DRAFT TECHNICAL MEMORANDUM

Date: January 29, 2024

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From: Jeffrey N. King, PhD PE CFM
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Subject: Lake Prevatt Minimum Flows and Levels Peer Review
Task B2: Draft Peer-Review Memorandum

Executive Summary

The St. Johns River Water Management District may wish to refine a numerical simulation of Lake Prevatt water levels, in Orange County, Florida, prior to using this simulation to inform determination of minimum lake levels, in satisfaction of State of Florida Water Resource Implementation Rule 62–40.

The district may wish to revise the simulation to

- Delineate watershed to areas that drain to Lake Coroni and Lake McCoy.
- Simulate the periodic hydraulic connection between Lake McCoy and Lake Coroni.
- Simulate the periodic hydraulic connection between Lake Coroni and Lake Prevatt
- Refine the surface-water conveyance system to include stormwater management ponds, culverts, weirs, and other constructed and natural water control features

that both convey surface water through the watershed to Lake Prevatt, and retain and detain surface water throughout the watershed.
- Simulate climate uncertainty.
- Use a shorter duration time step, such as 15 minutes.

The district may wish to revise the report that describes the simulation to

- Include a link-node diagram.
- Formally discuss adaptive management.
- Describe climate uncertainty.
- Use and reference additional source material.
- Justify calibrated leakance with literature reference to simulations of similar hydrologic and hydrogeologic systems, such as the EFCTx simulation or the NFSEG simulation.

This memorandum also includes other revision recommendations.

Introduction

St. Johns River Water Management District (SJRWMD) published the following introduction and background statement in engineering and environmental services contract 39104, work order 1:

> The St. Johns River Water Management District (District), as mandated by state water policy, is engaged in a District-wide effort to establish [minimum flows and levels (MFLs)] for priority lakes, streams and rivers, wetlands, springs, and groundwater aquifers. MFLs designate the minimum hydrologic conditions that must be maintained in these water resources to prevent significant harm resulting from permitted water withdrawals.
>
> Lake Prevatt [(**Figure 1**, **Figure 2**, **Figure 3**)] is an MFLs priority waterbody located within the Wekiva Springs State Park, approximately 2 miles northeast of the city of Apopka, in Orange County, Florida. Minimum levels were adopted for Prevatt Lake in 1998. The peer review services described herein will support the reevaluation of minimum levels for Prevatt Lake, based on updated methods and data. Lake Prevatt receives water from direct precipitation, surface runoff, and base flow, and loses water primarily through evaporation, an outflow to Carpenter Creek (which then drains to Mill Creek and Rock Springs Run) and seepage to the Upper Floridan Aquifer.
>
> District staff developed and calibrated a continuous simulation hydrological model for Lake Prevatt using Hydrological Simulation Program – FORTRAN (HSPF). The HSPF model was set up for the period 1995 to 2020 and then calibrated and validated for the periods 2008 to 2020 and 1995 to 2007, respectively.
>
> Once successfully calibrated and validated, the model was extended to the period from 1953 to 2020 for long-term simulations. Long-term simulations are important because MFLs assessments often require frequency analysis of lake levels. Due to the presence of short- and long-term climatic cycles (e.g., El Nino Southern and Atlantic Multidecadal Oscillations), the frequencies of lake levels could be significantly different in wet periods such as in the 1960s than dry periods such as in the 2000s. Thus, it is important to perform a frequency analysis using long-term lake levels so that the effect of short- and long-term climatic variations on lake

levels can be captured. Although observed long-term lake levels are available, the data is usually discontinuous and sometimes sparse. A complete MFLs analysis includes developing a long-term simulation model, simulating no-pumping (pre-withdrawal) and current-pumping condition lake levels and typically performing a frequency analysis to assess the current and future status of the MFLs. Review of this HSPF model will occur as part of the comprehensive Central Florida Water Initiative (CFWI) peer review process.

