strategies for monitoring species of greatest conservation need and their habitats. The project developed a statewide habitat monitoring system for 6 priority habitats (coral reefs, seagrasses; softwater streams; springs/spring runs; scrub and sandhill) using existing monitoring programs run by local, state, and federal agencies, universities, and environmental groups. Dr. Woithe managed this \$225,000 effort that included multiple workshops to synthesize background research and expert recommendations for structuring and implementing the habitat monitoring system. After coordinating and building consensus with over 60 agencies and groups to design a monitoring system, the team implemented the system. The programs final results were summarized in a report designed to meet the needs of the Fish and Wildlife Commissioners and the lay public as well technical professionals.

**STOPR Wetland Impact Permitting and Compliance Monitoring, STOPR Group Utilities, Central Florida.** Project Manager and lead scientist. Five Florida Utilities formed strategic partnership to settle "competitive use" conflicts that arose during their individual water use permitting efforts. Dr. Woithe was contracted to provide environmental support in addressing potential wetland impacts from groundwater pumping. Groundwater modeling analysis and joint site inspections of wetland areas located within the area of influence associated with the STOPR Utilities' groundwater withdrawals identified 575 acres of wetlands where wetland impacts were believed to have occurred or expected to occur as a result of STOPR Utilities operations. Dr. Woithe successfully negotiated values for wetland functional impacts in the 575 acres described above and compensatory wetland mitigation to offset impacts. Impact and credit determinations were completed on an accelerated schedule in order to allow the STOPR permits to be issued as originally planned. Mitigation was secured without further financial risk to the permittees by STOPR Utilities contributing funds to an escrow account for the purpose of restoring this site. Dr. Woithe was then tasked with implementing monitoring programs for 31 "wetlands of concern" and 8 "wetland reference areas" and reporting the monitoring data to SFWMD. The monitoring program used a network of surficial aquifer groundwater monitoring wells and staff gages, vegetation monitoring transects and aerial photography in order to study and characterize the wetlands. The monitoring included both baseline monitoring of vegetation and soils and ongoing-annual monitoring of vegetation. Contract Value: \$650,000

**Collier County Watershed RESTORE Act Funding Plan. Collier County, FL.** Lead wetland scientist and principal in charge for the Collier County Watershed Management Plan (CCWMP) RESTORE Act funding plan. The objectives of this project were to: 1) re-evaluate, further develop, and integrate projects already outlined in the CCWMP into a Comprehensive Watershed Management Program that meets the goals of both the Golden Gate Watershed Improvement Plan and the RESTORE Act; and 2) assist Collier County developing funding strategies for projects identified in the Comprehensive Watershed Management Program, including various RESTORE Act funding streams. The project team presented the watershed management plan at a series of agency and

stakeholder workshops. The team refined the plan to produce a consensus product that was supported by all relevant state and federal agencies as required for successful Restore Act Funding.

**Dissolved Oxygen Monitoring Program for the Progress Energy Bartow Generating Station. Old Tampa Bay, St. Petersburg, Florida.** Dr. Woithe led the team that conducted a two-year dissolved oxygen monitoring program for this Tampa Bay power plant. The plant's state permits required the development and implementation of a study to evaluate the concentrations of dissolved oxygen in the Station's cooling water intake and discharge. The team conducted multiple studies to identify optimal sampling locations, then installed and is operating continuous dissolved oxygen recorders. The team also analyzed the data to determine dissolved oxygen differences between the plant's intake and discharge canals and whether differences are affected by tide, season, weather, and other factors.

**Myakkahatchee Creek Hydrobiological Monitoring Program Northport, Florida.** Project manager and chief scientist for 8-year continuous water quality monitoring program for the City of Northport, Florida. Program operates several continuous, water quality recorders in the Myakkahatchee Creek/Big Slough tributary of the Myakka River. Monitoring program supports City's Water Use Permitting process and developed and implements statistical models for salinity, dissolved oxygen, and flow to analyze the effect of water diversions.

**City of North Port, Source Water Assessment Project. North Port, Florida.** Project Manager and lead scientist for \$390,000, 1-year, water quality and hydrologic monitoring project to assess existing source water quality and flow conditions and identify feasible habitat and water quality enhancement projects in the City of North Port's water bodies. The City's extensive system of drainage canals discharge a large amount of runoff to a state "Wild and Scenic River" and a state "Aquatic Preserve" and the Charlotte Harbor estuary. The project collected and analyzed water quality and flow data within City's stream and drainage systems and developed recommendations for future projects to improve the water quality and downstream nutrient loadings. The study found existing infrastructure and best management practices already instituted by the City of North Port were minimizing the impact of stormwater runoff from the residential and commercial development and that stormwater retrofits were not necessary.

**Peace River/Manasota Regional Water Supply Authority, Existing Scientific-Literature Review for the Peace River and Upper Charlotte Harbor, Southwest Florida** – Estuarine scientist for review and interpretation of existing literature and scientific studies regarding zooplankton and phytoplankton and their relationship to freshwater inflow on the Peace River and Charlotte Harbor. Resulting document was produced to orient and familiarize the recently convened for Peace River Scientific Advisory Committee members to specific conditions and patterns in the region.

