Appendix F

INITIAL PEER REVIEW REPORT

REEVALUATION OF MINIMUM FLOWS FOR THE LITTLE MANATEE RIVER SYSTEM

AGREEMENT NUMBER: 19CN0001936

SOUTHWEST FLORIDA WATER MANAGEMENT DISTRICT
2379 BROAD STREET
BROOKSVILLE, FLORIDA 34604

NOVEMBER 2021

TABLE OF CONTENTS

1.0 INTRODUCTION

1.1 BACKGROUND AND SYSTEM DESCRIPTION

The Southwest Florida Water Management District (SWFWMD) contracted with an independent panel of experts to provide a technical peer review of the proposed Recommended Minimum Flows for the Little Manatee River Draft Report. The Peer Review Panel includes:

- Dr. Steven Peene (Panel chair)
- John Loper
- Russ Frydenborg

The Little Manatee River is a minimally disturbed blackwater river in Southwest Florida. The river and watershed are located in the southern end of Hillsborough County and the northern portion of Manatee County, as shown in Figure 1-1. The river extends over 40 miles from the headwaters near Fort Lonesome down to Tampa Bay near Ruskin. The downstream estuarine portion of the river ranges from the mouth at Tampa Bay to where the river crosses US 301, where the primary flow gage for the system is located (02300500). Above US 301, the river branches into two primary forks, the North Fork and the South Fork. Multiple additional tributaries drain to the system as shown in Figure 1-1.

A total of three flow gage stations are located along the system (see green squares in Figure 1-1). The primary station, and the one upon which the minimum flows and level (MFL) is developed, is located at the break between the estuarine and freshwater portion of the river where it crosses US 301 (02300500). Other flow gages are shown within the South and North Forks. Additionally, in support of the MFL and model development, continuous gages that collected water levels, temperature and conductivity (for salinity) were installed in the lower estuarine portion of the river from 2004 to 2005. The station locations are shown as red circles.

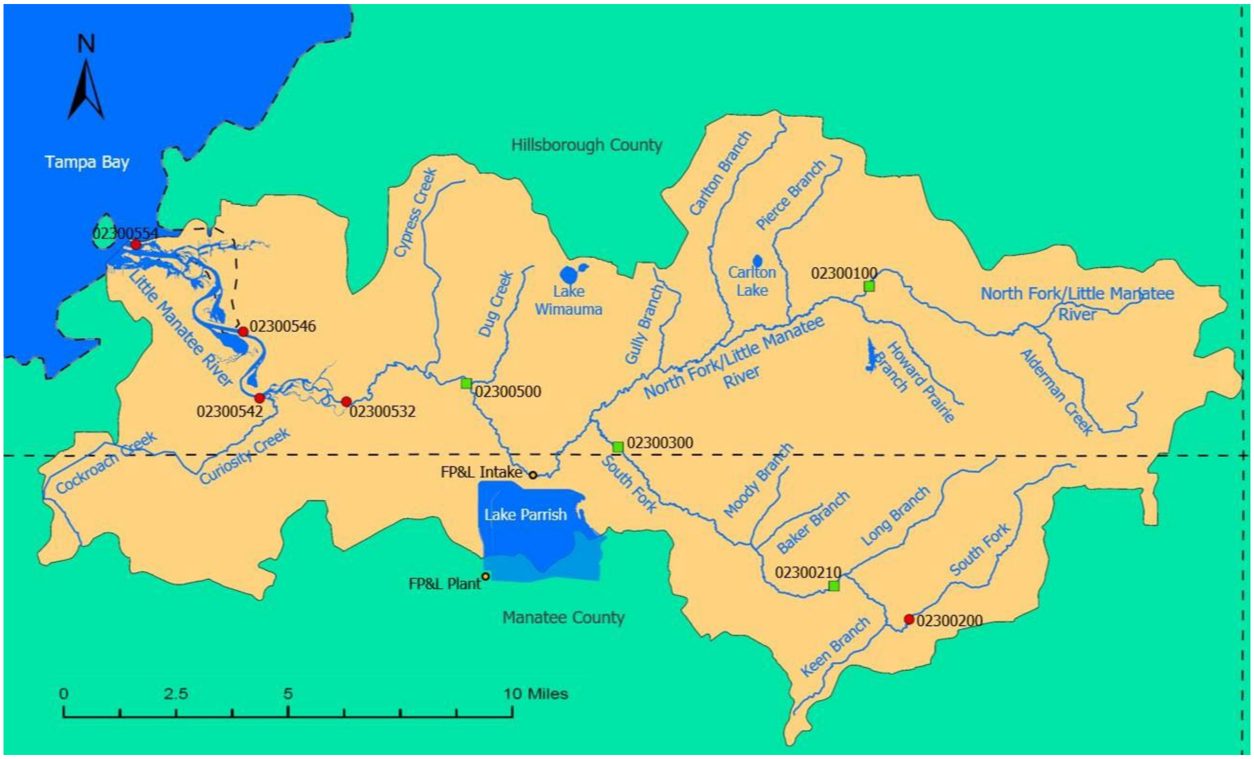

Figure 1-1. The Little Manatee River System and Watershed (SWFWMD, 2021).

For the MFL, the system is divided into two sections, the Upper and Lower River. The Upper River extends from where the river crosses US 301 [U.S. Geological Survey (USGS) 02300500] up to the headwaters of the North and South Forks. The Lower River extends from the US 301 crossing down to the mouth at Tampa Bay. Analyses were performed to define allowable flow reductions within each of the two segments. Presently, there is one withdrawal located on the river. This is the FPL intake that pumps water from the river into Lake Parrish for use as cooling water.

Key components of the MFL development were various mechanistic and empirical models developed to provide physical data (salinity, water levels, flows) under baseline and flow reduction scenarios. The models included an Environmental Fluid Dynamics Code (EFDC) model of the lower river, a logistic regression model to project salinity in the Lower River, and a Hydrologic Engineering Centers River Analysis System (HEC-RAS) model to project flows and water levels in the Upper River. In addition to the physical models, significant biological data collection efforts were undertaken for both the Upper and Lower River to support MFL development and environmental effects models developed to determine how anthropogenic flow reductions may adversely affect sensitive biological attributes.

The draft MFL presented within the report was based on allowance of a 15 percent reduction in critical habitats (estuarine and freshwater) based on changes in the flow conditions. The MFL was established by three flow blocks, Block 1 [<35 cubic feet per second (cfs)], Block 2 (35 cfs to 72 cfs), and Block 3 (>72 cfs). Table 1, pulled from the draft MFL document, outlines the MFLs established for each flow block and for the Upper and Lower River. The document also assessed the flow reductions in consideration of the 10 Environmental Values.

	Block 1 (< 35 cfs)	Block 2 (> 35 cfs and < 72 cfs)	Block 3 (> 72 cfs)
Upper Little Manatee River (Headwaters to Highway 301)	90% of the flow on the previous day	80% of the flow on the previous day	87% of the flow on the previous day when the previous day's flow was > 72 cfs and ≤ 174 cfs, or 89% of the flow on the previous day when the previous day's flow was > 174 cfs
Lower Little Manatee River (Highway 301 to Tampa Bay)	90% of the flow on the previous day	80% of the flow on the previous day	70% of the flow on the previous day
Upper and Lower Little Manatee River	No surface water withdrawals are permitted when flows are ≤ 35 cfs		

Table 1. Draft MFLs by Flow Block for the Upper and Lower Little Manatee River System (SWFWMD, 2021)

1.2 REGULATORY BASIS FOR MFL AND PEER REVIEW

Florida Statutes (F.S.) mandate that SWFWMD must establish MFLs for state surface waters and aquifers within its boundaries for the purpose of protecting the water resources and the ecology of the area from "significant harm." Section 373.042, F.S., provides that the minimum flow for a given watercourse is the limit at which further withdrawals would be significantly harmful to the water resources or ecology of the area, and the minimum water level is the level of groundwater in an aquifer and the level of surface water at which further withdrawals would be significantly harmful to the water resources or ecology of the area.

Section 373.042, F.S., also provides that MFLs shall be calculated using the best information available, that the Governing Board shall consider and may provide for non-consumptive uses in the establishment of MFLs and, when appropriate, MFLs may be calculated to reflect seasonal variation. The law also requires that when establishing MFLs, changes and structural alterations to watersheds, surface waters, and aquifers shall also be considered (Section 373.0421, F.S.). The State Water Resource Implementation Rules (Chapter 62-40, Florida Administrative Code) includes additional guidance for establishing MFLs, providing that "…consideration shall be given to the protection of water resources, natural seasonal fluctuations in water flows or levels, and environmental values associated with coastal, estuarine, aquatic, and wetlands ecology, including:

a) Recreation, in and on the water;
b) Fish and wildlife habitats and the passage of fish;
c) Estuarine resources;
d) Transfer of detrital material;
e) Maintenance of freshwater storage and supply;
f) Aesthetic and scenic attributes;
g) Filtration and absorption of nutrients and other pollutants;
h) Sediment loads;
i) Water quality; and
j) Navigation."

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

1.3 DOCUMENTS AND DATA UTILIZED IN THE PEER REVIEW

The following documents and data were provided to the panel members to be utilized in the peer review.

- MFL Report: Recommended Minimum Flows for the Little Manatee River Draft Report (2021)
- Appendix A: Proposed Minimum Flows and Levels for the Little Manatee River – Peer Review DRAFT Report (2011)

- Appendix B: Review of Minimum Flows and Levels for the Little Manatee River, Florida (2012)
- Appendix C: Reevaluation of the Proposed Minimum Flows for the Upper Segment of the Little Manatee River, DRAFT REPORT (2018)
- Appendix D1: Technical Memorandum – Water Quality (2020)
- Appendix D2: Technical Memorandum – Hydrodynamic Modeling (2021)
- Appendix D3: Technical Memorandum – LOESS and EFF Modeling (2021)
- Appendix D4: Technical Memorandum – Sediment and Detrital Transport (2021)
- Appendix D5: Technical Memorandum – Navigation (2021)
- Appendix E: Recommended Minimum Flows for the Little Manatee River Estuary DRAFT REPORT (2018)
- Appendix F: Analysis of Benthic Community Structure and its Relationship to Freshwater Inflows in the Little Manatee Estuary (2008)
- Appendix G: Characterization of Woody Wetland Vegetation Communities along the Little Manatee River (2008)
- Appendix H: Instream Habitat Modeling in the Little Manatee River. Update using System for Environmental Flow Analysis (SEFA) (2021)
- Hydrodynamic Modeling of the Little Manatee River, (Huang and Liu, 2007)
- Estimating the Un-Gaged Inflows In the Little Manatee River Basin, Florida (Interra, 2006)
- Little Manatee River Watershed Master Plan Update (Jones Edmunds, 2015)
- Little Manatee River Watershed Management Plan (PBS&J, 2002)
- HEC-RAS Modeling of the Little Manatee River (ZFI, 2010)
- HEC-RAS Model files
- EFDC Model Input files for baseline run
- HEC-RAS Transect files
- Freshwater Inflow Effects on Fishes and Invertebrates in the Little Manatee River Estuary; an Update of Data Analyses (Peebles, 2008)
- SWFWMD Internal Memos
- Public Comments

1.4 PEER REVIEW PANEL SCOPE AND APPROACH

For this initial report (Phase I), the Peer Review Panel has been scoped to complete the following tasks as part of the MFL Peer Review:

- Review draft of the Recommended Minimum Flows for the Little Manatee River along with supporting documentation.
- Participate in Public Meetings including:
  - Kickoff Virtual Meeting (October 5, 2021)
  - Web-Meetings (October 20, 27 and November 3, 2021)
- Post written review comments and collaborate with other panelists to develop a single peer review panel report
- Review and provide support in development of meeting agendas and meeting summaries

Following the process outlined above, the subsequent sections present the initial results, comments, and recommendations of the Peer Review Panel.

2.0 REVIEW OF MFL REPORT AND SUPPORTING DOCUMENTATION

The following sections provide general and detailed comments on the MFL report and supporting documentation provided by SWFWMD for use by the Peer Review Panel. Section 2.1 presents narrative discussions of key aspects of the MFL by the Panel. Section 2.2 provides detailed comments in tabular format. The tables provide for the following.

- Panel member providing the comment;
- identification of what document and location within the document to which the comment pertains;
- identification if the comment directly and materially affects the conclusions of the report;
- the specific comment; and
- the reviewers' recommended corrective action.

2.1 GENERAL COMMENTS

Specific components of the MFL report and supporting documentation were identified by the Peer Review Panel as critical in the MFL development. The following components were identified for specific review and discussion or were general items to address:

- Significant harm;
- Development of baseline flow record;
- HEC-RAS modeling;
- Biology data and System for Environmental Flow Analysis (SEFA) in the Upper River;
- EFDC Model;
- Salinity Regression Modeling;
- Biological data and biological assessment Lower River;
- Flow blocks (Upper River); and
- Flow blocks (Lower River).

The following sections present the reviewers' discussion of these items.

Significant Harm

The introduction provides three critical assumptions: "1. Alterations to hydrology will have consequences for the environmental values listed in Rule 62-40.473, F.A.C., and Section 1.2.2 of this report; 2. Relationships between some of these altered environmental values can be quantified and used to develop significant harm thresholds or criteria that are useful for establishing minimum flows and minimum water levels; and 3. **Alternative hydrologic regimes** may exist that differ from non-withdrawal impacted conditions **but are sufficient to protect water resources and the ecology of these resources from significant harm**."

The report states, "Criteria for developing minimum flows are selected based on their relevance to environmental values identified in the Water Resource Implementation Rule and confidence in their predicted responses to flow alterations. The District uses a weight-of-evidence approach to determine if the most sensitive assessed criterion is appropriate for establishing a minimum flow, or if multiple criteria will be considered collectively."