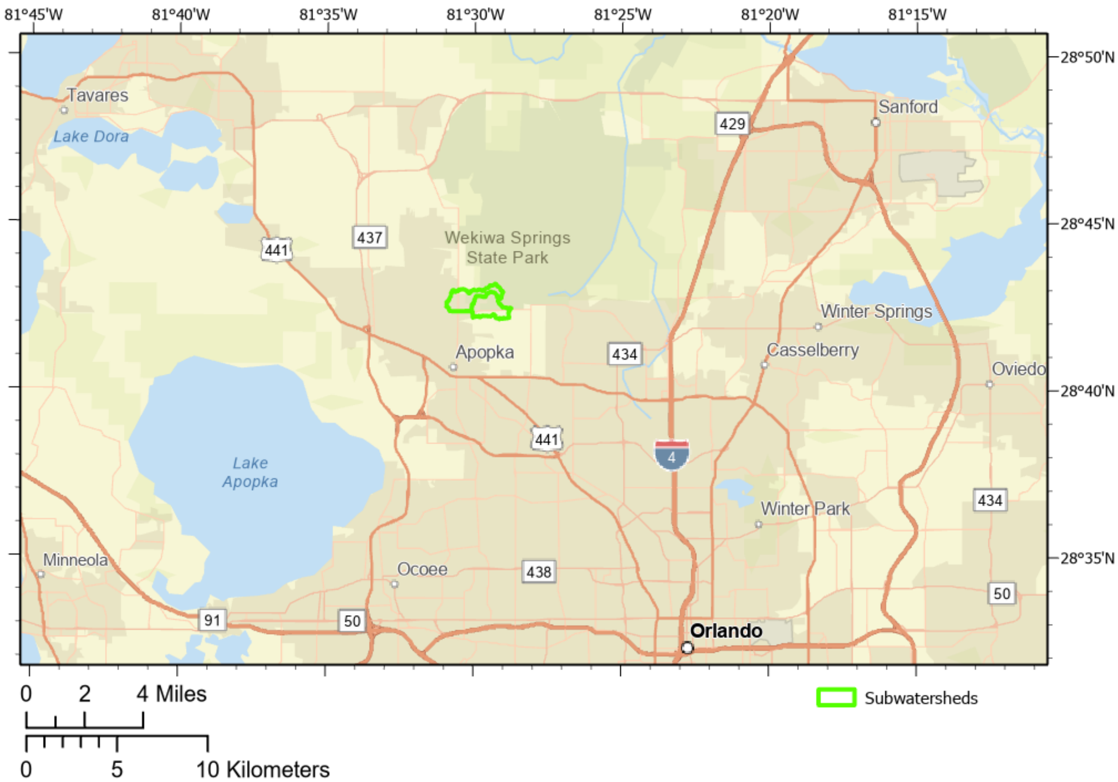


Figure 1. Lake Prevatt sub-watersheds (green polygons) delineated by Sarker and others (2023), over the ESRI World Street Map at a regional scale.