**Rainbow River Vegetation Evaluation, Dunnellon, Florida.** Dr. Woithe was the project manager and lead scientist for the \$145,000, vegetation evaluation for 2011-2012 and the \$100,000 2005 mapping effort. The Rainbow River, a world renowned, spring run famous for its clear water and submerged vegetation, is a Florida Aquatic Preserve and spring head is a Florida State Park. The team also mapped and analyzed vegetation patterns and changes in the river in 1996, 2000, and 2005. The river is subject to several pressures including damage from recreation use, water quality degradation from activities in the watershed, and loss of habitat and aesthetic qualities as a result of the expansion of invasive exotic plant species. The submerged aquatic vegetation community covers almost 100% of the river's 10 km length and is seen as a good indicator of river condition and a good metric of changes over time. This mapping and analysis facilitated the

development and refinement of river management options. This event included mapping of filamentous algae for the first time. These types of algae may be good indicators of water quality conditions in the river. Emergent wetland vegetation was also mapped in greater detail to allow additional management recommendations.

**Lake Tarpon Water Quality Management Plan. Pinellas County, Florida.** Project manager for \$700,000 effort to develop water quality goals and appropriate projects to meet the lake water quality improvement goals. The project used ICPR modeling to generate water budgets and nutrient loading estimates for this large lake. These model data were then combined with statistical models to evaluate various lake management scenarios. The results of these modeling and data analysis efforts produced a lake level management regime that ensured appropriate water quality, flood management, and healthy submerged and aquatic vegetation communities.

**Ecological Baseline Study, Gulf Coast Desalination Facility, Pasco County, Florida.** Project scientist for \$350,000, two-year, water quality and biological monitoring project to establish baseline conditions in the Anclote Estuary prior to the construction and operation of a desalination facility. Management of water chemistry, hydrologic, and benthic sampling and monitoring efforts. Data interpretation, review, analysis, and management as well as quality assurance and control reviews.

**South Florida Water Management District (SFWMD), Estero Bay Watershed Assessment, Lee, Collier, and Hendry Counties, Florida** – Developed and wrote watershed management plan which included water quality management techniques, and wetland, habitat, wildlife evaluations as part of watershed evaluation project.

**Long-Term NOAA and BOEM, Flower Garden Banks National Marine Sanctuary, Texas.** Lead scientist for water quality and fish monitoring tasks in a long-term MMS program to test effects of natural gas and petroleum facilities on the coral reef communities of the Flower Garden Banks. Management of deployed water quality monitoring equipment program and fish population studies. Data interpretation, review, analysis, management, quality assurance and quality control.

**Coral Reef Damage Assessment and Restoration, ARCOS Telecommunications Cable, North Miami Beach, Florida** – Provided expert review of ecological sampling techniques used by similar studies. Marine biologist and scientific diver for project assessing and restoring the damage to Atlantic coral reefs caused by installation of undersea fiber optic cables

**Sanibel Causeway Seagrass Assessment, Lee County, Florida** – Lead field scientist for sea grass mapping, assessment, and project damage impacts in San Carlos Bay for the proposed expansion of the Sanibel Causeway bridges.

**Panther Island Mitigation Bank, Collier County, Florida.** Lead scientist responsible for design and data analysis for wetland functional analysis, vegetation assessment, wildlife surveys, and monitoring program on 2,775-acre wetland mitigation bank site. Wetland functional assessment using MWRAP, wetland restoration plan design, hydrologic monitoring program development and analysis, vegetation mapping, wetland delineation, wildlife surveys, Florida Mitigation Bank Review Team (MBRT) review and approval coordination, and state and federal permitting.

**Estero Park Mangrove Die-off Assessment. Estero Bay, Lee County, Florida** – Project scientist using historical and current aerial photographs, stereographic infrared aerial photographs, topographic surveys, and field data to analyze the factors driving the death of an expanding area of dead black mangrove swamp. Dr. Woihe designed a long-term monitoring program implemented at the conclusion of the study.

**Gary M. Serviss, LEED AP**  
Principal Scientist



**Education**

MS, Biological Sciences,  
Florida Institute of  
Technology, 1982

BS, Marine Biology, Florida  
Institute of Technology, 1979

**Registrations**

LEED Accredited  
Professional, 2009

Certified Wetland  
Delineator, 1996

Gopher Tortoise Authorized  
Agent, Florida Fish & Wildlife  
Commission FL, 2010

Open Water Diver, PADI  
Certified, 1976

**Affiliations/Memberships**

Society of Wetland Scientists

Gary specializes in wetlands evaluation and classification, mitigation design, wildlife evaluations, and habitat mapping. He has designed and coordinated numerous environmental investigations extensively, gaining valuable technical and project management experience. As an expert witness, Gary is sought after for testimony on environmental constraints, protected species, and wetland impacts.