SWFWMD indicated that when natural breakpoints in environmental data were not available, they use a **15% habitat or resource-reduction standard as a criterion for significant harm**. This was partially based on peer review panel recommendations associated with minimum flows development for the Upper Peace River (SWFWMD 2002). In considering the Physical Habitat Simulation (PHABSIM) model, the Upper Peace River peer reviewers noted that "in general, instream flow analysts consider a loss of more than 15% habitat, as compared to undisturbed or current conditions, to be a significant impact on that population or assemblage" (Gore et al. 2002).

The Little Manatee MFL report presents additional literature to support the 15% change criterion that could be applied to a number of metrics (e.g., wetted area, habitat guild, oligohaline salinity zone area, etc.). The report also states that, "More than 20 peer review panels have evaluated the District's use of the 15% standard for significant harm. Although **many have questioned its use, they have generally been supportive** of the use of a 15% change criterion for evaluating effects of potential flow reductions on habitats or resources when determining minimum flows." While the panel agrees that the 15% threshold is based on a sound scientific evaluation and represents a reasonable management decision, we would offer the U.S. Environmental Protection Agency (EPA) Biological

Condition Gradient (BCG) model as a potential source of support for this decision. What follows is a brief description of the BCG conceptual model.

The EPA has outlined a tiered system of aquatic life use designation, along a Biological Condition Gradient (BCG), that illustrates how ecological attributes change in response to increasing levels of human disturbance (Davies and Jackson, 2006). The BCG is a conceptual model that assigns the relative health of aquatic communities into one of six categories, from natural to severely changed (Figure 2-1). The model is based in fundamental ecological principles and has been extensively verified by aquatic biologists throughout the U.S. (FDEP, 2011).

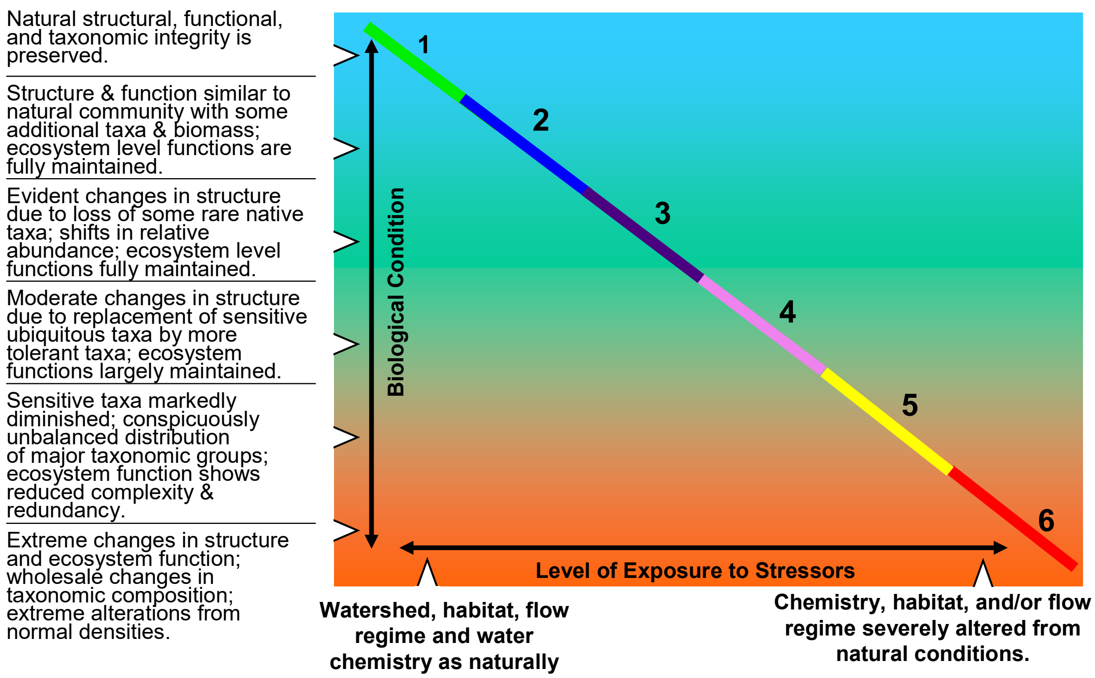

Figure 2-1. The Biological Condition Gradient Model (from Davies and Jackson 2006).

FDEP conducted a BCG exercise to calibrate scores for the Stream Condition Index (SCI) in 2006 (FDEP, 2012). Twenty-two experts examined taxa lists from 30 stream sites throughout Florida, 10 in each Ecoregion, that spanned the range of SCI scores. Without any knowledge of the SCI scores, they reviewed the data and assigned each macroinvertebrate community a BCG score from 1 to 6, where 1 represents natural or native condition and 6 represents a condition severely altered in structure and function from a natural condition. Experts independently assigned a BCG score to each site, and then were able to discuss their scores, rationale, and could opt to change their scores based on arguments from other participants (Delphi approach). At the conclusion of the workshop, FDEP regressed the mean BCG score given to each stream against the SCI score for that site (Figure 2-2).

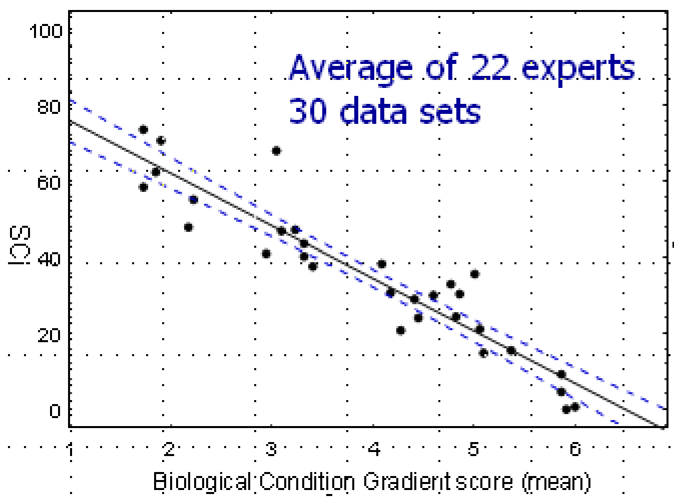

Figure 2-2. Regression Line with 90% Confidence Interval Showing the Relationship between the Mean BCG Score and SCI Score. The "exceptional" threshold was established at 64 and above, based on the score associated with a BCG 2. Based on an additional EPA analysis, the impairment threshold was an average SCI of 40, with no score below 35 during the past two sampling events.

This indicated that Florida riverine invertebrate metrics were responding predictably to human disturbance, and that the use of benthic invertebrates to assess the condition of Florida systems is consistent with the concepts in EPA's Biological Condition Gradient. Based on this (in part), Chapter 62-302, F.A.C. prohibits a 20 point drop in exceptional SCI scores, and Chapter 62-303, F.A.C. lists any stream with an SCI score of <40 as impaired.

The BCG utilizes biological attributes of aquatic systems that respond predictably to increasing human disturbance, and hydrologic modification was one component of the Human Disturbance Gradient used for metric selection. These BCG attributes may be inferred via the community composition data. The biological attributes considered in the BCG are:

- Historically documented, sensitive, long-lived or regionally endemic taxa;
- Sensitive and rare taxa;
- Sensitive but ubiquitous taxa;
- Taxa of intermediate tolerance;
- Tolerant taxa;

- Non-native taxa;
- Organism condition;
- Ecosystem functions;
- Spatial and temporal extent of detrimental effects; and
- Ecosystem connectance (FDEP, 2011).

The gradient represented by the BCG has been divided into six levels (tiers) of condition that were defined via a consensus process (Davies and Jackson, 2006) using experienced aquatic biologists from across the U.S., including Florida representatives. The six tiers are as follows:

- Native structural, functional, and taxonomic integrity is preserved; ecosystem function is preserved within range of natural variability;
- Virtually all native taxa are maintained with some changes in biomass and/or abundance; ecosystem functions are fully maintained within range of natural variability;
- Some changes in structure due to loss of some rare native taxa; shifts in relative abundance of taxa but sensitive–ubiquitous taxa are common and abundant; ecosystem functions are fully maintained through redundant attributes of the system;
- Moderate changes in structure due to replacement of some sensitive–ubiquitous taxa by more tolerant taxa, but reproducing populations of some sensitive taxa are maintained; overall balanced distribution of all expected major groups; ecosystem functions largely maintained through redundant attributes;
- Sensitive taxa are markedly diminished; conspicuously unbalanced distribution of major groups from the expected; organism condition shows signs of physiological stress; system function shows reduced complexity and redundancy; increased buildup or export of unused materials; and
- Extreme changes in structure; wholesale changes in taxonomic composition; extreme alterations from normal densities and distributions; organism condition is often poor; ecosystem functions are severely altered (Davies and Jackson, 2006).

The six levels described above can be used to correlate biological index scores or other management tools with biological condition, as part of calibrating an index or assessing the management decision (Figure 2-2). Once the correlation is established, a determination is made as to which biological condition represents attainment of the Clean Water Act (CWA) goal according to paragraph 101(a)(2) related to aquatic life use support, “protection and propagation of fish, shellfish, and wildlife”, or in the case of MFLs, protecting against significant harm. Many groups of experts have provided opinions that human activities should not cause the biological condition to drop more than two categories, and in no case should anthropogenic activities reduce the condition to less than 4.

Suggestion: **For future MFLs**, SWFWMD scientists should assess how much the biological condition gradient category of the waterbody in question would be reduced at the 15% MFL reduction threshold compared to baseline conditions. Perhaps the BCG approach can provide an additional, nationally recognized method of support for the 15% reduction threshold.

<u>Development of Baseline Flow Record</u>

Development of a baseline flow record is necessary to identify and/or estimate a long-term flow record that is relatively unimpacted by surface water withdrawals, groundwater withdrawals, and the impacts of land use changes. This flow record is then used as the basis for evaluating the effects of flow reductions on the metrics used to determine the point at which significant environmental harm occurs. The measured streamflow at the USGS Wimauma gage, which has daily flow records dating back to April 1939, was used for this purpose. The period of time before 1977 was identified in the current MFL draft report as relatively free from anthropogenic influences. A statistical change-point analysis conducted by Janicki Environmental, Inc. (JEI) determined that a change in the rainfall-flow relationship occurred around this time. The change in this relationship was attributed primarily to agricultural practices, although mining, urbanization, and surface water withdrawals undoubtedly have played a role.

Following the change-point analysis, the baseline flow record was then extended post-1976 using a regression analysis to estimate the rainfall-flow relationship in the absence of anthropogenic influences.

FP&L Withdrawals

Florida Power and Light is permitted to withdraw 10% of the river flow to augment its cooling water reservoir when flows are above 40 cfs at the Wimauma gage. The intake is located approximately 3.5 river miles upstream of the Wimauma gage. Also at this location is a spillway and outfall channel which evidently serves as an emergency outlet. This most likely is only used during extended periods of above-average rainfall. According to data presented in Appendix C, withdrawals started in or around 1977, which coincides roughly with the change point identified in the statistical analysis. The baseline flow record therefore does not include the effects of these withdrawals, which is appropriate. It is assumed these withdrawals will be counted towards the allowable reductions upon implementation of the proposed MFL.

Agricultural Irrigation

The 2011 draft MFL study assumed a constant value of 15 cfs for the contribution of agricultural practices including irrigation, use of plastic mulch, etc. on streamflow at the Wimauma gage. The current MFL study employed a more sophisticated statistical approach to estimating the excess streamflow caused by agricultural irrigation. In the Myakka River Watershed Initiative (Interflow Engineering, 2008), an integrated groundwater/surface water model was used to show that excess agricultural flows occur throughout the year, with the largest flows occurring early in the wet season (July), due to elevated water tables early in the wet season following farm irrigation during the preceding dry season, and suppression of evapotranspiration (ET) during the non-growing months of June and July, with ET suppressed due to bare fields largely covered with plastic mulch. The excess flows taper off in August and September and remain relatively low throughout the dry season. The current draft MFL report compares the Upper Myakka River excess flows, estimated from a predictive regression equation, and suggests a similar pattern in the Little Manatee River Watershed. The graph (Figure 5-3) shows Little Manatee peak excess flows in August and remaining higher in September than in July, but the overall pattern is similar. This is a better approach than assuming a constant value throughout the year in the 2011 MFL study.

One potential flaw in the approach is that the changes in streamflow caused by the active phosphate mining in the watershed was not considered as an additional anthropogenic effect on the rainfall-streamflow relationship. All bias in the residuals between the predicted and observed flows post-1976 was ultimately attributed to agricultural practices. The report further concludes that agricultural excess flows are trending towards zero. That may be the case, however, an alternative or additional explanation may be that the agricultural excess flows are being partially offset by a decrease in streamflow from actively mined areas, which have been increasing in spatial coverage over the past 20+ years.

Phosphate Mining

Active phosphate mines are effectively severed from the watershed through the construction of ditch and berm systems designed to capture all stormwater runoff within the mine, for rainfall events up to and including the 100-year design storm. The ditch and berm systems are in place for the duration of mining and reclamation; discharge of stormwater is only allowed via FDEP-permitted outfalls. These discharges tend to be relatively infrequent and typically occur only during the wettest months of the year, since the mining operation is water-intensive and much of the rain that falls within the footprint of the active mine is used as process water. One such outfall exists within the Little Manatee Watershed – Mosaic site D-001 located within the headwaters of the river. Although the daily discharges from this outfall through 2009 are reported in Appendix C, no effort was made to account for potential effects of mining on historical flows. The ramifications of not accounting for the changes in flow due to mining separately are probably negligible for the purposes of this MFL, however, because the regression method used to extend the baseline flow record developed for the current draft MFL study corrects for all the anthropogenic influences post 1976.