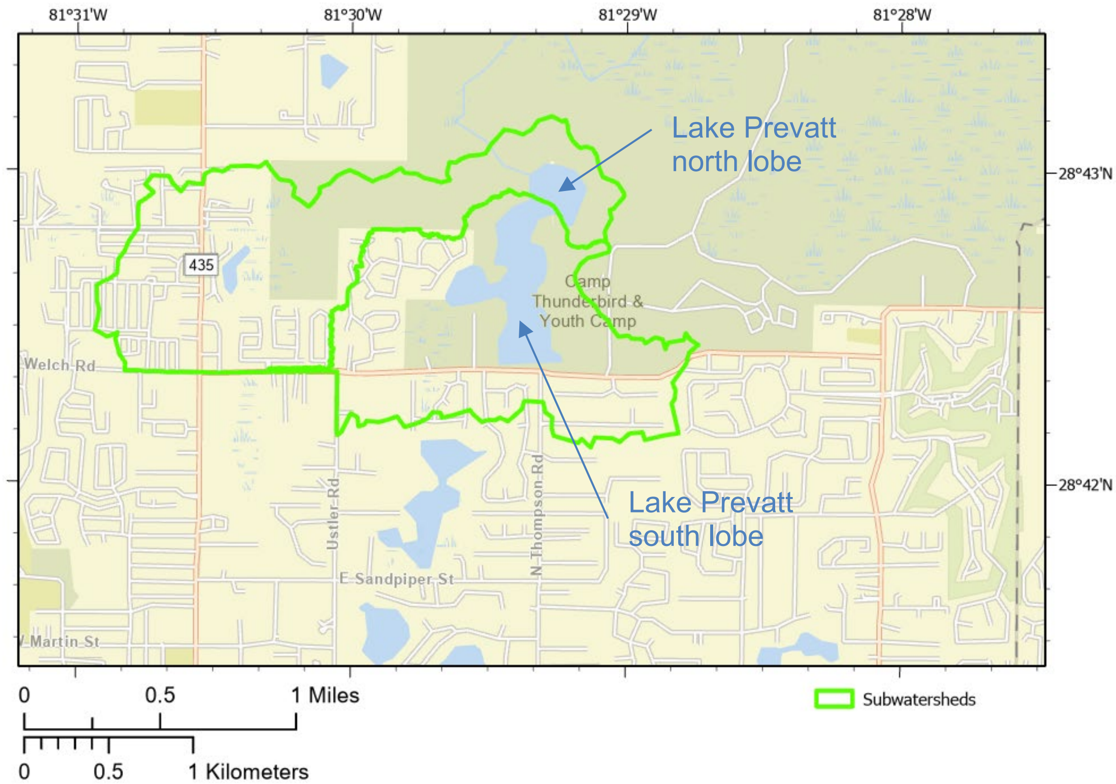


Figure 2. Lake Prevatt sub-watersheds (green polygons) delineated by Sarker and others (2023), over the ESRI World Street Map at a local scale.

Figure 3. Lake Prevatt sub-watersheds (green polygons) delineated by Sarker and others (2023), over a January 28, 2021 aerial photograph attributed to Orange County.

State of Florida states in Water Resource Implementation Rule 62.40.473 that in determining an MFL, "consideration shall be given to natural seasonal fluctuations in water flows or levels, non-consumptive uses, and environmental values associated with coastal, estuarine, riverine, spring, aquatic, and wetlands ecology, including" the following ten water-resource values:

(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

(j) Navigation

SJRWMD's numerical simulation of Lake Prevatt water-surface elevation will inform SJRWMD's consideration of these values to determine an MFL for Lake Prevatt.

This draft technical memorandum constitutes task B2 of SJRWMD engineering and environmental services contract 39104, work order 1: an independent technical peer review of a simulation of Lake Prevatt levels with HSPF (Sarker and others, 2023).

In December 2023, SJRWMD identified Dr. Jeffrey King, PhD PE CFM, Principle Engineer, Geosyntec Consultants, as the independent peer reviewer for the Lake Prevatt HSPF long-term simulation of the hydrologic cycle and lake levels.

SJRWMD, Dr. King, and interested parties visited Lake Prevatt, the Lake Prevatt simulation domain, and south of the domain on December 11, 2023, as task A of work order 1. Dr. King described task A in a memorandum dated December 13, 2023.

SJRWMD conducted a public, virtual workshop on January 16, 2024, as task B1 of work order 1. Prior to this workshop, Dr. King conducted an initial, cursory review of the HSPF simulation and supporting documents. During this initial workshop, Dr. King presented initial comments related to his cursory review. Dr. King published maps, figures, tables, and slides that he used in the presentation. In the January 16 workshop, District staff commented that EFCTx is a relevant leakance reference for Lake Prevatt. Dr. King described the task B1 workshop in a January 24 email to David Christian, PE, Senior Project Manager, Division of Basin Management and Modeling, SJRWMD. Dr. King attached the January 16 publication to the January 24 email.

Subsequent to the January 16 workshop, Dr. King substantially completed an independent technical peer review. Dr. King describes the substantially complete, independent technical peer review in this task B2 technical memorandum.

SJRWMD and Dr. King will present this draft, independent technical memorandum to stakeholders and the general public in a virtual workshop on or near February 5, 2024, as task C1 of work order 1. Stakeholders and the general public may ask questions or share concerns in the task C1 workshop.

Subsequent to the task C1 workshop, Dr. King may revise or refine this task B2 draft technical memorandum. Dr. King will publish a final technical memorandum by February 14, as task C2 of work order 1. Publication of the final technical memorandum will constitute the conclusion of this independent technical peer review of SJRWMD's numerical simulation of MFLs in Lake Prevatt, in Orange County, Florida.

Task C1 and C2 milestone dates presented in this section are approximate; SJRWMD may reschedule these milestones.

Task B2 Scope

The following scope governs task B2:

B.2 Draft Peer Review Technical Memorandum: Consultant shall prepare a draft TM summarizing the findings and recommendations related to the peer review of the Lake Prevatt HSPF model, long-term simulations and report and other files and submit to the District.

As part of their review process, the Consultant shall provide answers to the following questions in the TM.