*34 years of professional experience*

**Hydrobiological Monitoring Program and Salinity Modeling, Parrish, FL**

Gary was Project Manager for an eight-year project that involved the design and execution of a Hydrobiological Monitoring Program (HBMP) for the Little Manatee River relative to potential surface water withdrawals by FPL's Manatee County Plant. Services included preparation and District approval of an HBMP; selection, design, and installation of two stations with continuous stage, temperature, conductivity and salinity recording devices; baseline and subsequent aerial photography and habitat mapping; continuous stage, temperature, conductivity, and salinity data collection for eight years; equipment maintenance; data reports; salinity modeling and trend analysis; and interpretative reports. Also, as part of FDEP's permit requirements for FPL's withdrawal of river water for cooling requirements, VHB monitors and analyzes salinity and temperature regimes in the Little Manatee River at two sites (US41 and I-75). VHB is responsible for modeling and analysis of salinity impacts as well as providing and interpreting changes in georectified FCIR aerial photography at periodic intervals. The data are summarized and presented in data and interpretive reports on an alternating basis every two years. In addition, periods of emergency withdrawals during 2006, 2007/2008 and 2011 required an additional analysis of the effects of withdrawals on the salinity in the river.

**Biological Monitoring of the Evers Reservoir and the Braden River, Manatee County, FL**

Task Manager for a biological monitoring program for the tidal portion of the Braden River downstream of the Evers Reservoir dam. Quantitative natural substrate sampling for benthic macroinvertebrates was conducted during the wet and dry season using replicate petite ponar grab samples at eleven stations. Macroinvertebrate grab samples were field sieved, preserved, picked, sorted and organisms identified to the lowest practical taxonomic level. Sediment samples were collected at the benthic macroinvertebrate stations and analyzed for particle size distribution and total organic carbon. Juvenile fish

sampling was conducted with a seine net during the winter and fall at six stations distribution within the various reaches of the river. All fish collected were identified and enumerated, with recreationally and commercially important species being measured for standard length. A data summary report was prepared which included community parameters for the benthic macroinvertebrates and comparison of results along the length of the river. Designed and implemented a five-year water quality study of the Evers Reservoir and Braden River in compliance with water use permit conditions. Collected water quality samples from 2 stations within the Evers Reservoir and 11 stations within the Braden River for several parameters. Water quality data were collected quarterly over a five-year period with the results summarized in quarterly data reports. In addition, annual summary reports were prepared for the previous four quarterly events summarizing the overall results for that annual reporting period. An interpretative report will be prepared summarizing the five-year program.

**Springs Inventory and Flow Evaluation in Kings Bay, Crystal River, FL**

Gary managed a three-phase project for the Southwest Florida Water Management District (SWFWMD) to inventory, document, and evaluate discharge from the numerous spring vents in Kings Bay. The initial phase involved the field inventory of previously documented springs. For the second phase VHB obtained flow and in situ water quality measurements to quantify spring discharge from submerged spring vents for the District in its efforts to establish a Minimum Flow for Kings Bay. The efforts in the second phase were repeated in Phase 3 and three springs were measured over two tidal cycles.

**Abbey Management, Lee County, FL**

Served as the project environmental consultants for the preparation and processing of applications for a 1286 acre Planned Development District Option (PDDO)/Residential Planned Development (RPD) zoning in Lee County, Florida. Services included the field investigation for wetland delineations, habitat categorization, and protected species survey in accordance with Lee County requirements. Developed narrative responses for wetland protection, mitigation plans, and protected species management plans. Services also included expert testimony and exhibits for five days of administrative hearing and a Lee County Board of County Commissioner's Hearing.

**Sarasota Bay Juvenile Fisheries Habitat Assessment Study, (52 square miles), Sarasota and Manatee Counties, FL**

Project Manager for scheduling and performance of project team and subconsultants. Served as client liaison, principal scientist for the artificial reef assessment, field scientist for the FMI monitoring and QA/QC officer. Presented interim results at technical advisory committee workshops, performed data management, data analysis and prepared final report. Obtained available digital mapping data for the study area including color aerial photography, Southwest Florida Water Management District (SWFWMD) Land Use/ Land Cover Maps and SWFWMD seagrass maps. Prepared a shoreline routing system by established bay segments and identified the shoreline type within three tiers (geomorphic, shore morphology and vegetative). Refined the tidal flats mapping units to break out salt barrens and oyster bars. Sampled juvenile fish using the Florida Marine Research Institute's Fisheries Independent Monitoring protocol at 40 natural and restored

sites during two seasons. Over 310,000 fish were counted during a total of 160 sampling events which were conducted in eight habitat types. In addition, fish species were counted at 14 sites located on three artificial reef sites within Sarasota Bay. A total of over 59,000 individuals were counted during a total of 56 sampling events. The data were analyzed to determine any preferences of fish species and selected taxa (commercially and recreationally important species) for various habitat types and microhabitats within the Sarasota Bay study area. The preference of species and of course species-specific size classes for various material types or configurations of artificial reef material were also evaluated. The results were summarized and recommendations were provided relative to artificial reef construction and habitat restoration within a report.

**Quantification of Ungauged Groundwater Discharge to Spring-Fed Rivers, Citrus County, FL**

Gary managed a study for SWFWMD to quantify ungauged groundwater contributions for the Chassahowitzka, Crystal and Homosassa Rivers in a systematic and consistent manner to assist in establishing minimum flows and levels (MFLs) for these systems. VHB initially conducted a field reconnaissance to identify the best locations and methods to conduct discharge measurements for each river system. A total of six transects (two in each system) downstream of the mainspring and bracketing defined reaches were measured using Acoustic Doppler Current Profilers over a partial tidal cycle along with readings of water levels at reference points. Analysis of the initial data resulted in the relocation of one transect in Crystal River and the deletion of monitoring in the Homosassa River. The study was repeated with an extended flow measurement window for an entire tidal cycle for all transects. The measurement results and conclusions were provided in Summary Letter Reports.