HEC-RAS Modeling

The HEC-RAS model is a very important tool used in estimating minimum flow requirements in the upper (non-tidal) segment of the Little Manatee River. The results of the model are used to determine fish passage and wetted perimeter requirements, inundation of snag habitat, navigability, and inundation frequency/duration of riverine vegetation and floodplains. Digital HEC-RAS model input files were obtained and reviewed as part of this peer review effort.

Cross Section Representation

The HEC-RAS model used for this study largely replaced an earlier HEC-RAS model developed by ZFI (2010) for an earlier draft of this MFL study (Hood, et al., 2011). One of the concerns identified by reviewers of the ZFI model was that little or no survey information was used to develop the river cross sections. According to the ZFI report, the cross sections were based on topographic contours and a digital elevation model (DEM) rather than field survey.

The draft MFL report cites a Stormwater Management Model (SWMM) developed in support of a Watershed Management Plan (WMP) update prepared for Hillsborough County as the source of cross section information used in the HEC-RAS model. According to the MFL report, the SWMM model "…was based on survey data and was assumed to provide the best available information on the flow-stage relationships at various cross sections in the Upper Little Manatee River." According to the report documenting the WMP update (Jones Edmunds, 2015), no surveys were conducted within the main river channel and within the domain of the HEC RAS model developed in support of this MFL (i.e., from the Fort Lonesome USGS gage downstream to US Hwy 301). The 2015 WMP update evidently reused cross section information from an older SWMM model developed by PBS&J as part of an earlier version of the WMP (PBS&J, 2002).

A review of the HEC-RAS digital model input shows that practically all the river cross sections are represented with idealized flat bottoms. From field observations, this does not capture the cross-sectional variability in channel depth at many locations (e.g., at channel bends). This raises the question of how many of the source cross sections were surveyed and thus merited additional investigation into the sources of cross section data used in the model.

According to the earlier 2002 WMP report, cross sectional information for the Little Manatee River main channel were taken from a 1992 update to the Flood Insurance Rate Map (FIRM) study [Federal Emergency Management Agency (FEMA), 1992]. However, the field survey of cross sections of the main channel for the 1992 update was reportedly performed in the mid-1970s for an earlier FEMA mapping effort. A very limited field survey (two cross sections) of the main channel was conducted for comparison to the 1970s data as part of the 2002 WMP study, but both cross sections were miles downstream of US Hwy 301, outside the domain of the subject HEC-RAS model. So, in the best-case scenario, the cross sections from the most recent SWMM model were indeed based on survey, but that survey probably dates to the mid-1970s. And without access to the original 1970s field survey notes, it is impossible to know how many of the modeled cross sections were originally surveyed. It is not uncommon in flood studies to employ a combination of surveyed cross sections and approximated cross sections.

Another concern is that because the 1970s cross sections have been used and re-used several times for different modeling efforts, the spatial integrity may have been compromised as the cross sections were ported from one modeling platform to another and later to yet another. SWMM assumes prismatic cross sections with a single representative cross section used for each computational link, while HEC-RAS (and its predecessor, HEC-2) assumes non-prismatic sections (different cross sections used to represent each end of the computational link). Porting the cross sections from SWMM to HEC-RAS requires the modeler to assume a single location for each cross section in the prismatic SWMM links, which may extend several hundred feet longitudinally.

Recommendation: The uncertainty introduced by the questionable cross section data has repercussions for all evaluations that rely on the HEC-RAS results, including, but not limited to, the wetted perimeter analysis, the fish passage criterion, and navigability. Figure 4-1 of the draft MFL report shows the locations of 10 vegetation transects with field surveyed cross sections tied into NAVD88. These were apparently not used in the HEC-RAS model. It is recommended to provide a comparison of these with the nearest HEC-RAS cross sections. Then, characterize the level of accuracy of the modeled cross sections and its ramifications on the reliability of the model output for the MFL analyses.

Suggestion: While the imported SWMM model cross sections are probably an improvement over the cross sections estimated from the DEM by ZFI for the previous iteration of the HEC-RAS modeling for the 2011 MFL study, a new field survey of the river channel (to supplement the 10 cross sections noted above) should be collected to support future updates to the MFL.

Model Calibration and Flow Apportionment

The flow apportionment by reach originally developed by ZFI was retained by JEI in the current HEC-RAS model setup. The flow apportionment ratio, which is used to apportion flows recorded at the USGS Wimauma gage to the other reaches, is shown in Table 5-1. It is not clear from either the main MFL report, its appendices, or the ZFI (2010) report how the flow apportionment was determined. The ZFI report describes how the earlier HEC-RAS model was calibrated and verified to two extreme rainfall events and used in the simulation of design storm events.

Evidently, the HEC-RAS model was not calibrated to a long-term period of record that includes a range of high and low flows. If the flow apportionment ratios were developed based on the extreme (high) rainfall event simulations, the ratios may not be appropriate for the low and mid-range flows used to establish Block 1 and Block 2 MFL criteria. This is because the relative flow contributions of different parts of the watershed to the total flow at the Wimauma gage can change based on hydrologic flow regime. The draft MFL report does acknowledge this phenomenon in at least one location, at the upstream end of the model where flows are recorded at the Fort Lonesome gage so direct comparisons can be made to the total flows at the Wimauma gage.

Biology Data and System for Environmental Flow Analysis (SEFA) in the Upper River

The biological information for the upper Little Manatee River presented in the MFL report addressed previous peer review comments concerning a need for more extensive faunistic studies of the river. In response, SWFWMD obtained benthic macroinvertebrate SCI data from FDEP and also obtained fish community data via a field survey conducted by the Florida Fish and Wildlife Conservation Commission (FWC) in late 2020. Fish data from museum records was also reviewed as part of the SEFA analysis.

The floodplain vegetation of the upper river was characterized as part of the SWFWMD's minimum flows development process (PBS&J 2008, Appendix G). Relationships among vegetation, soils, and elevation in wetlands were evaluated at ten study transects. Communities found included:

- Willow Marsh: Carolina willow (*Salix caroliniana*), popash (*Fraxinus caroliniana*) and Dahoon holly (*Ilex cassine*);
- Tupelo Swamp: swamp tupelo (*Nyssa aquatica*), an obligate wetland species, and slash pine (*Pinus elliottii*), a facultative wetland species; and
- Hardwood Swamp: swamp bay (*Magnolia virginiana*), an obligate wetland species, and water oak (*Quercus nigra*), a facultative wetland species.

Wetlands did not appear to be well developed along the upper river, and the three wetland classes present were characterized by species with somewhat lower inundation requirements. There was no consistent steep increase in cumulative wetted perimeter coincident with a particular shift in vegetation classes along the upper river transects.

Since 2015, approximately 200 taxa of benthic macroinvertebrates have been collected from the US Highway 301 location. The mean SCI score for the Upper River (n = 12) was 55, a value that indicates a healthy, well-balanced community at the existing water withdrawal conditions (Table 2-1).

Table 2-1. Stream Condition Index Data for the Little Manatee River from FDEP

Date	FDEP LIMS ID	Variable Name	Result
1/23/2015	1147639	SCI_2012	30
1/22/2015	1232845	SCI_2012	72
1/23/2015	1312457	SCI_2012	67
1/23/2015	1389059	SCI_2012	43
1/23/2015	1466871	SCI_2012	60
1/22/2015	1553243	SCI_2012	68
1/16/2015	1648970	SCI_2012	51
10/14/2015	1725280	SCI_2012	61
3/21/2016	1760010	SCI_2012	53
6/14/2016	1782696	SCI_2012	24
3/13/2018	1955765	SCI_2012	68
10/31/2019	2078357	SCI_2012	67
		Mean	55.3

Recommendation: Include the SCI results and mean score in the MFL report and provide evidence that the existing consumptive use has not caused significant harm to the invertebrate community

An electrofishing survey was conducted by the FWC on September 10, 2020 in about 0.5 mile (0.6 km) of the river upstream of the US Highway 301 Bridge (Nagid and Tuten, 2020) at four locations. Sixteen species of freshwater and marine fish were collected by the FWC, mostly freshwater species typical of southwest Florida river systems, although two non-native, freshwater species and three marine species were collected. An additional taxa list was provided based on museum collections.

The fish and invertebrate taxa identified as inhabiting the Upper River supported the use of the 25 species and habitat guilds used for the SEFA evaluation.

SWFWMD conducted a SEFA evaluation to characterize the potential effects of flow reductions on a suitability index for instream habitat. SWFWMD collected physical habitat data on substrate and cover and combined this with depth and velocity from the HEC-RAS model and habitat suitability curves to develop an area-weighted habitat index for selected fish and aquatic macroinvertebrates. SEFA used cross-sectional elevation profiles, water surface elevation, velocity, and substrate/cover types at specific locations across the channel, along with suitability profiles for water depth, velocity, and substrate/cover for selected fish and aquatic macroinvertebrates. These data were used to derive a taxon-specific area weighted suitability (AWS) for each flow rate. Baseline flows were compared to various flow reduction scenarios to determine the 15% loss of habitat associated with decreases in flows.

A set of 25 habitat suitability curves corresponding to species, life history stages, larger taxonomic groups of fish and aquatic macroinvertebrates, and habitat guilds was used for the SEFA analysis. Substrate and cover observations were made at 21 cross sections grouped into 7 sites in the Upper River. These transects also represented an increased sampling effort in response to previous peer review comments. The SEFA Block 1 flows included the 0 to 33rd percentile flows, which equals flows 1 to 21 cfs at the reference reach and 1 to 35 cfs at the gage reach. The SEFA Block 2 flows corresponded to the 34th to 60th percentile flows, equaling >21 cfs to 44 cfs at the reference reach and >35 to 72 cfs at the USGS gage. The time series of habitat relationships by AWS were condensed into median values for each habitat suitability group. Model runs were compared, and maximum flow reduction scenarios were identified that corresponded to reductions in median values of less than 15% loss compared to the baseline condition.

Results of the SEFA analysis for Block 1 indicated that the most sensitive habitat suitability group is the deep-fast (DPFA) habitat guild, which experienced a 15% loss in median habitat at baseline flow reductions greater than 10%. For Block 2, the most sensitive habitat suitability group was the Ephemeroptera (mayflies) and Trichoptera (caddisflies) (ETs) group, which experienced a 15% loss in median habitat at baseline flow reductions greater than 20%.

Recommendation:

The panel agreed that the additional data gathered by the SWFWMD was sufficient to support the SEFA approach. The SEFA evaluation was environmentally relevant and provided a sound basis for minimum flows in the upper river.

Hydrodynamic (EFDC) Modeling

An EFDC model was utilized to simulate the changes in salinity in the estuarine portion of the Little Manatee River (below the crossing at 301). This model was one of two methods utilized for defining the changes in salinity in the estuarine portion of the Little Manatee River. Salinity changes in the river were a key aspect driving the MFL determinations, therefore, the accurate simulation of those changes is very important.

The model was developed and calibrated between 2005 and 2007 (Huang and Liu, 2007). The model was developed and calibrated using data collected in 2004 and 2005 at four stations located from the mouth of the Little Manatee River to below US 301. The model extents are from the mouth up to 301, and the upstream boundary includes the measured freshwater inflow at 301.

The EFDC model provided output from 2000 through 2004 (some portions of 2005 were simulated but not used in the analyses) to provide baseline salinity conditions and then salinity conditions under flow withdrawal scenarios from 5% up to 40% in increments of 5%. In work completed for this MFL development, some modifications were made to the code to provide more accurate output of hourly salinity and depth/level data to provide more accurate calculations of the salinity volumes. This update created more accurate output. The model output was processed to provide volumes and areas for each 1 ppt increment of salinity isopleths. These volumes and areas were then evaluated to see what level of flow reduction would create a 15% change in the habitat volume and area under varying conditions. The following identifies findings and recommendations on the EFDC model.

General Findings: A number of issues are raised below relative to the EFDC model development, documentation and application. These issues bring into question the use of the model (as it stands) for performing the simulations used to assess potential changes in area and volume of salinity habitat. A series of recommendations are provided below to help in determining the model's suitability as it stands at present. The final determination on model suitability will then be assessed based on the results of the requested analyses as part of the Final Peer Review Report.

Model Documentation

Within the original document and appendices there was insufficient documentation on the model development, calibration and application. While the main report and some of the appendices provided limited information on the model development and application, no complete report was provided. The MFL document referenced a report of the model (Huang and Liu, 2007), but this report was not included as part of the supporting documentation. The Huang and Liu report was provided by District staff to the Peer Review Panel upon request. An additional report (Interra, 2006), which outlined the development of the ungaged flows below US 301, was also referenced but not included in the MFL documentation. The Interra report was provided by District staff upon request. Additionally, some aspects of the model development were not well documented in the Huang and Liu report. This included how depths/elevations within the model were developed and the source of the bathymetry data used to develop the depths in the model. Subsequent discussions with District consultants identified a report that outlined the bathymetric survey work performed on the lower portions of the river. Additionally, no documentation was provided on how the EFDC model downstream boundary conditions were developed for the MFL reduction scenarios, which went from 2000 to 2005. Data collection at the location of the downstream boundary condition only occurred from mid-2004 through 2005. Subsequent investigations and discussions with District staff identified that the unmeasured portion of the simulations utilized regressions between salinity and flow developed by HSW around 2007, but there is no documentation of that as part of the MFL documentation. District staff provided various reports and information relative to the regressions and how they were utilized to develop the boundary conditions.