1) Assess the adequacy and appropriateness of the data used in model development and calibration.
    a) Was "best information available" utilized to develop and calibrate the HSPF model?
    b) Are there any deficiencies regarding data availability?
    c) Was relevant information available that was discarded without appropriate justification? Would use of discarded information significantly affect results?
2) Assess the validity, defensibility and appropriateness of the model development, and calibration.
    a) Determine if the model is appropriate, defensible, and valid, given the District's MFLs approach.
    b) Evaluate the validity and appropriateness of all assumptions used in the model developme and calibration.
        - Are the assumptions reasonable and consistent given the "best information available"?
        - Is there information available that could have been used to eliminate any of the assumptions? Could the use of this additional information substantially change the models results?

c) Review the HSPF model input and output data including an examination of:

- Model elevations vs collected data to verify same datum used consistently
- Flow/stage plots to look for model instabilities
- Output file for model warnings (full flow channels, flooded nodes, etc.) and fl classification summary
- Continuity error and convergence data
- Runoff and infiltration volumes to check for reasonableness
- Values assigned to model parameters to check for reasonableness
- Groundwater data use in model inputs
- Methodologies used to develop input data for long-term simulations
- Long-term simulation results to check for reasonableness

The development of an independent water budget will be included in this subtask.

Deliverable: Consultant shall prepare a draft TM summarizing their findings and recommendations regarding the Lake Prevatt HSPF model, long-term simulations and reports and submit to the District. The water budget shall be included in the deliverable.

This draft technical memorandum is structured to describe data and simulation elements, as stipulated in the task B2 scope. Each element is divided into sub-elements based on the B2 scope. I offer comments in each sub-element. For ease of subsequent reference, comments are numbered across elements, and across sub-elements, such that each comment in this peer review has a unique number.

Data

This data element of the independent technical peer review addresses the following sub-elements: (A) whether SJRWMD used best-available information to develop and calibrate the simulation; (B) whether necessary information was not available to SJRWMD to develop, calibrate, and verify the simulation; (C) whether SJRWMD discarded relevant information without appropriate justification; and (D) whether discarded information will change results.

A. Best-Available Information

SJRWMD used best available topographic land surface elevation, bathymetric lake-bed elevation, groundwater elevation, rainfall depth, evapotranspiration, hydrologic soil type, and land cover type to develop the numerical simulation. Groundwater elevation time series are reasonable. SJRWMD did not use available information detailed in comments 1, 2, and 3, below, to develop the simulation. SJRWMD may wish to revise the simulation and the report that describes the simulation to use additional relevant information, detailed in comments 1, 2, and 3, and to improve the documentation of available information in the report.

1. Sarker and others (2023) stated that the “area-weighted average of NEXRAD data was determined to provide the most accurate source for rainfall within the Prevatt watershed.” SJRWMD may wish to quantify how this rainfall source is the most accurate, compared to other sources.
2. SJRWMD used best available lake level measurements in Lake Prevatt to calibrate and verify the simulation. SJRWMD used lake water-surface elevation measurements from 1995 to December 2020. In December 2023, Mr. Dan Schmutz,

Vice President, Chief Environmental Scientist, Greenman-Pederson, Inc., obtained monthly Lake Prevatt water-surface elevation measurements from December 2020 to December 2023 from the Orange County Public Works Department. SJRWMD may wish to revise the simulation to include three additional years of lake water-surface elevation measurements for calibration or verification.

3. In March 1997, Professional Engineering Consultants, Inc., published a stormwater management plan of the surface-water conveyance system that drains to Lake McCoy, Lake Coroni, and Lake Prevatt (**Figure 4**). Professional Engineering Consultants conducted the study for Orange County, the City of Apopka, and SJRWMD. Professional Engineering Consultants field verified the watershed boundary, measured geometry and elevation of stormwater infrastructure, and measured or estimated geometry and volume of stormwater retention and detention facilities. Professional Engineering Consultants simulated water-surface elevations at selected locations in the watershed, such as in lakes and stormwater retention facilities; and flow rates in selected surface-water conveyance features, such as culverts, channels. Professional Engineering Consultants simulated flows between Lake McCoy, Lake Coroni, and Lake Prevatt. Geosyntec Consultants attach Professional Engineering Consultants (1997a) to this technical memorandum.