**SMR Development Corp., Manatee County, FL**

Conducted field services to support a 1,395-acre DRI. Each individual wetland was visited to assess its function, value, dominant species, as well as other characteristics. Habitats were mapped according to FLUCCS and APOXSEE nomenclature. Field surveys were conducted to locate protected plant and wildlife species. Specific surveys were conducted to quantify gopher tortoise density, red-cockaded woodpeckers and small mammal/herpetofauna trapping. Prepared a wildlife management plan and coordinated approval through the Florida Fish and Wildlife Conservation Commission.

**River Wilderness Golf and Country Club, Manatee County, FL**

Gary was Project Manager for design and permitting of a boating-related development along the Manatee River. As part of the long term planning process, VHB developed a comprehensive wetland and upland compensation program that preserved a mosaic of the mature native habitats, removed exotic species, and provided wetland compensation, which included creation, restoration, and enhancement components. Three freshwater marshes were created, a creek oxbow expanded, and a 21-acre salt marsh and tidal lagoon area constructed by spoil pile removal, ditch filling, and restoration of an exotic dominated wetland

fringe. The final component was the hydrologic restoration of the 65-acre former salt marsh by creating two large bridge openings to reconnect this system and restore tidal inundation. Gary also authored and obtained FFWCC approval of a Manatee Protection Plan for the project.

## Mehul J. Patel, PE

Water Resources Engineer



### Education

MS, Civil Engineering and Engineering, Construction Management, Florida Institute of Technology, 2007

BS, Civil Engineering, Florida Institute of Technology, 2005

### Registrations

Professional Engineer FL, 2013

### Affiliations/Memberships

American Public Works Association, 2015

Mehul has expertise in civil and environmental engineering in support of stormwater projects. He has provided planning, design, permitting, and construction services of stormwater management, drainage, and civil site development projects. His responsibilities include planning, project coordination, collection and evaluation of design data, coordination with other utilities, preliminary and final design, stormwater modeling, preparation and review of construction drawings and specifications; preparing cost estimates, preparing and processing permits, and assisting with bidding, construction, and project certification.

### *11 years of professional experience*

#### **Desoto Acres Sidewalk Improvements, Sarasota County, FL**

Mehul is served as a Stormwater Engineer for a sidewalk improvements project in Sarasota County, FL. The project included the design of stormwater infrastructure to accommodate a 5 ft. wide sidewalk throughout the Desoto Acres neighborhood, while maintaining and improving existing stormwater runoff drainage patterns. Mehul's role in the project also included floodplain evaluation and compensation, existing and proposed conditions hydrologic and hydraulic modeling, and Environmental Resource permitting with the Water Management District.

#### **Boggy Creek Road Widening; Osceola County, FL**

Mehul is providing stormwater engineering services for the design of a two-mile corridor from Osceola Parkway to East Boggy Creek Road at the Osceola/Orange County line. This project consists of designing a four-lane divided suburban roadway and a new bridge for the eastbound lanes while incorporating an existing bridge for the westbound lanes. Mehul led the design of the storm sewer system for the project. Additional facets of the project included right-of-way acquisition, drainage improvements, signal improvements, pedestrian/bicycle facilities, signing, and pavement markings. The project was permitted through the South Florida Water

Management District (SFWMD) and the US Army Corps of Engineers (USACE).

### **Ward Property, Gulfport, MS**

Mehul is serving as the stormwater engineer for the 1300 acre project in Gulfport, MS. Mehul took the lead in the preparation of an existing stormwater model for the project using AdICPR, which included estimation of hydrologic parameters using GIS. The project also included the development of an overall HEC-HMS model for the Turkey Creek Watershed, which is approximately 27 square miles. The project also included the development of an unsteady state HEC-RAS model for Turkey Creek. Mehul is currently leading the efforts in the analysis and design of the proposed conditions stormwater management system and supporting models for the project.

### **Raleigh Street, City of Orlando, FL**

Mehul was the stormwater project engineer for this roadway improvement project for the City of Orlando. The project extends from just west of Kirkman Road to just east of Broome Avenue. Mehul was responsible for designing the drainage system, consisting of storm sewer and swales, associated with the roadway improvements. All design work had to comply with the requirements of the appropriate regulatory agencies and the City of Orlando. Mehul performed supporting drainage computations including: estimating runoff, assessing inlet locations, performing conveyance/hydraulic computations for the storm sewer and swale systems.

### **Kissimmee and Longwood Bus Parking Facilities**

Mehul was the project engineer on the stormwater management analysis and design for the Kissimmee and Longwood Bus Parking Facilities. These 13.48 acre and 15.65 acre sites, respectively, are projects that involved the construction of a maintenance /operations/administrative building, service building, a covered bus parking lot and a paratransit parking lot for the Central Florida Regional Transportation Facility (LYNX). The Kissimmee project site is located in the Shingle Creek Watershed of the SFWMD and the Longwood facility is located in the Lake Jesup Watershed of the St. John's River Water Management District (SJRWMD). For both sites, VHB provided a summary of the rules and regulations for the quality and quantity of stormwater and a summary of design criteria for stormwater management system at each site. Lastly, a conceptual design for controlling stormwater onsite was developed. The conceptual design included an estimate of design and construction costs for the stormwater improvements.