<u>Recommendation:</u>

As part of the MFL documentation, an appendix should be created that includes all the reports and other information that document the development and calibration of the EFDC model. This includes the model calibration as well as the MFL reduction baseline scenario from 2000 to 2005. Where no specific reports exist (i.e., for how bathymetric data were interpolated onto the model grid) the District should provide text and figures to supplement the reports provided so that in the end, complete documentation of the EFDC model is included as part of the supporting documentation for the MFL.

Physical Representation of Estuarine Portion of the Little Manatee River

For mechanistic models of this type, a key aspect is that the grid developed provides a reasonable and accurate physical representation of the system. Figure 2-3 presents the EFDC model grid overlain onto an aerial of the estuarine portion of the Little Manatee River. The program utilized to transform the available model input files into a representation of the grid in some areas is not completely accurate, but overall, the recreated grid represents what is in the model.

Examination of the grid in relation to the shoreline of today shows areas where the physical representation does not match the actual conditions horizontally. This is especially evident in the area between the mouth up to US 41. This can be seen in the figure as well as in the original grid plots presented within the Huang and Liu report. In this area the sinuosity of the channel is not represented. Upstream of US 41 while the grid does generally follow the primary river channel, the grids extend outside of the channel into tidal marsh areas and in some instances upland areas. Figure 2-4 presents the depths as represented in the model. Examination of this figure identifies that the model, in a number of areas, is flat across the cross sections with no true channel geometry defined. This is most likely not an accurate representation of the overall system geometry.

One aspect of the model is that there is no wetting and drying being simulated. Examination of the model input files indicates this function is turned off. Wetting and drying is where the model simulates areas of tidal marsh that flood and drain throughout the tidal cycle. Examination of the aerial photographs indicates there are potentially significant areas of tidal marsh adjacent to the system. While the model does include some side storage areas, it would appear that overall, a number of areas are not being simulated. This would relate to the accuracy of the tidal prism being simulated.

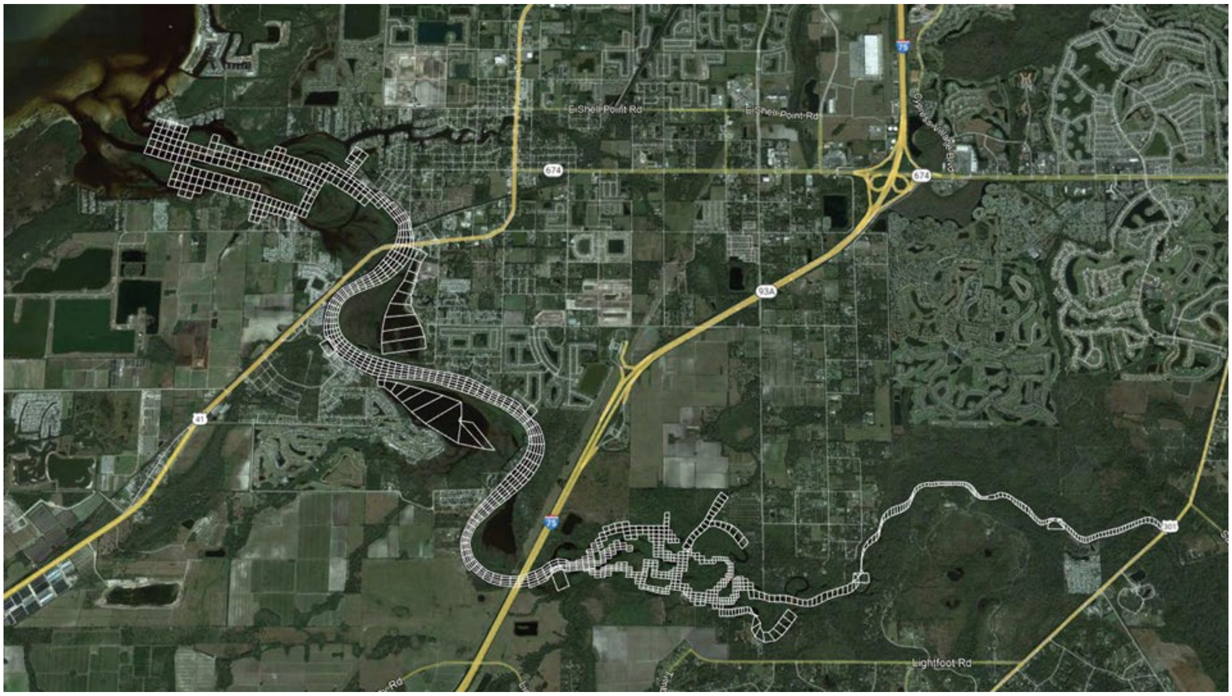

Figure 2-3. Model Grid Overlain onto Aerial Photography

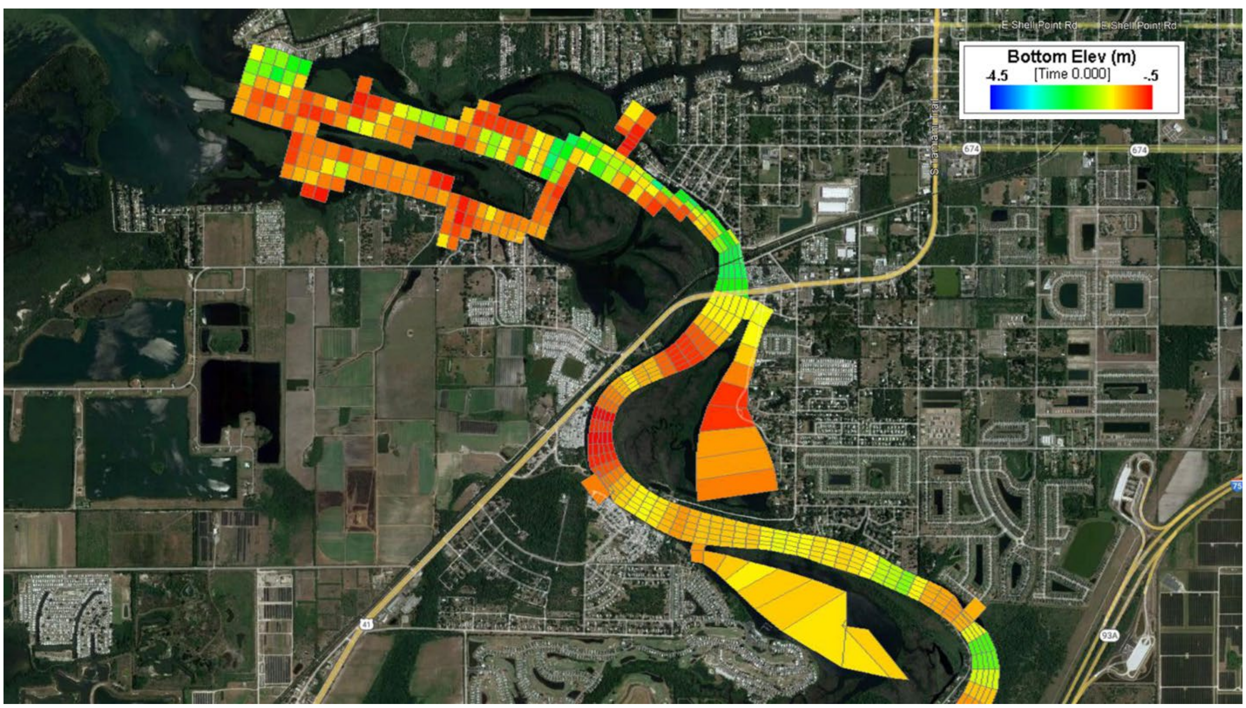

Figure 2-4: Model Bathymetry Overlain onto Aerial Photography

Recommendation:

The model is utilized to calculate area and volume changes, so an analysis should be conducted to provide a comparison of the model areas and volumes with the actual volumes and areas in the system. A recommendation would be to calculate the longitudinal cummulative volume and area from the river mouth in the model (by river mile) up to US 301 versus actual inundated volume and area calculated from available shoreline, light detection and ranging (LiDAR), and bathymetric data. This should include adjacent tributaries as well as potential areas for flooding and drying in the adjacent marsh areas.

Model Calibration

The datasets utilized to calibrate the model had good temporal and spatial coverage. Having three continuous monitoring stations with data over a 2-year period provides ample data to calibrate the model. Given the age of the dataset it would have been good to see some more recent datasets utilized to either recalibrate or check the model performance under present conditions. One point to note on the data collection is that the upstream station below US 301 (532) did not have conductivity measurements. This is the station just upstream of the braided area and, based on material presented in the main document and appendices, an area that much of the time is experiencing the lower salinity conditions that drove the MFL.

As discussed above, the model calibration is presented in the Huang and Liu report (2007). This report needs to be provided as part of the overall model documentation as it is the only relatively complete documentation. Based upon the presentation of graphs and statistics within the MFL report documents and the Huang and Liu report (2007) the calibration looks good. For the periods where the model data are presented against the measured continuous salinities, temperatures, and water levels, the agreement is good both graphically and statistically. The plots showing the comparisons of the measured and simulated continuous salinities shows that the model is capturing the characteristics of the salinity changes and the responses under different tidal and freshwater inflow conditions.

Model Boundary Condition Location

Generally, for hydrodynamic model development it is recommended that boundary conditions in the model be located such that they are well outside of the areas that the model is being used for. The model boundary is located at the mouth of the river and this is an area being evaluated.

Flow reduction is the parameter change being evaluated by the model and it is likely that the salinity levels at the mouth would change (on average) if there is a net overall reduction in flow. As such, some evaluation or sensitivity analysis should be performed using the model and available data to show how potential changes in the flow would impact the boundary conditions and ultimately the MFL determinations.

Recommendation: Using the updated salinity regressions derived by Janicki, estimate the average net change in salinity at the boundary under the flow reduction where the 15% change in habitat was seen (21% reduction) for the habitat volume and area calculations. Apply this net change in salinity to the boundary condition in the model and rerun the simulations and recalculate the volume and area changes from the baseline condition to determine the impact on the volume and area changes of the response at the boundary.

Model Boundary Condition Time Series for MFL Scenarios

For the MFL baseline run and the flow reduction runs it was determined that the boundary conditions in the model are a mixture of measured data (for the period from around march 2004 through 2005) and data generated from regressions developed by HSW. This was not documented in any of the supporting materials. Figure 2-5 presents a plot of the surface and bottom salinities for 60 days where the measured data were utilized. Figure 2-6 presents a plot of the surface and bottom salinities where the boundaries were derived from the HSW regression. Examination of the plots shows two things. First, it appears for the boundaries created using the HSW regression, an error was made and the bottom and surface salinities appear to have been flipped. Second, the overall behavior of the boundary in the regressed condition does appear to match that seen in the measured data. It should be noted that for the MFL the HSW regressions were updated and per the documentation provided improved.

Recommendations: Runs should be performed to determine if the error is fixed if it would change the results of the simulations. It is likely that this error will not have a significant impact on the overall calculations due to the generally small degree of stratification in the system, but the District must determine the defensibility of carrying this error forward if the analyses are not fully redone with the fixed boundary condition. Additionally, the regression utilized for the generation of the boundary conditions should be utilized to calculate the boundary condition during the period of the measured data and the two compared. This will allow for an assessment of the reasonableness of the created boundary for MFL determination.

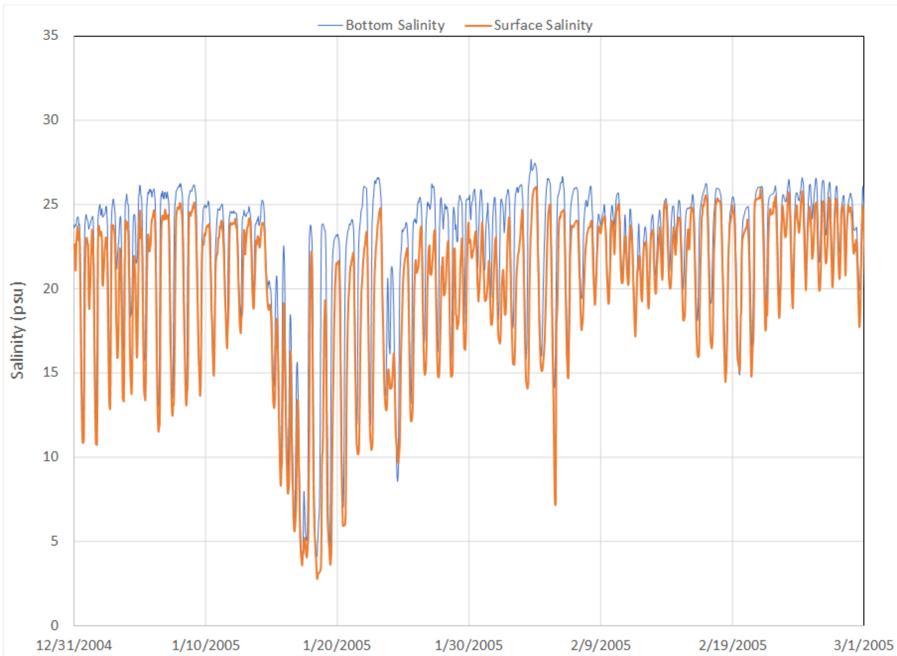

Figure 2-5: Measured Surface and Bottom Salinity Boundary Condition

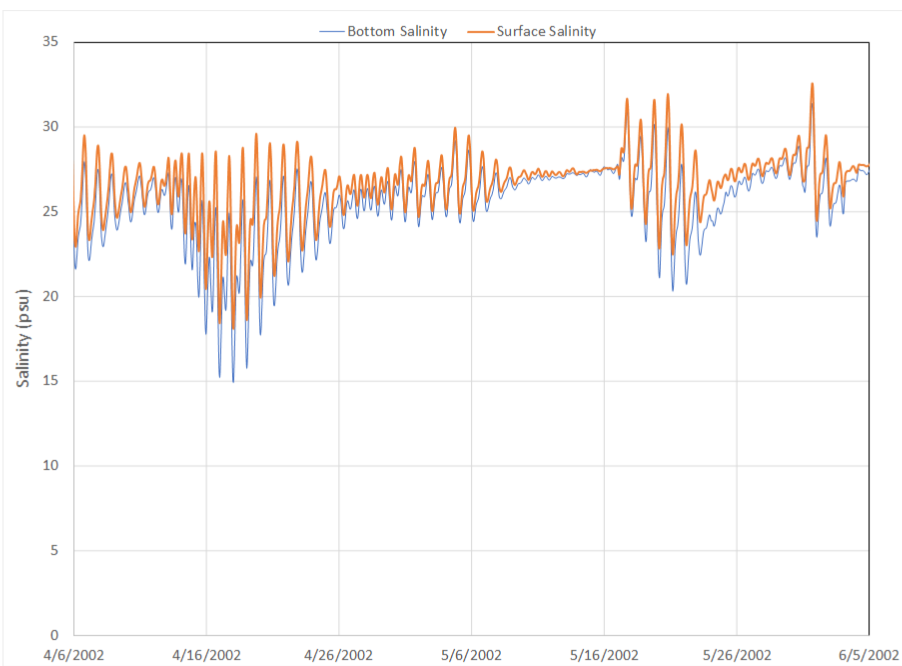

Figure 2-6: Created Surface and Bottom Salinity Boundary Condition

Salinity Regression Modeling

For the lower portion of the Little Manatee River, an analysis was described that utilized a LOESS salinity-flow regression model to predict salinity changes due to flows. This model was described in conjunction with the EFDC model discussed above. For the habitat suitability analyses using an Environmental Favorability Function (EFF) the salinity regression model was used to project salinity changes under flow reductions and resultant evaluations of percent change in habitat for various fish species. The evaluation examined if the changes in salinity projected by the regression model under different flow reduction scenarios would create more than a 15% negative change.