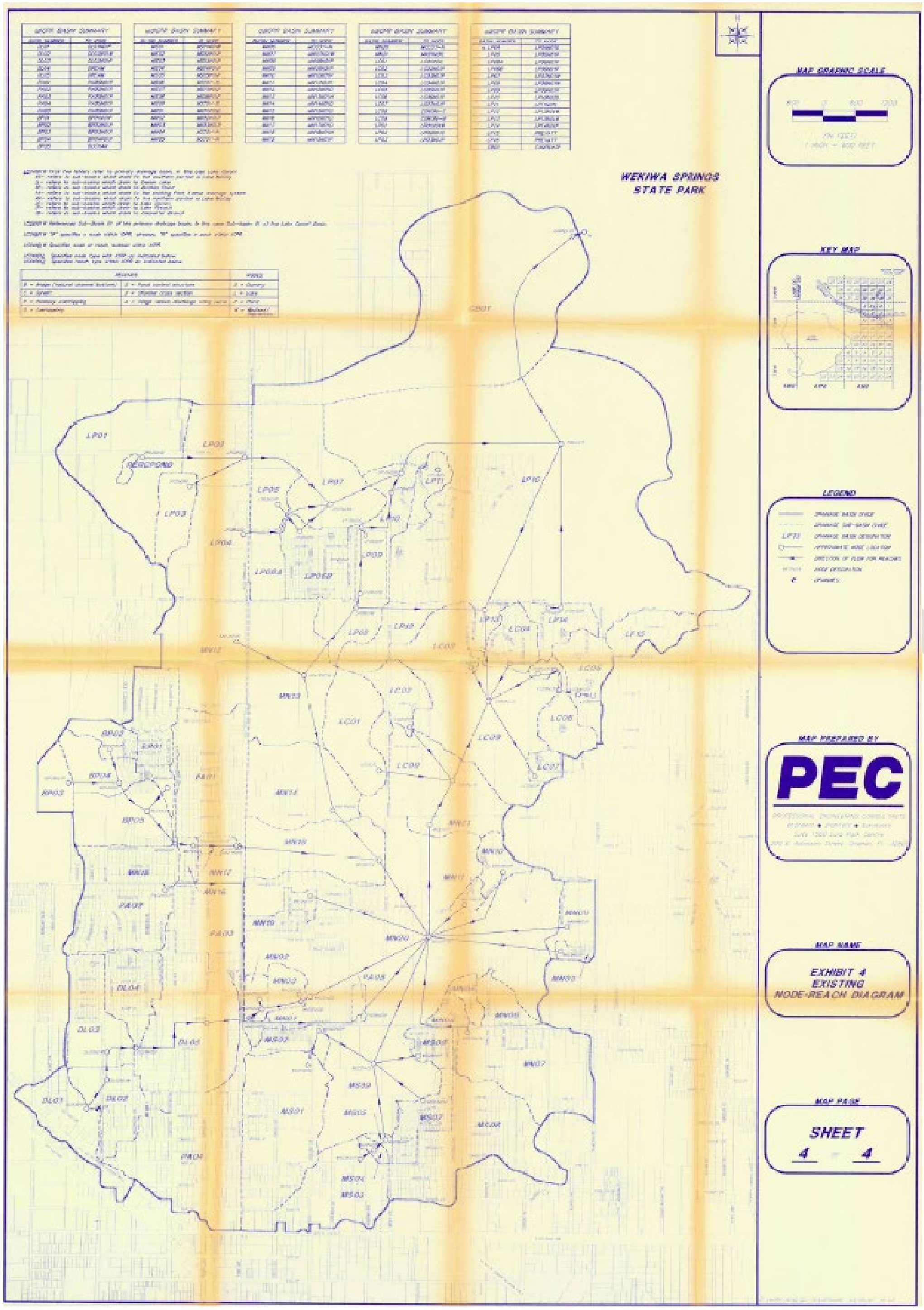


Figure 4. Professional Engineering Consultants, Inc., node-reach diagram for a simulation of surface-water flows and elevations in areas that drain to Lake Prevatt, Lake Coroni, and Lake McCoy; and inter-flow paths between these lakes.

During the task A watershed visit on December 11, Wekiva Springs State Park Manager Robert Brooks asserted discharge from Lake Coroni inundates the pond near the park manager's residence [fig. 6 and photo. 15 of King (2023)], one-to-three days after relatively large episodic rainfall events, such as rainfall events associated with 2010s and 2020s era hurricanes and tropical depressions. During these events water in Lake Coroni flows north, into the pond, and subsequently into Lake Prevatt. Manager Brooks stated that the maximum pond stage in response to this episodic discharge inundates the pond adjacent to the park manger's residence [photo. 15 of King (2023)] to a point that is equidistant between the normal pond shoreline and the park manager’s residence. Manager Brooks witnessed these flows and stages.