### **SR 500 at SR 464, Ocala Florida**

Mehul was the stormwater project engineer for this intersection improvement in Ocala, Florida. He was responsible for designing the drainage and stormwater management systems affected by the intersection improvements. All design work had to comply with the requirements of the appropriate regulatory agencies and the Florida Department of Transportation's Drainage Manual. Mehul performed drainage computations including: estimating runoff, assessing inlet locations, and estimating spread for the affected storm sewer inlets. He calculated the systems new hydraulic losses and tailwater conditions. He had to assure that the existing storm sewer system would still function or retrofit a new stormwater design. Mehul also obtained a permit determination letter confirming that the proposed improvements were exempt from permitting.

Mr. John E. Coffin

Senior Hydrologist

#### Education

B.S., Geology, Florida State University, 1974

A.S., Oceanographic Technology, Florida Institute of Technology, 1971

#### Experience

2001-2016 Hydrologic Data Collection, Inc. – Vice President and Senior Hydrologist

1991-2001 U.S. Geological Survey, WRD- Supervisory-Hydrologist, Hydrologic Data Section,  
Tampa, FL

1981-1991 U.S. Geological Survey, WRD- Supervisory-Hydrologist, Jacksonville, FL

1971-1981 U.S. Geological Survey, WRD-Hydrologic Technician, Tallahassee, FL

Mr. Coffin has over 44 years of experience in the collection of streamflow, groundwater, water quality, and meteorological data collection. He specializes in the development of discharge ratings and computation of streamflow at gauging stations using USGS methods and standards. He has conducted streamflow measurements and collected water quality samples routine and extreme hydrologic conditions for use in several hydrology projects. He is very familiar with the wide variety of data loggers, pressure transducers, and water quality instrumentation used in the collection of hydrologic, water quality and meteorological data.

On his retirement from the U.S. Geological Survey, as Chief, Hydrologic Data Section, Tampa, FL in 2001, he founded and incorporated Hydrologic Data Collection (HDC). As the Senior Hydrologist for HDC he has overseen the instrumentation, data collection and processing of hydrologic data at: over 135 continuous daily discharge stations, 15 acoustic velocity discharge stations, 8 continuous rainfall stations, 170 monthly wells, 6 water quality stations collecting continuous temperature, conductance, salinity and stage. These stations are located throughout north and west Florida and South Georgia. He is currently a contract employee with VHB. Mr. Coffin's project history includes the following:

Mr. Coffin was responsible for the installation, operation, maintenance and collection of discharge data at Cypress and Piney Springs in Washington County near Vernon, FL. Discharge measurements were conducted monthly to determine spring flow at each spring. Water level data were recorded electronically to determine water level trends at each spring. All work was conducted using USGS standards and techniques.

Mr. Coffin assisted the inventory and measurement of discharge at over 100 submerged springs in the Kings Bay Portion of Crystal River. Discharge measurements were conducted at over 100 springs using standard and non-standard techniques, methods and various mechanical and acoustic velocity meters.

For two years Mr. Coffin oversaw the operation and maintenance of a streamflow network for the St. Johns River Water Management District. Bi-monthly discharge measurements were made and used to develop stage versus discharge ratings at 39 continuous daily discharge stations, 8 acoustic velocity meter stations and 15 springs. The discharge ratings were applied to the recorded gage heights with appropriate stage shifts and datum corrections to compute instantaneous (15-minute) and daily values of discharge as well as monthly and annual runoff statistics. All work was conducted using USGS standards and techniques

For two years Mr. Coffin oversaw the operation and maintenance of a streamflow network for the Suwannee River Water Management District. Bi-monthly discharge measurements were made and used to develop stage versus discharge ratings at 24 continuous daily discharge stations in the Suwannee River basin. The discharge ratings were applied to the recorded gage heights with appropriate stage shifts and datum corrections to compute instantaneous and daily values of discharge as well as monthly and annual runoff statistics. All work was conducted using USGS standards and techniques.

Mr. Coffin oversaw the collection installation, operation and maintenance of 6 real-time water quality monitoring stations at three stormwater ponds in St Petersburg, FL to evaluate the performance efficiency of the ponds. Seven storm events and three base flow sampling events were conducted during the wet season of 2012 at the inflow and outflow of each pond. Collection of flow-weighted composite water quality samples were conducted during discrete storm-events and base-flow events. The stations were operated in real-time and automated for remote triggering for storm-event sampling. Flow weighted sampling was triggered based on rainfall.

Mr. Coffin oversaw the installation, operation and maintenance of 7 real-time water quality monitoring stations to monitor the effectiveness of the Celery Fields Regional Stormwater Facility in Sarasota, FL. The stations were operated in real-time and were automated for remote triggering for storm-event sampling. Flow weighted sampling was triggered based on discharge. Water quality samples were collected on a flow-weighted basis at two inflow sites and three outflow sites during rain events using automated refrigerated samplers. Water quality data for nine storms were collected at each site. In addition to storm event sampling, seven base flow samples were also taken. The water quality data provided the basis for calculating the efficiency of the system in reducing pollutants.