First, it would always be best to utilize a well-developed and sufficiently calibrated hydrodynamic model that accurately represents the system extents and geometry in order to project salinity changes. This is recognized within the appendix documentation where it is identified that a mechanistic model would be the “Gold Standard” for such an evaluation. Such a model would provide for projections of salinities over a more 2-D spatial extent rather than be limited to a more simplistic longitudinal projection which occurs through use of the regression model. Per the documents, the limited timeframe of the EFDC model application (2000 to 2005) relative to available data from 2015-2019 identified the need for an alternate method for projecting salinity changes under this later time frame.

Examination of the documentation on the development of the salinity regression model identified that previous work was completed to develop regressions between flows and salinity for the system. This work was updated such that data through 2019 was utilized. The data came from long-term monitoring along the system. The available data for the regression modeling was relatively robust and represented a reasonable dataset for development of such a regression. Examination of plots presented in the main document and appendices provides a demonstration of the accuracy of the regression model under various flow conditions. Figure 2-7 below presents a plot of the final regression against the available data (right) versus previous regressions prior to the update. The plots show that the updates to the original regressions represented a significant improvement. Examination of the results does show that the revised regression has somewhat of an overprediction bias at the lower salinity levels and somewhat of an underprediction bias in the upper salinities. Figure 2-8 presents comparisons of the salinity projection contours under different flow conditions and location along the river. The results show that the regression model does well in representing the conditions along the overall flow gradient and longitudinally and in some aspects provides a more accurate representation of the data than the EFDC model. Based on the evaluation of the model, the determination is that the regression (within some of the limitations of this type of regression modeling) is sufficient for use in the MFL development.

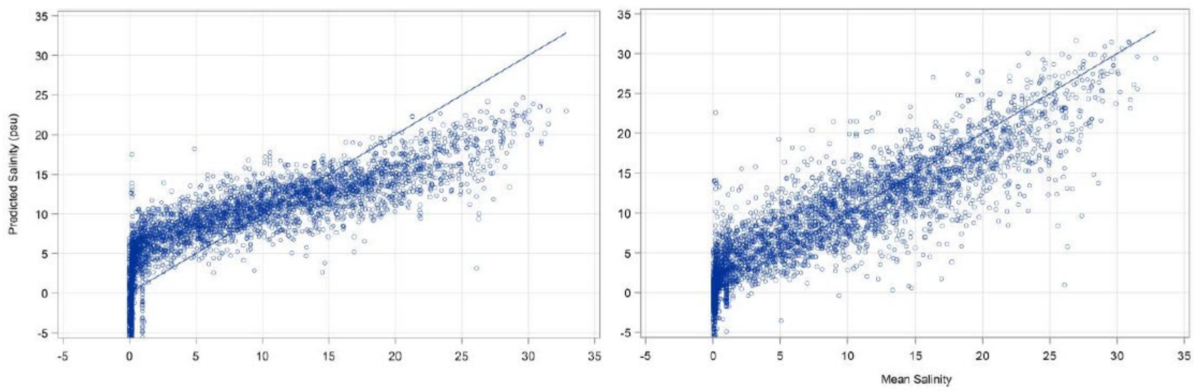

Figure 2-7. Comparison of Original Least Squares Regression to Update LOESS Regression

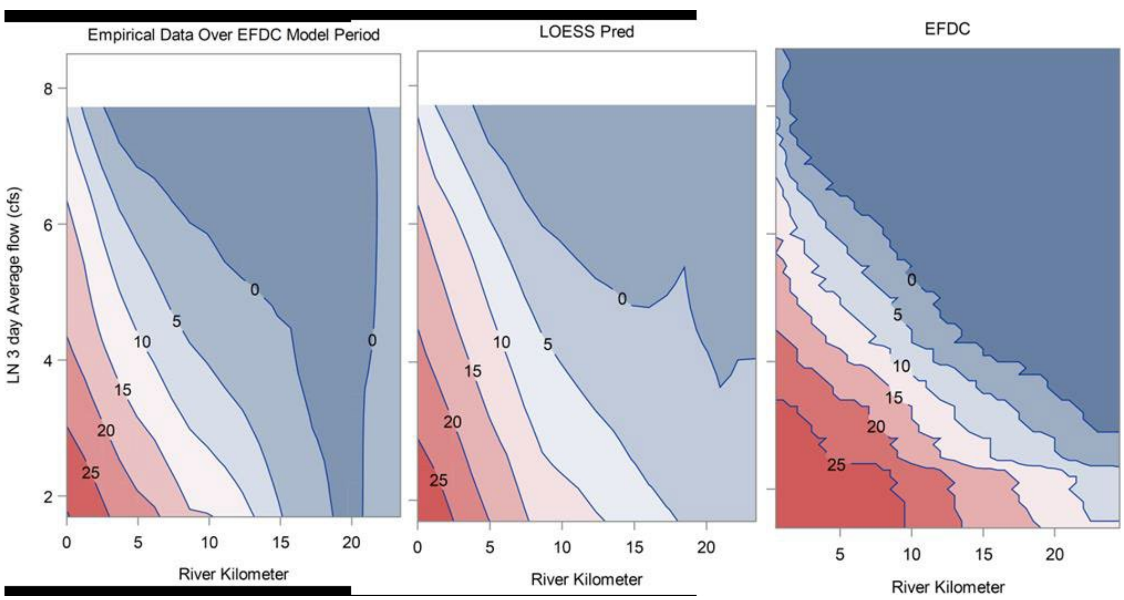

Figure 2-8. Contour Plots of Empirical Data, LOESS Projection, EFDC Projection for EFDC Time Period

<u>Biological Data and Biological Assessment Lower River</u>

The MFL report provided benthic macroinvertebrate community data from a study conducted by Grabe and Janicki (2008, Appendix F), fish and nekton data from the FWC's long-term

Fisheries-Independent Monitoring (FIM) program, and fish data from a study conducted by Dutterer (2006).

The panel agreed that a robust invertebrate and fish community data set was available for the estuarine portion of the river. It was striking that location in the river (river Km) was the single abiotic variable with the highest Spearman rank correlation coefficient to changes in multivariate community structure, suggesting salinity as the principal driver. Examination of the taxa list revealed that the many of the organisms present are adapted to thrive in low but variable salinity. The Little Manatee estuary, which yielded 1,855,578 individuals from 136 taxa (caught in 2,447 seine hauls between 1996 and 2019) and 371,478 individuals (117 taxa) from 1,724 trawls over the same period of record, represents an extremely valuable estuarine habitat. Ichthyoplankton data also indicated that the estuary is a high functioning nursery area. The panel found that SWFWMD's MFL goal to maintain the 1-2 psu habitat conditions associated with salinity-sensitive taxa was an appropriate target.

Residence Time and Low Salinity Habitat in Little Manatee River Estuary

At low to moderate flows, water residence time at the area most likely to support taxa favoring 1-2 psu salinities (river kilometer 15-19) ranges from 1 to 5.6 days (Fig 2-9). This indicates that a fairly narrow, transient area exists that is capable of supporting the taxa that require the 1-2 psu salinity range. This short resident time area is critical for the protection of these salinity-sensitive organisms. For example, Peebles (2008) found that the highest community heterogeneity was associated with higher river flows and lower salinities, indicating that this transient, low salinity habitat is important to protect through the MFL process (Fig 2-10).

Scenario	Upstream gaged inflow (cfs)	Total inflow Q(cfs)	Water age *T* (days) at different distances from the river mouth (Rkm)									
			1	3	5	7	9	11	13	15	17	19
1	7	9	50.0	49.5	49.0	46.8	44.4	39.8	29.1	19.2	13.1	3.1
2	11	18	39.9	39.6	38.8	36.8	34.5	30.2	20.8	12.5	8.6	2.5
3	18	28	32.5	32.3	31.5	29.8	27.5	23.5	14.2	9.6	5.5	1.9
4	21	34	31.3	31.2	30.4	29.2	26.4	22.9	13.6	9.3	5.4	1.8
5	28	41	28.5	28.5	27.9	26.8	23.5	20.5	12.1	7.2	4.5	1.7
6	32	49	27.2	27.1	26.6	25.5	22.3	19.5	11.9	6.3	4.1	1.6
7	35	55	24.4	24.4	23.8	22.8	19.6	17.0	10.1	5.6	3.9	1.5
8	42	62	22.7	22.5	22.0	21.2	17.9	15.6	9.6	5.2	3.3	1.5
9	46	71	21.8	21.5	21.3	20.5	17.1	15.0	9.2	4.7	3.1	1.4
10	53	82	20.9	20.7	20.4	19.8	16.8	14.5	9.0	4.2	3.1	1.3
11	64	96	19.9	19.6	19.4	19.0	16.1	13.9	8.3	3.9	2.6	1.2
12	85	129	15.7	15.5	15.3	14.9	12.4	10.3	4.6	3.4	1.7	1.0
13	124	190	11.1	11.0	10.8	10.6	8.4	6.6	3.7	2.5	1.5	0.8
14	201	305	7.3	7.0	6.9	6.6	5.2	3.4	1.6	1.1	0.6	0.3
15	406	619	3.7	3.3	3.2	2.9	2.1	1.6	1.1	0.7	0.4	0.3
16	710	1078	2.0	1.8	1.6	1.3	1.1	1.0	0.5	0.5	0.3	0.2
17	1780	2707	1.2	1.0	0.7	0.6	0.6	0.4	0.3	0.2	0.2	0.1

* Note that flow values have been converted to cfs.

Fig. 2-9. Residence time associated with various flow conditions by river kilometer (from Huang et al. 2009)

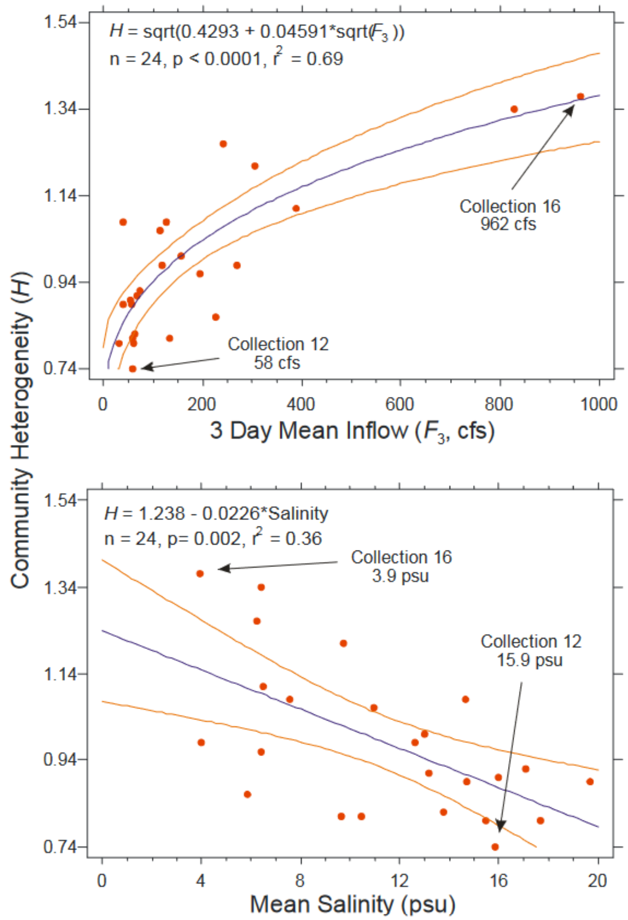

Fig. 2-10. Zooplankton community heterogeneity in Little Manatee River estuary by flow (top panel) and salinity (bottom panel) (from Peebles 2008).