Mr. Coffin oversaw the collection installation, operation and maintenance of 4 real-time stage vs discharge and water quality monitoring stations in Hillsborough County. The stations were operated in real-time and automated for remote triggering for storm-event sampling. Continuously monitored parameters included: pH, conductance, dissolved oxygen, dissolved oxygen percent saturation, turbidity, and temperature. Discharge measurements were conducted to develop stage versus discharge ratings. The discharge ratings were applied to the recorded gage heights with appropriate stage shifts and datum corrections to compute instantaneous and daily values of discharge as well as monthly and annual runoff statistics. All work was conducted using USGS standards and techniques.

As Chief, Hydrologic Data Section, U.S. Geological Survey, Tampa, Florida from 1991-2001, he managed a \$3.2 million budget and supervised 17 employees in all aspects of: streamflow, ground water, meteorological, and quality of water data collection. This included: quality assurance and control of all data collected, selection station locations, selection and installation surface water, ground water, and quality of water instrumentation, data analysis, design of and implementation of equipment modifications. Supervised the collection computation of data at 90 continuously recording streamflow stations, 210 recording wells, 36 recording rainfall stations, and 60 quality of water stations, He was instrumental in implementing real-time data collection technology in the USGS Jacksonville Field and Tampa Sub-District Offices and overseeing the quality assurance of the data on the USGS web pages. Several of these real-time sites recorded continuous water quality parameters.

Authored a series of annual reports for the Water Resource Division of the U.S. Geological Survey; Water Resources Data, Florida, Volume 3A: Southwest Florida Surface Water: U.S. Geological Survey Water-Data Report FL-3A and Water Resources Data, Florida, Volume 3B: Southwest Florida Ground Water. U.S. Geological Survey Water-Data Report FL -3B from 1991 to 2001.

**Gary A. Zarillo, Ph.D., PG**  
Department of Ocean Engineering and Marine Sciences  
Florida Institute of Technology  
150 West University Blvd  
Melbourne, FL 32901

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### **Professional Experience**

Dr. Zarillo has more than 35 years of experience in coastal ocean processes, marine geology, and sedimentology. Dr. Zarillo also has extensive experience the application of statistics and time-series analysis to environmental studies and the application of remote sensing methods in coastal and terrestrial environments. He has conducted applied and basic research on tidal inlet hydraulics, dynamics of barrier island systems, sediment transport mechanics, and the hydrodynamics of coastal and estuarine environments. Dr. Zarillo has been applying 3D process and environmental models to coastal and estuarine environments for more than 25 years. Over the past 10 years Dr. Zarillo has served as principal investigator for several large multidisciplinary projects funded at levels of between \$500,000 and \$1 million.

### **Professional Preparation**

Ph.D. Geology, University of Georgia, 1979.  
M.S. Geology, University of Rhode Island, 1975.  
B.S. Geology, University of Rhode Island, 1970.

### **Appointments**

Professor, Department of Marine and Environmental Systems. Florida Institute of Technology, 1996-Present.  
Research Scientist. GKSS Research Center, Geesthacht, Germany, 1997-1998.  
Associate Professor, Department of Oceanography/Ocean Engineering, Florida Tech, 1987-1996.  
Assistant Professor, Marine Sciences Research Center, State University of New York at Stony Brook, 1982-1987.  
Research Assoc. & Assistant Dir., Coastal Research Div., Department of Geology, University of South Carolina, 1979 -1982.

### **Refereed Publications 2011-2017**

Dohner, S.M. and Zarillo, G.A. 2017 <sup>Morphologic</sup> and Hydraulic Storm Response at St. Lucie Inlet, Florida. Jour. Coastal Res., in press.

Lazarus, S. M., S. T. Wilson, M. E. Splitt, and G. A. Zarillo, 2012. Evaluation of a wind-wave system for ensemble tropical cyclone wave forecasting. Part I: Winds. *Wea. Forecasting*, 28, 297-315.

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Zarillo, G.A and Zarillo, K.A., 2011. Combining Geological and Numerical Models to Evaluate Sand Resources of the Northeast Florida Inner Continental Shelf. *Jour. Coastal Res.* 59, 192-201.

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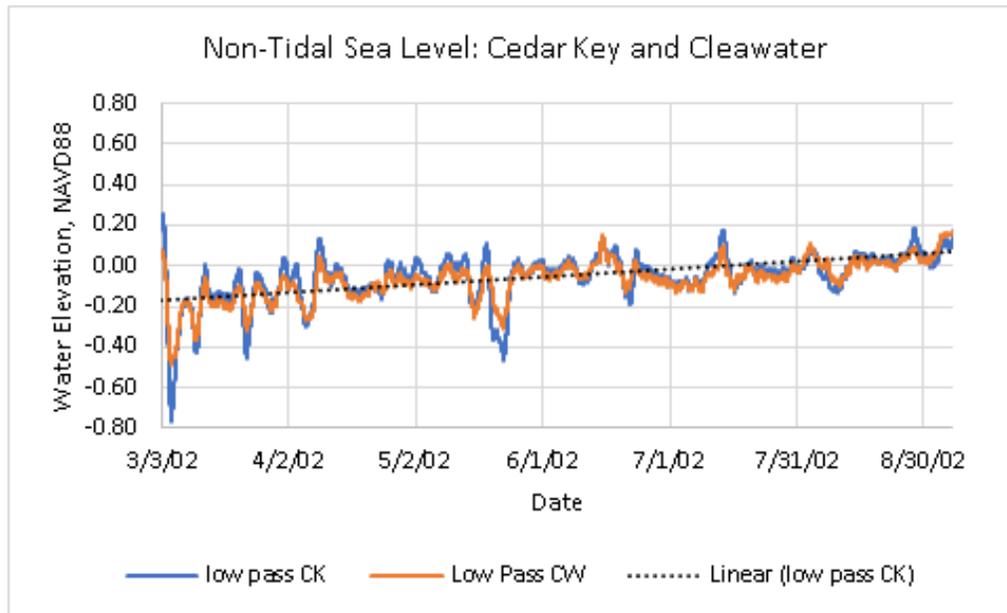
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## Appendix C - Additional Comments on the EFDC Model