Low Salinity Fish Habitat

The effects of flow reductions on estuarine fish habitat were evaluated using a habitat suitability index for fishes (EFF), based on logistic regression. First, a LOESS model timeseries was used to predict salinity for each date and each 0.1 river kilometer increment from 2015 through 2019. These predicted salinity values were then used as input into the logistic regression model along with the assigned habitat and season categories for each location and date in the timeseries. The report indicated the EFF was a post-hoc modification of the output of logistic regression to compensate for the differences in species prevalence (i.e., how often a species occurs) by adjusting the intercept term by the log odds of the empirical occurrence of the species being modeled. Since the EFF standardizes the outcomes to their average log odds of occurrence, a cut-point value of 0.5 was used to assign “favorable” and “unfavorable” predictions for each species using the LOESS model salinity predictions. Only those t**axa with negative responses to salinity** (they require low salinity) were considered for the MFL analysis. These included Sheepshead (Archosargus probatocephalus), Common Snook, Striped Mojarra (*Eugerres plumieri*), Eastern Mosquitofish (*Gambusia holbrooki*), Naked Goby (*Gobiosoma bosc*), Rainwater Killifish, Clown Goby, Sailfin Molly (*Poecilia latipinna*), Hogchoker, and gobies less than 20 millimeters (small gobies). The effects of flow reductions were quantified as the percent change in area of favorable (low salinity) habitat for these taxa.

For the EFF, flow blocks 1 and 2 were more sensitive to changes in flows than the overall average change across all blocks. For Block 1, Rainwater Killifish, Sailfin Molly, Clown Goby, Naked Goby, and small gobies less than 20 millimeters exhibited a 15% reduction in favorable habitat at a 10% reduction in flows.

At Block 2 flows, Rainwater Killifish, Sailfin Molly, and small gobies exceeded the 15% reduction in favorable habitat threshold at a 20% reduction in flows. The results for Block 3 indicated that none of the species evaluated would see reductions in favorable habitat of 15% or greater until flows were reduced by 30%.

The panel agrees that this was a relevant and rational approach to protect the taxa shown to require low salinity using comprehensive biological data set.

Suggestion: In the conclusions for this topic, it would be useful to summarize how other data considered (e.g., zooplankton) also indicated the need to protect the low salinity habitat, so as to provide as a weight of evidence approach for selection of the 15% EFF habitat reduction. Note that establishing the precise flow blocks for the estuary also needs additional analysis.

Flow Blocks (Upper River)

The District's "building block" approach categorizes the flow record into discrete blocks of low, mid-range, and high flows for the purpose of assessing the potential for significant harm separately for each flow regime. While many previous MFLs defined the blocks based on season with specific days of the year used to differentiate the blocks, the District has recently shifted to a flow-based approach. Blocks in the Little Manatee River MFL are defined using flow thresholds that are independent of day-of-year but do generally correspond to typical seasonal periods of low (dry season), mid-range (transition), and high (wet season) flows. The use of flow-based blocks is an improvement over the seasonal block approach, as it properly accounts for times when flows are higher or lower than expected based on historical seasonal variations alone.

Low-Flow Threshold and Block 1 Definition

Several low-flow metrics were evaluated to determine an appropriate division between flow blocks 1 and 2. These include wetted perimeter, fish passage, instream habitat, and navigability. Upper river fish passage was evidently determined to be the controlling factor for selecting the proposed low-flow threshold of 35 cfs. However, the rationale for choosing the Reach 6 cross section for the fish passage requirement is not entirely clear. The critical flow values for Reaches 2 and 4 would result in a more protective MFL for this criterion, although as pointed out in the text it probably wouldn't be appropriate to tie that to flows at the Wimauma flow gage. Perhaps the analysis could be strengthened by estimating the percent of time fish passage would be impeded under the proposed MFL in upstream reaches 2 and 4, compared to current conditions. This would be similar to the method used in the navigation and sediment transport analyses.

Under the proposed MFL, the reduction in frequency of navigable days is projected to exceed 30 per year in river reaches 4 and 6. This seems significant, yet no standard for significant harm resulting from a loss of navigability was presented. The report could benefit from further discussion of this metric and a conclusion regarding the extent of harm caused by the reductions in frequency of navigable days on the upper river. Operations of the existing Canoe Outpost business should be considered.

Uncertainties in the HEC-RAS analysis due to the questionable cross section data, once resolved, may merit a re-evaluation of the proposed low-flow threshold. Essentially all the upper river analyses rely on the HEC-RAS model output directly or indirectly, and a reasonable model representation of channel geometry is essential to these analyses.

Block 3 Lower Threshold

Upper river floodplain inundation was determined to be the controlling factor for selecting two high flow thresholds of 72 cfs and 174 cfs, with 72 cfs being the proposed division between flow blocks 2 and 3. Based on an allowable 15% reduction in wetland area and frequency of inundation, proposed minimum flows are 87% of the flow on the previous day when the previous day's flow was > 72 cfs and < 174 cfs, or 89% of the flow on the previous day when the previous day's flow was > 174 cfs. Table 2-2 relates high flow percentiles to flow values (from Janicki Environmental, Inc., 2016):

Table 2-2. Relationship between High Flow Percentiles and Flow Values

High Flow Percentiles	Flow Values (cfs)
P60	**72**
P65	86
P70	105
P75	133
P80	**174**
P85	241

Figure 2-11 shows the results of an analysis relating HEC-RAS model-predicted stages to spatial extents of floodplain inundation for various flow percentiles.

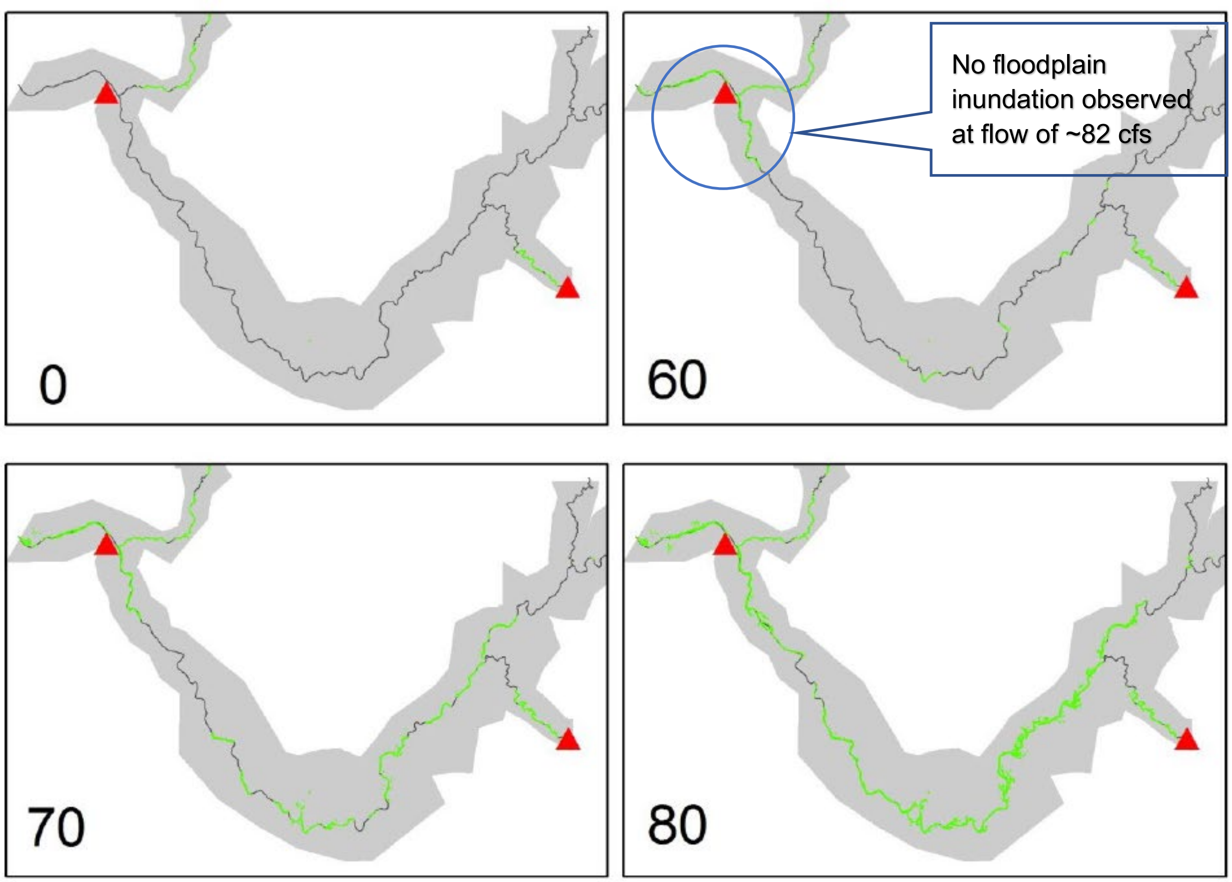

Figure 2-11. Area of Inundated Vegetation (green) as a Function of the Percentile Flow at the USGS Wimauma Gage. USGS flow gages are shown as red triangles. From Janicki Environmental, Inc., 2016.

Janicki Environmental, Inc. (2016) referred to the above figure this way: "This example demonstrates that the floodplain generally does not become inundated until flows are above the 70th percentile (i.e. 110 cfs) though small pockets of wetlands are inundated with flows as low as the 60th percentile (72cfs)." It is not clear from the supporting documentation if this analysis considered channel bank elevations, or only the elevations within the floodplain. There undoubtedly are low areas within the floodplain that are lower than the adjoining riverbank elevations and are therefore hydraulically isolated river until the stage exceeds its banks.

Furthermore, during field observations conducted on October 15, 2021, flow at the USGS Wimauma gage was about 82 cfs, which would be within proposed block 3. Field observations were conducted at several locations, including the entire area along the main river channel circled in blue in Figure 2-11. No floodplain inundation was observed at any of the visited locations. Flows were fully contained within the banks with significant freeboard suggesting much higher flows would be needed to inundate the floodplain. This raises the question of whether the 60^{th} percentile flow (72 cfs) is properly supported as a high-flow threshold.

Recommendation: Consider riverbank elevations, in addition to floodplain topography, in determining the flow threshold at which floodplain wetlands experience significant inundation due to Little Manatee River flows and stages.

Flow Blocks (Lower River)

The flow blocks developed for the Upper River were utilized for the Lower River and determinations made on allowable percent reductions to protect salinity habitat within those flow blocks. As part of the salinity habitat volume and area change analyses calculations were made to identify the sensitivity of the change in habitat to different flow ranges and with and without consideration of the low flow cutoff. The calculations basically showed that salinity habitat changes are most sensitive for the lower salinity conditions (<2ppt) and are most sensitive to changes in the low flow ranges. Presently, flow Block 2 extends from the 35 cfs low flow cutoff up to 72 cfs. 72 cfs is not a significantly high flow value and represents the 60^{th} percentile as outlined in the section above. If flow Block 2 were expanded, i.e. such that the high value is increased, the likely impact would be higher allowable reduction calculations based on the volume and area. It is not clear at present what changing the flow block extents would do to the EFF analyses which presently drive the MFL.

Recommendation: Some additional analyses of the sensitivity of the allowable reductions under differing flow blocks should be provided to assess how the MFL may change depending upon the flow block choices for the Lower River.

2.2 DETAILED COMMENTS

This section presents detailed comments in tabularized form for the MFL report and (where specific comments were provided) supporting documentation. The tables include the location in the report the comment refers to, the specific comment, whether the comment materially impacts the conclusions of the MFL, and proposed corrective actions.

Detailed Comments on Recommended Minimum Flows for the Little Manatee River Draft Report from John Loper, P.E., Anclote Consulting PLLC					
Comment No.	**Peer Reviewer**	**Figure, Table, or Page and Paragraph Number**	**Does Comment Directly and Materially Affect Conclusions of Report? (Yes/No)**	**To be completed by Reviewer(s)** **A. Reviewer's Specific Comments**	**B. Reviewer's Specific Recommended Corrective Action**
1	JL	Page 113, 2nd paragraph	Yes	Review of the HEC-RAS digital model input shows that practically all the river cross sections are represented with idealized flat bottoms. From my field observations, this does not capture the cross-sectional variability in channel depth at many locations (e.g., at channel bends). This raises the question of how many of the source cross sections were surveyed.	Figure 4-1 of the draft MFL report shows the locations of 10 vegetation transects with field surveyed cross sections tied into NAVD88. These were apparently not used in the HEC-RAS model. Please provide a comparison of these with the nearest HEC-RAS cross sections. Characterize the level of accuracy of the modeled cross sections and its ramifications on the reliability of the model output for the MFL analyses. <u>Suggestion:</u> New field survey of the river channel, to supplement the 10 cross sections mentioned above, should be collected to support future updates to the MFL.
2	JL	Table 6-9	No	Minimum flows are to be established at the USGS Wimauma Gage. If withdrawals are proposed further upstream, where flows are lower than at Wimauma gage, how will impacts to the affected upper river reaches be evaluated?	Clarify that upon implementation, future allowable withdrawals would be apportioned based on reach-based flow allocations assumed for this study, relative to flows at the Wimauma gage, or another proposed method.
3	JL	Figure 2-4	No	Soils map doesn't appear to show the current extents of mined lands. Mining and reclamation typically transform the native soils into something quite different.	Suggest revising the soils map to indicate (perhaps using a hatch pattern) areas of mined and reclaimed lands are no longer representative of native undisturbed soils

Detailed Comments on Recommended Minimum Flows for the Little Manatee River Draft Report from John Loper, P.E., Anclote Consulting PLLC					
Comment No.	**Peer Reviewer**	**Figure, Table, or Page and Paragraph Number**	**Does Comment Directly and Materially Affect Conclusions of Report? (Yes/No)**	**To be completed by Reviewer(s)**	
				A. Reviewer's Specific Comments	**B. Reviewer's Specific Recommended Corrective Action**
4	JL	Page 26, last paragraph	No	Did the acreage of wetlands really increase between 1974 and 1990, or is this just an artifact of differences in mapping methodology (i.e., different agencies and mapping scales)?	Clarify the reason for the apparent increase in wetlands.
5	JL	Figures 2-5 through 2-10	No	Mining land use is lumped in with urban land use. These two categories exhibit radically different hydrologic responses to rainfall.	Map the mined lands (excluding those fully reclaimed and re-connected) as a separate land use category. Table 2-1 has this as a separate category.
6	JL	Section 2.4	No	Section 2.4 provides ample evidence that the UFA in the area is well confined. Based on the District's data and analysis, we can conclude streamflow is unlikely to be significantly affected by groundwater withdrawals from the UFA. Should we be concerned that the phosphate mining activities in the eastern portion of the watershed are changing the degree of confinement to the point where the previous statement will no longer be true? In other words, will the removal, via mining, of the upper Hawthorne in mined areas make the SAS and streamflow more vulnerable to withdrawals from the UFA?	Add discussion to the report, following an evaluation of post-reclamation confining unit thickness and characteristics. Suggestion for future data collection: Install nested monitor wells in reclaimed mined lands for comparison with those nearby with undisturbed geology.

Detailed Comments on Recommended Minimum Flows for the Little Manatee River Draft Report from John Loper, P.E., Anclote Consulting PLLC					
Comment No.	Peer Reviewer	Figure, Table, or Page and Paragraph Number	Does Comment Directly and Materially Affect Conclusions of Report? (Yes/No)	To be completed by Reviewer(s)	
				A. Reviewer's Specific Comments	B. Reviewer's Specific Recommended Corrective Action
7	JL	Section 2.5, page 38, first paragraph	No	"…historical excess flows have been trending towards zero since 2000." The paragraph implies this can be attributed to agricultural BMPs. But, to what extend have agricultural excess flows been offset by reduced flows from actively mined lands? Coverage of actively mined lands has increased over the same period, and these lands are essentially severed from the watershed during mining.	Report needs more discussion regarding the impacts of mining on recent streamflow record.
8	JL	Page 42, last paragraph	No	Pumping was reduced by 50% in the scenario and then the changes multiplied by two to estimate no-pumping conditions. Why not just turn off pumping in the model to estimate no-pumping conditions? How was agricultural return flow estimated in ECFTX?	Clarify in report text.
9	JL	Page 113 and Table 5-1	Possibly	How was the flow apportionment ratio by reach determined in the HEC-RAS model? Shouldn't reach # 8, most of which appears to be downstream of the reference USGS streamflow gage, have a flow apportionment ratio of 1.0 instead of 0.92?	Report and/or an appendix needs to include a discussion on how the flow apportionment ratios by reach were estimated.
10	JL	Page 133	Possibly	"Application of the LWPIP approach to the HEC-RAS model results suggested that most of the wetted perimeter inflection points were near the lowest flows considered…" This may be an artifact of the idealized flat channel bottoms used in the HEC-RAS model.	Recommended action in Comment #1: Please provide a comparison of the 10 surveyed cross sections (Figure 4-1) with the nearest HEC-RAS cross sections. Re-do and compare LWPIP analysis for those surveyed cross sections.

Detailed Comments on Recommended Minimum Flows for the Little Manatee River Draft Report from John Loper, P.E., Anclote Consulting PLLC					
Comment No.	Peer Reviewer	Figure, Table, or Page and Paragraph Number	Does Comment Directly and Materially Affect Conclusions of Report? (Yes/No)	To be completed by Reviewer(s)	
				A. Reviewer's Specific Comments	**B. Reviewer's Specific Recommended Corrective Action**
11	JL	Table 6-9	No	If no surface water withdrawals will be permitted during Block 1, when flows are equal to or less than 35 cfs, why are the Block 1 MFLs shown to be 90% of flows on the previous day? Seems contradictory. Should the Block 1 MFL be 100%?	Clarify in the table or accompanying text.
12	JL	Section 6.7.8	No	Critical velocity method was used to evaluate sediment transport. Critical shear stress is a more rigorous approach, and shear stress is one of the outputs of the HEC-RAS model. Was this approach considered?	Consider using critical shear stress method in future river and stream MFL evaluations.
13	JL	Sections 6.7.8 and 6.7.10	No	It is not clear in the report how the flows were modified to simulate the proposed minimum flows at each of the 13 HEC-RAS cross sections. Per Mike Wessel (verbal communication), the flows were apportioned based on the factors in Table 5-1.	Supplement the report text accordingly.

Detailed Comments on Recommended Minimum Flows for the Little Manatee River Draft Report from John Loper, P.E., Anclote Consulting PLLC					
Comment No.	Peer Reviewer	Figure, Table, or Page and Paragraph Number	Does Comment Directly and Materially Affect Conclusions of Report? (Yes/No)	To be completed by Reviewer(s) A. Reviewer's Specific Comments	B. Reviewer's Specific Recommended Corrective Action
14	JL	Page 137, fifth paragraph	Yes	"…(the floodplain is not inundated until the 60th percentile of flow, which is 72 cfs). Did this consider channel bank elevations, or only the elevations within the floodplain? Please provide additional details of the predictive model relating flows and floodplain inundation mentioned at the beginning of this subsection. During field observations, flow at the Wimauma gage was about 82 cfs, and no floodplain inundation was observed at any of the visited locations. Flows were fully contained within the banks with significant freeboard suggesting much higher flows would be needed to inundate the floodplain.	Reconsider the 72 cfs threshold for floodplain inundation
15	JL	Page 163, Table 6-13	No	The critical flows presented in this table are based on "first occurrence of out-of-bank flows", according to the text, which should correspond to initial floodplain inundation. However, all the values are multiples of the 72 cfs at the Wimauma gage cited in Section 6.2 as the flow resulting in floodplain inundation. Please explain this apparent contradiction.	Revise report to reconcile this apparent contradiction.

Detailed Comments on Recommended Minimum Flows for the Little Manatee River Draft Report from John Loper, P.E., Anclote Consulting PLLC					
Comment No.	Peer Reviewer	Figure, Table, or Page and Paragraph Number	Does Comment Directly and Materially Affect Conclusions of Report? (Yes/No)	To be completed by Reviewer(s): A. Reviewer's Specific Comments	To be completed by Reviewer(s): B. Reviewer's Specific Recommended Corrective Action
16	JL	Section 6.7.8.1	Yes	Under the proposed MFL, the reduction in frequency of sediment and detrital transport events relative to baseline is projected to be quite large at certain locations. The report does not include an analysis of the consequences of these reductions. Will significant harm result?	Add a discussion, and a conclusion, regarding the extent of harm caused by the reductions in frequency of sediment and detrital transport events.
17	JL	Section 6.7.10	Yes	Under the proposed MFL, the reduction in frequency of navigable days is projected to exceed 30 per year in river reaches 4 and 6. Seems significant.	Add further discussion and a conclusion regarding the extent of harm caused by the reductions in frequency of navigable days on the upper river. Consider the operations of the existing Canoe Outpost business.
18	JL	Page 19, third paragraph	No	"Level 1 is the most granular…" Level 1 is the most general (least granular) FLUCCS level.	Minor correction to report text

Detailed Comments on Recommended Minimum Flows for the Little Manatee River Draft Report from Steven J. Peene, PhD., ATM, a Geosyntec Company					
Comment No.	**Peer Reviewer**	**Figure, Table, or Page and Paragraph Number**	**Does Comment Directly and Materially Affect Conclusions of Report? (Yes/No)**	**To be completed by Reviewer(s)**	
				A. Reviewer's Specific Comments	**B. Reviewer's Specific Recommended Corrective Action**
1	SP	Page 17, second paragraph	No	Per the discussion in the next paragraph, the tides along the river are a mixture of diurnal and semi-diurnal tides.	Update text
2	SP	Page 20, last paragraph	No	Given the nature of mining activities in this area and the impacts of that specific land use on hydrology, it would be beneficial, if possible, to show mining as its own category labeled mining.	Update text
3	SP	Page 36, last paragraph	No	It would be good at the end of this section to include a discussion of what the information presented in this section means relative to the MFL. Basically identify that surface runoff and interaction with the surficial aquifer drives the flow in this system and the MFL would not need to address losses in flow from the UFA. This is a surface water withdrawal issue	Update text
5	SP	Page 46, Section 3.1.1	No	Should expand on what special protections the OFW designation provides in terms of regulations, regulatory authority, or allowable impacts.	Update text

Detailed Comments on Recommended Minimum Flows for the Little Manatee River Draft Report from Steven J. Peene, PhD., ATM, a Geosyntec Company					
				To be completed by Reviewer(s)	
Comment No.	**Peer Reviewer**	**Figure, Table, or Page and Paragraph Number**	**Does Comment Directly and Materially Affect Conclusions of Report? (Yes/No)**	**A. Reviewer's Specific Comments**	**B. Reviewer's Specific Recommended Corrective Action**
6	SP	Page 47, Section 3.2, first paragraph	No	There are inconsistencies in ways and detail in how the upper river water quality results are presented compared to the lower river water quality. The flow of the document and the clarity would benefit from consistent presentations of the water quality results summaries in this section.	Modify the sections in water quality write up to present in a consistent manner where appropriate
7	SP	Page 48, third paragraph	No	There is also an increasing trend in pH which should be mentioned here. That isn't necessarily a positive or negative thing, but it should be discussed.	Update text
8	SP	Page 48, third paragraph	No	Is there a need to discuss the increasing trend in fluoride? This can be a result of mining activity and is worthy of further discussion on what it means.	Consider and update text if determine it makes sense.
9	SP	Page 48, fourth paragraph	No	Table 3-2 referenced here in the text does not have the p values as stated which show the relationships with flow. It seems like the table with the regression analyses is missing from this section	Bring in the right table and reference it.
10	SP	Page 48, fifth paragraph	No	Nitrogen also showed an increasing trend per the table, but this is not discussed here, either for total nitrogen or nitrate-nitrite.	Update text
11	SP	Page 51, Table 3-3	No	The title in this table references the regression analysis results which are not presented in the table.	Update title and bring in correct table per earlier comments

Detailed Comments on Recommended Minimum Flows for the Little Manatee River Draft Report from Steven J. Peene, PhD., ATM, a Geosyntec Company					
				To be completed by Reviewer(s)	
Comment No.	**Peer Reviewer**	**Figure, Table, or Page and Paragraph Number**	**Does Comment Directly and Materially Affect Conclusions of Report? (Yes/No)**	**A. Reviewer's Specific Comments**	**B. Reviewer's Specific Recommended Corrective Action**
12	SP	Page 54, first paragraph	No	Whenever FDEP thresholds are used in the analyses, the text needs to clearly caveat that these analyses do not represent a determination of impairment.	Update text
13	SP	Page 54, first paragraph	No	Need to always state that these are geometric means.	Update text
14	SP	Page 54, second paragraph	No	Same comment as above on caveating the analyses where FDEP thresholds are utilized.	Update text
15	SP	Page 125, fifth paragraph	No	It is recommended that the Huang and Liu report, which is the only somewhat complete presentation of the development of the EFDC model, be included as an Appendix and referenced as such here.	Include report as an appendix
16	SP	Page 126	No	Site 02300532 which is the most upstream site did not collect specific conductance and temperature. This is the one station above the braided area in the river which is a critical section of the model for salinity projections especially in the lower salinity ranges, i.e., 0.5 to 5 ppt.	No action
17	SP	Page 126	No	The Aquaterra report should be included in the appendices and referenced in the document as such.	Include report as an appendix

Detailed Comments on Recommended Minimum Flows for the Little Manatee River Draft Report from Steven J. Peene, PhD., ATM, a Geosyntec Company					
				To be completed by Reviewer(s)	
Comment No.	Peer Reviewer	Figure, Table, or Page and Paragraph Number	Does Comment Directly and Materially Affect Conclusions of Report? (Yes/No)	A. Reviewer's Specific Comments	B. Reviewer's Specific Recommended Corrective Action
18	SP	Page 126	No	This document provides a short summary of the data that was used in the development of the model. This is good to give the reader of the main document an idea of how it was developed and calibrated. A key data set was not described, i.e., the data that was used for the shoreline and depths which went into the model grid. These data are not described in the Huang and Liu report either.	Update text to include discussion of data used for grid shoreline and depths.
19	SP	Page 126	Maybe	The representation of the shoreline in the EFDC model is not good in places. This is particularly the case in the lower river but also into some of the upper estuary areas (braided sections). This raises a concern if the representation of the system volume and bottom area (which are key drivers in the MFL analyses) are sufficient to accurately predict the net changes under differing flow reduction scenarios.	A recommendation would be to use available data (LIDAR and bathymetry) to calculate the volume and area as a function of river outside of the grid and then using the grid. A comparison will identify if the model reasonably captures the area and volume as a function of river mile.