### **A1: Water level Boundary Conditions**

The EFDC model applied in the analysis of the minimum flows and levels for the Steinhatchee River estuarine section seems to be well calibrated with respect to measured data from the September to April 2015-2016. However, in the final application of EFDC, the calibration can be questioned because offshore boundary conditions rely solely on predictions from Gulf Coast Shelf Model (GCSM). GCSM is also dependent, in part, on model boundary conditions for salinity and temperature from the Navy Coastal Ocean Model (NCOM). This directly conflicts with the calibration of EFDC model of the Steinhatchee, which is dependent on measured water level, salinity and temperature data. Further, the water level boundary conditions for GCSM are derived from tidal constituents and exclude non-tidal sea level as illustrated in Figure 1 below from Cedar Key and Clearwater CO-OP Stations 8727520 and 8726724, respectively. Note that short term non-tidal water levels can change by more than 20 cm over a time scale of about a week. In addition there is a trend of about a 20-cm increase in sea level during the 2002 calibration period of the GCSM. The water level calibrations of GCSM look good only in the tidal frequency band. The GCSM- predicted water levels were apparently compared with the unfiltered Cedar key and Clearwater data the comparisons or comparisons were made over short periods of time during which changes in non-tidal sea level were small. Based on the

scatter plots of measured and predicted water level data and the time series comparison of model-measured water level data in the GCSM calibration report (2006), it seems likely that the Cedar Key and Clearwater data from the 2002 calibration period were fileted to eliminate the non-tidal part of the records.



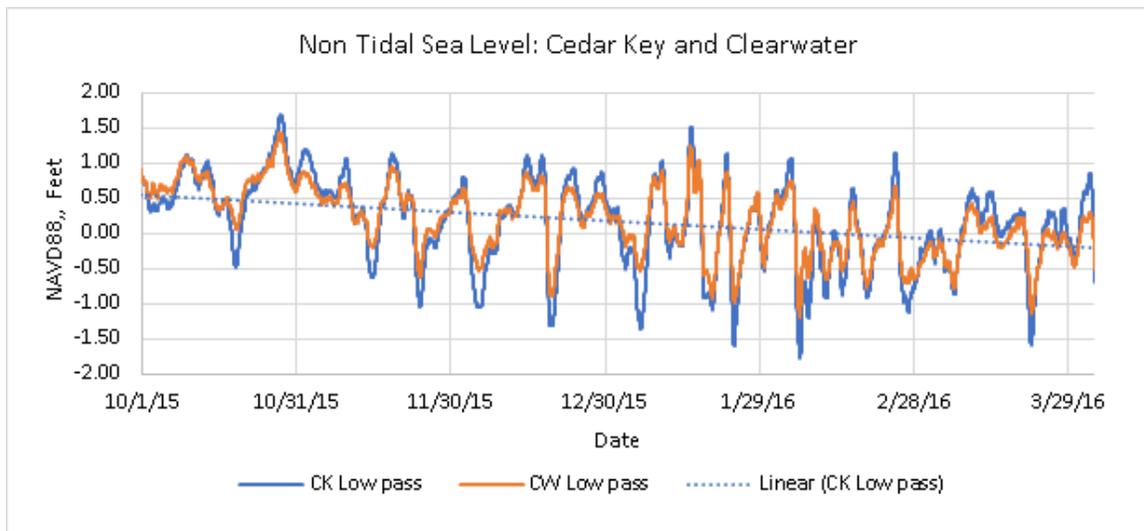
**Figure 1. Non-tidal water level records from Cedar key and Clearwater, 2002. Water level are in meters NAVD88.**

Thus, applying the tidally produced GCSM-predicted water level time series from 1995-1999 to the outer boundary of the EFDC Steinhatchee River/estuarine model will produce predicted water levels in the Steinhatchee that are inconsistent with the full spectrum calibration. This inconsistency could produce unknown errors in calculated water volumes and salinity calculations in the Steinhatchee.