Detailed Comments on Recommended Minimum Flows for the Little Manatee River Draft Report from Steven J. Peene, PhD., ATM, a Geosyntec Company					
				To be completed by Reviewer(s)	
Comment No.	**Peer Reviewer**	**Figure, Table, or Page and Paragraph Number**	**Does Comment Directly and Materially Affect Conclusions of Report? (Yes/No)**	**A. Reviewer's Specific Comments**	**B. Reviewer's Specific Recommended Corrective Action**
20	SP	Page 126	Maybe	The statistics and plots presented in the reports show very good agreement between the data and the model for water levels, salinity and temperature which may indicate that the overall representation of the system, while not highly accurate horizontally, may be accurate relative to volume and depths longitudinally. This will be identified based on the recommendations in the previous comments.	See recommendation for comment 19
21	SP	Page 133	No	This graphic is not highly useful in terms of evaluating the representation of the grid. A better graphic, depicting the grid should be created by overlaying the grid onto aerial photography to provide a better visual of the grid representation. In addition to the graphic of the grid, a graphic showing the depths in the model should be provided.	Develop a better graphic that shows how the grid represents the system, perhaps overlain onto an aerial photo.
22	SP	Page 136	No	If only salinities over the dates from 2015 through 2019 are utilized in the analyses, it is important to discuss how representative of overall hydrologic conditions this period is.	Provide an assessment of the hydrologic conditions for this period against the conditions over the full period of record.
23	SP	Page 136	No	In the EFDC presentation within the main report, there is discussion on the accuracy of the model in simulating salinities. Some discussion should be provided here on the accuracy of the salinity regression.	Update text

Detailed Comments on Recommended Minimum Flows for the Little Manatee River Draft Report from Steven J. Peene, PhD., ATM, a Geosyntec Company

Comment No.	Peer Reviewer	Figure, Table, or Page and Paragraph Number	Does Comment Directly and Materially Affect Conclusions of Report? (Yes/No)	To be completed by Reviewer(s) A. Reviewer's Specific Comments	 B. Reviewer's Specific Recommended Corrective Action
24	SP	Page 145	Maybe	In the other reports on the EFDC model, the period of data collection was only described for 2004 to 2005. The simulations for the area and volume calculations were outside of the period of available data. The data that was used for the simulation boundary conditions needs to be described. Examination of the data in the EFDC input files appears to indicate it is a combination of generated and measured data. This needs to be discussed here and in other sections of the appendices.	Update text to describe how the data for the boundary condition in the EFDC model was developed over the full period of the simulations.
25	SP	Page 145	No	As the 2000 to 2005 period was used for the volume and area calculations, it is important to show or discuss in this section how that period is reflective of the overall hydrology.	Provide an assessment of the hydrologic conditions for this period against the conditions over the full period of record.
26	SP	Page 149	No	I think the number in the Block 2 here is not correct. I believe it should be 21% and not 31% based on the graphs above.	Update text

Detailed Comments on Recommended Minimum Flows for the Little Manatee River Draft Report from Steven J. Peene, PhD., ATM, a Geosyntec Company					
				To be completed by Reviewer(s)	
Comment No.	**Peer Reviewer**	**Figure, Table, or Page and Paragraph Number**	**Does Comment Directly and Materially Affect Conclusions of Report? (Yes/No)**	**A. Reviewer's Specific Comments**	**B. Reviewer's Specific Recommended Corrective Action**
27	SP	Page 151	No	It would be beneficial to present the comparison of the updated model predictions to the measured data as is done in the appendices with some discussion on the accuracy of the regression for projecting salinity. This was done in Section 5 for the EFDC modeling and should be presented in Section 5 for the salinity regressions used in the habitat analyses.	Update text
28	SP	Page 154	Maybe	Is there an argument to be made that the MFL should reflect the most sensitive species so that Sailfin Molly should be the driver of the MFL under this analysis?	Provide reasons for not using the most sensitive species.
29	SP	Page 155	No	It was good that this type of run was done to show what having the low flow cutoff means to the analyses.	No action
30	SP	Page 156	No	It is important to note that the salinity regressions do not differentiate lateral differences in salinity off the main stem. While they do appear to utilize some data off of the main stem, the end result by river mile provides for a single condition to compare against with no lateral variability. A 3-D model like EFDC, if properly developed and providing good resolution of the system longitudinally and laterally would provide this.	No action

Detailed Comments on Recommended Minimum Flows for the Little Manatee River Draft Report from Russ Frydenborg, Frydenborg EcoLogic					
Comment No.	Peer Reviewer	Figure, Table, or Page and Paragraph Number	Does Comment Directly and Materially Affect Conclusions of Report? (Yes/No)	To be completed by Reviewer(s)	
				A. Reviewer's Specific Comments	B. Reviewer's Specific Recommended Corrective Action
1	RBF	Chapter 1.1	No	Historical MFL approaches and SWFWMD MFL institutional knowledge could be better summarized.	In the future (not associated with current MFL), compile a table that summarizes the relationship between previous, successful MFL approaches/metrics and protection against significant harm.
2	RBF	Chapter 2.2	No	Discussion on land use, land use changes, and current status of the system could be better quantified.	Please calculate Landscape Development Intensity Index (LDI) on 100 m buffer adjacent to river channel to determine if system is <2, representing minimally disturbed reference conditions.
3	RBF	Chapter 2	No	The river was not classified in hydrobiogeomorphological terms.	For future riverine MFLs, please consider use of John Kiefer's Florida-specific approach to classify river by hydrobiogeomorphology.
4	RBF	Figure 3-5, Table 3-8	No	Would occurrences of chlorophyll a >11 ug/L as an annual geometric mean be expected to increase at MFL implementation withdrawals in the Little Manatee River estuarine nutrient region?	Please provide analysis with short discussion.
5	RBF	Chapter 3.3.1	No	Marine portions of the system should continue to achieve the Chapter 62-303, F.A.C. requirement that the daily average percent DO saturation not be below 42 percent saturation in more than 10 percent of the samples.	No action needed.

Detailed Comments on Recommended Minimum Flows for the Little Manatee River Draft Report from Russ Frydenborg, Frydenborg EcoLogic					
Comment No.	Peer Reviewer	Figure, Table, or Page and Paragraph Number	Does Comment Directly and Materially Affect Conclusions of Report? (Yes/No)	To be completed by Reviewer(s)	
				A. Reviewer's Specific Comments	**B. Reviewer's Specific Recommended Corrective Action**
6	RBF	Chapter 4.2.1	No	Based on data provided by SWFWMD, the FDEP substrate availability scores were not related to velocity scores.	No action needed.
7	RBF	Chapter 4.2.1	No	Average SCI score (55) shows that upper river is healthy at existing water withdrawals.	Please report this finding.
8	RBF	Appendix G, Table 4-4	No	Are upland occurrences of *Quercus laurifolia* (swamp laurel oak) actually *Quercus hemisphaerica* (sand laurel oak)?	Check species differentiation for future vegetation studies.
9	RBF	Chapter 7.1	No	Sea level rise will contribute to non-attainment of MFL.	Monitor and revise as needed.
10	RBF	Figure 5-3	No	Caption indicates 7 sites for substrate/cover collection, and map shows 8 locations.	Revise as appropriate.
11	RBF	Section 6.5	Maybe	LOESS model salinity predictions suggested that the inclusion of the 35 cfs low flow water withdrawal threshold would be protective of adverse changes (>15%) in favorable habitat for the species requiring the 1-2 psu salinity area. Selection of other precise flow block thresholds for the lower river would benefit from additional analysis.	See comments by Dr. Peene.
12	RBF	Chapter 1.1	No	I agree with the 15% change metric as a measure to protect against significant harm and expect that the EPA Biological Condition Gradient could help support its use.	In the future (not associated with current MFL), please consider how the 15% change metric would affect aquatic communities in relation to the EPA Biological Condition Gradient.

Detailed Comments on Recommended Minimum Flows for the Little Manatee River Draft Report from Russ Frydenborg, Frydenborg EcoLogic					
Comment No.	**Peer Reviewer**	**Figure, Table, or Page and Paragraph Number**	**Does Comment Directly and Materially Affect Conclusions of Report? (Yes/No)**	**To be completed by Reviewer(s)**	
				A. Reviewer's Specific Comments	**B. Reviewer's Specific Recommended Corrective Action**
13	RBF	Table 3-2, 3-3	No	Organic nitrogen shows an increasing trend at stations 129 and 140, can this be associated with tannin inputs from the floodplain or agriculture?	Provide short narrative if answer is known.
14	RBF	Section 6-5	No	While the EFF ultimately was the basis for the MFL, it would be useful to summarize how other data considered (e.g., zooplankton, vegetation) also indicated the need to protect the low salinity habitat.	Please provide short summary describing the weight of evidence indicating the need to protect the low salinity zone.

Detailed Comments on Hydrodynamic Modeling of the Little Manatee River from Steven J. Peene, PhD., ATM, a Geosyntec Company					
				To be completed by Reviewer(s)	
Comment No.	**Peer Reviewer**	**Figure, Table, or Page and Paragraph Number**	**Does Comment Directly and Materially Affect Conclusions of Report? (Yes/No)**	**A. Reviewer's Specific Comments**	**B. Reviewer's Specific Recommended Corrective Action**
1	SP	Page 10, first paragraph	No	The available data for model calibration from April 2004 to June 30, 2005 is sufficient for the purpose of model calibration	No action
2	SP	Page 11, Table 3.1, title	No	While it is stated in the text, the table should show the period of record (of good data) for each station.	Update table
3	SP	Page 11, Table 3.1	Maybe	There is no specific conductance data above the braided section of the river so no way to know if the salinity above this area is reasonably calibrated. It is this salinity area, i.e., the less the 2 ppt area that drives the MFL calculations.	For discussion
4	SP	Page 11, Figure 3-1	No	It is typically better to show the measurement stations on a map and not on the grid for reference purposed.	Provide a better station map

Detailed Comments on Hydrodynamic Modeling of the Little Manatee River from Steven J. Peene, PhD., ATM, a Geosyntec Company					
Comment No.	**Peer Reviewer**	**Figure, Table, or Page and Paragraph Number**	**Does Comment Directly and Materially Affect Conclusions of Report? (Yes/No)**	**To be completed by Reviewer(s)**	
				A. Reviewer's Specific Comments	**B. Reviewer's Specific Recommended Corrective Action**
5	SP	General	Maybe	Review of the model input files provided identified some issues with the downstream boundary conditions utilized in the EFDC model. The first issue is that it appears that the surface and bottom salinity were mistakenly flipped for a portion of the modeling period. This corresponds to the time frame for the boundary conditions outside of the period of the measured data. The second issue is that (based on investigation by District staff) and examination of the input files, the boundary condition for the earlier parts of the simulation 2000 through 2003 were based on "created" water levels, salinities and temperatures versus measured water levels salinities and temperatures. The portions of the simulation where measured data were available utilized measured data. The "created" conditions came from harmonic tides and regressions for salinity. The regressions were developed by HSW at the time. It should be noted that for the MFL presented, the HSW regressions were updated.	Recommendations on how to evaluate the impact of the issues raised are provided with the narrative text.

Detailed Comments on Hydrodynamic Modeling of the Little Manatee River from Steven J. Peene, PhD., ATM, a Geosyntec Company					
Comment No.	Peer Reviewer	Figure, Table, or Page and Paragraph Number	Does Comment Directly and Materially Affect Conclusions of Report? (Yes/No)	To be completed by Reviewer(s)	
				A. Reviewer's Specific Comments	**B. Reviewer's Specific Recommended Corrective Action**
5	SP	Page 16, first paragraph	Maybe	The discussion in this section is an inadequate description of the development of the model grid and the sources of data that went into it. It does not provide any discussion of the source of the shoreline data that the model grid was developed from nor the bathymetric data that was utilized to interpolate onto the grid. It provides no documentation of the accuracy of the physical representation of the depths in the system. The discussion of the grids horizontal representation of the system states that it "adequately approximates the boundaries and the bayous" but examination of the figures provided doesn't support that well. Additionally, there are tributaries and other aspects that are not represented.	Do demonstration outlined in earlier comments on the main document
6	SP	Page 16, first paragraph	Maybe	There is no discussion of the impact of flooding and drying in the system and if it plays an important role in the hydrodynamics. Examination of aerial photography in the area would indicate some significant tidal marsh areas which would be expected to flood and dry.	Do demonstration outlined in earlier comments on the main document

Detailed Comments on Hydrodynamic Modeling of the Little Manatee River from Steven J. Peene, PhD., ATM, a Geosyntec Company					
				To be completed by Reviewer(s)	
Comment No.	Peer Reviewer	Figure, Table, or Page and Paragraph Number	Does Comment Directly and Materially Affect Conclusions of Report? (Yes/No)	A. Reviewer's Specific Comments	B. Reviewer's Specific Recommended Corrective Action
7	SP	Page 20, Figure 4.2.2	No	Station 554 should not be presented as part of the model calibration as this is the boundary forcing station. It is good to present the comparison to show that the boundary is well represented in the model, but it does not belong in the model calibration discussion.	Adjust text and figures
8	SP	Page 25, Figure 4.3.2	No	As was identified for the model calibration period, the comparisons for Station 554 should not be presented for the model validation.	Adjust text and figures

3.0 REFERENCED LITERATURE

Hood, J., M. Kelly, J. Morales, and T. Hinkle. 2011. Proposed Minimum Flows and Levels for the Little Manatee River – Peer Review Draft. Prepared by the Southwest Florida Water Management District, Brooksville, Florida.

Interflow Engineering, Inc., 2008. Myakka River Watershed Initiative, Historical and Future Conditions Technical Memorandum. Prepared for the Southwest Florida Water Management District, Brooksville, Florida.

Janicki Environmental, Inc., November 2016. Technical Memorandum D-8, Memo on Floodplain Inundation. Prepared for the Southwest Florida Water Management District, Brooksville, Florida.

Jones Edmunds, Inc., 2015. Little Manatee River Watershed Master Plan Update. Prepared for Hillsborough County Board of County Commissioners.

PBS&J, 2002.Little Manatee River Watershed Management Plan, Final Report, Volume 1. Prepared for Hillsborough County Board of County Commissioners.

ZFI Engineering and Construction, Inc. (ZFI). 2010. HEC-RAS Modeling of the Little Manatee River. Prepared for the Southwest Florida Water Management District, Brooksville, Florida.