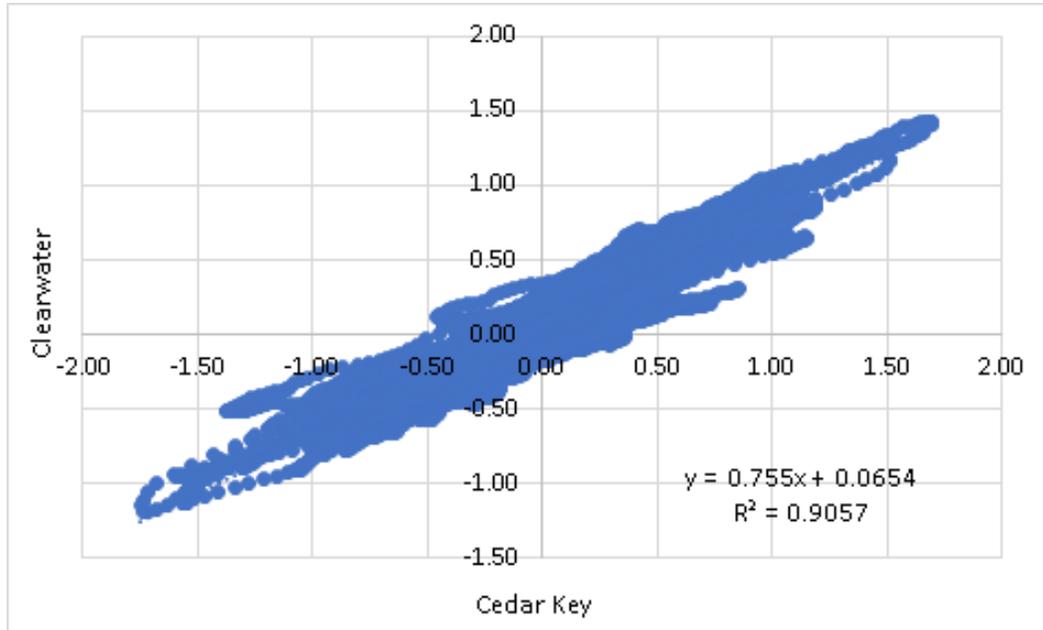
As we all know model boundary conditions are an ongoing issue. In this case two avenues are available to address the problem. One approach could involve re-running GCSM for the 1995-99 period using a full water level spectrum. This would require an analysis of the non-tidal water levels in the region and including of the non-tidal signal in the model boundary conditions. Figure 1 shows that there is good sea level coherence in non-tidal frequency band in the region for the 2002 calibration period of the GCSM model. Presumably this can be verified for the 1995-99 period of the model production runs. It might allowable to apply the non-tidal portions of the Cedar key and Clearwater water level records along the outer boundary of GCSM model in combination with the tidal water level records. The non-tidal record could

simply be added to the water levels record derived from tidal constituents. A drawback is that we do not know how well the non-tidal record applies to deeper water, distal from the NOAA CO-OP stations, although it is coherent in shallow water along the coast.

A second approach, more preferable in my opinion, would be to use the 2015-2016 measured water level record at SRWMD 02324190 to calculate a set of tidal constituents for this location, which should be applicable over the outer boundary of the EFDC model. A tide based water level time series could then be produced from for the 1995-99 period and the combined with the low frequency non-tidal water levels from this period derived from the Cedar key NOAA CO-OP station. This would require comparisons between non-tidal water level from SRWMD 02324190 and Cedar Key for the 2015-2016 period. to assure that are similar. Figure 2 shows the Cedar Key an Clearwater records for 2015-16. Note the short-term water levels variations of up to 2 feet and the trend of decreasing sea level of about 0.5 feet during this period. Figure 3 shows the same comparison in the form of a scatter plot shown an  $R^2$  value of about 0.9 between the two non-tidal time series. A non-tidal sea level comparison between the SRWMD 02324190 and Cedar Key water level data should have the same or higher degree of correlation. Once the boundary water levels are constructed from tidal and non-tidal records, the original EFDC runs for the MFL would have to be re-run.



**Figure 2. Non-tidal water level records from Cedar key and Clearwater 2015-16. Water levels are in feet, NAVD88.**



**Figure 3. Scatter plot comparison of water level records from Cedar key and Clearwater 2015-16. Water levels are in feet, NAVD88.**

## **A2: Salinity and Temperature Boundary Conditions**

Establishing historical salinity and temperature boundary conditions in the nearshore coastal ocean is an ongoing problem that cannot be completely solved. Yet in the minimum flows and levels (MFL) analysis of Steinhatchee River, salinity thresholds are key factors in establishing the MFL criterion. The issues of water level boundary conditions for the EFDC model are discussed above. However, further work is necessary to ensure that the best salinity boundary conditions are used to drive the offshore boundary of the EFDC model. In the summary Steinhatchee MFL report and in the EFDC model calibration report (Appendix B) virtually no information is given about model boundary conditions except to day they were established from the GCSM model. He salinity calibration of GCSM is somewhat limited due to low temporal resolution of salinity data available from the 2002-time period from the SEAS and COASTS project as noted in the 2006 GCSM calibration report. In addition, there were no calibration points in the vicinity of the mouth of the Steinhatchee River.

At a minimum, plots of salinity and temperature time series from GCSM used for the EFCD model boundary in the Gulf should be provided. This would at least provide a check to see if the predicted values are realistic. Another possibility would be to run the GCSM for the 2015-16 EFDC model calibration for which a continuous salinity and temperatures measured time series

exist at SRWMD 02324190. A Comparison of GCSM-computed and measured time series of salinity could be used to assess the accuracy and resolution of GCSM data at the mouth of the Steinhatchee River. While performing this exercise the GCSM model should be run with a full water level spectrum and addition of ET data to the atmospheric (aser.inp) input file to try and improve salinity calculations.