During the task A watershed visit on December 11, SJRWMD staff and I inspected two locations south of the ranger's residence [figs. 7 and 8 of King (2023)] and found that Lake Coroni was dry on December 11. The group agreed that this lake volume is likely sufficient to contain relatively lesser events, and that this volume is likely sufficient to significantly lag a storm of relatively larger magnitude. We inspected and photographed a 60-inch diameter round concrete pipe that controls flows from Lake Coroni, toward the ranger's residence. If Lake Coroni is dry during an episodic event, lake water may eventually pop off during the episodic event, through the culvert [photo. 16 of King (2023)]. We made a similar conclusion relative to a rectangular weir [photo. 19 of King (2023)] that controls outflow from Lake McCoy to Lake Coroni.

During the task A watershed visit on December 11, Manager Brooks stated that during extreme events, the water surface exceeds the northeastern banks of the small pond in front of his residence, and that this lake pops off across an overland flow path toward Lake Prevatt.

SJRWMD issue environmental resource permits to property owners who wish to alter land or hydrologic systems, or to construct stormwater management infrastructure. Requests for permits are typically based on construction plans and engineering calculations. SJRWMD archive plans and calculations on which permits are based. These plans and calculations detail watershed boundary delineations, geometry and elevation of stormwater infrastructure, and geometry and volume of stormwater retention and detention facilities. Calculations detail simulated water-surface elevations at selected locations and flow rates in selected surface-water conveyance features. Geosyntec tabulated selected facility names, and associated SJRWMD environmental permit numbers and relevant file names from the SJRWMD permit archive (**Table 1**) for permitted stormwater management systems in the Lake Coroni, Lake McCoy, or Lake Prevatt watersheds. Geosyntec Consultants attach these files to this technical memorandum.

Table 1. St. Johns River Water Management District environmental resource permit (ERP), facility name, and file name that details selected stormwater management infrastructure in the watershed that drains to Lake Prevatt.

ERP	Name	File
103054-1	Daugherty Center	EREG_1188174.pdf
105170-2	Foster's Co	1 19 07.pdf
105170-3	Dream Lake Plaza	EREG_430190.pdf
113163-1	Estates at Wekiva	
113530-1	Park Avenue Ani	EREG_677397.pdf
116464-1	Family Dollar-Ap	EREG_1264538.pdf
119437-1	Welch Rd Intersection	EREG_1278940.pdf
129948-1	Wawa US 441 & Bradsh	5560453_lbonilla.pdf
20280-1	Votaw Village\ER	EREG_1704141.pdf

ERP	Name	File
20675-2	Charleston Park (formerly Summit Lake Heights	
20779-3	Apopka Middle School Addition	
20779-4	OCPS Northwest Bus Depo	
27258-2	Rhapsody Oaks Subdivision	
27543-2	Magnolia Oak	
27809-1	Carlton Oaks	EREG_557212.pd
28023-1	Sandpiper Estate	
28065-1	Baldwin-Fairchild Funeral Homes & Cemetery	
65705-1	Tanglewilde St	EREG_557501.pd
65705-2	Park Avenue Ditch Improvement	
100024-1	Rock Springs Ac	EREG_233963.pdf
104464-2	Fifth Third Ban	EREG_183196.pdf
115968-1	Kids R Kids-Apo	EREG_117192.pdf
127571-1	Dollar General at Ap	2257565_lbonilla.pdf
20518-2	Pines of Wekiva	EREG_431596.pd
20518-3	Pines of Wekiva	EREG_678884.pd
20518-4	Apopka 9th Gra	EREG_308240.pd
20518-5	Pines of Wekiva Tract	
20518-6	Pines of Wekiva Tract	
20518-7	Pines of Wekiva Tract	
20518-8	Pines of Wekiva Tract D-Section	
20669-2	Parkview at We	EREG_555197.pd
20676-1	Wekiva Park Parcel	
20676-11	AmSouth Bank	
20676-2	Wekiva Park Parcel	
20676-5	Shoppes at Wekiva Plaza	
20676-6	Wekiva Park Townhome	
27816-1	Spring Harbor	
27816-3	Rock Springs Plaza	

SJRWMD did not simulated flows from Lake Coroni to Lake Prevatt (**Figure 2**). SJRWMD also did not simulate flows from Lake McCoy to Lake Coroni (**Figure 2**).

SJWMD may wish to re-delineate the watershed that drains to Lake Prevatt to include areas that drain to Lake McCoy (**Figure 5**) and Lake Coroni (**Figure 6**). This re-delineation will conform to observations made by Manager Brooks, that water from Lake Coroni periodically flows to Lake Prevatt. SJRWMD may wish to inform this re-delineation with Professional Engineering Consultants (1997a) and select environmental resource permits (**Table 1**).

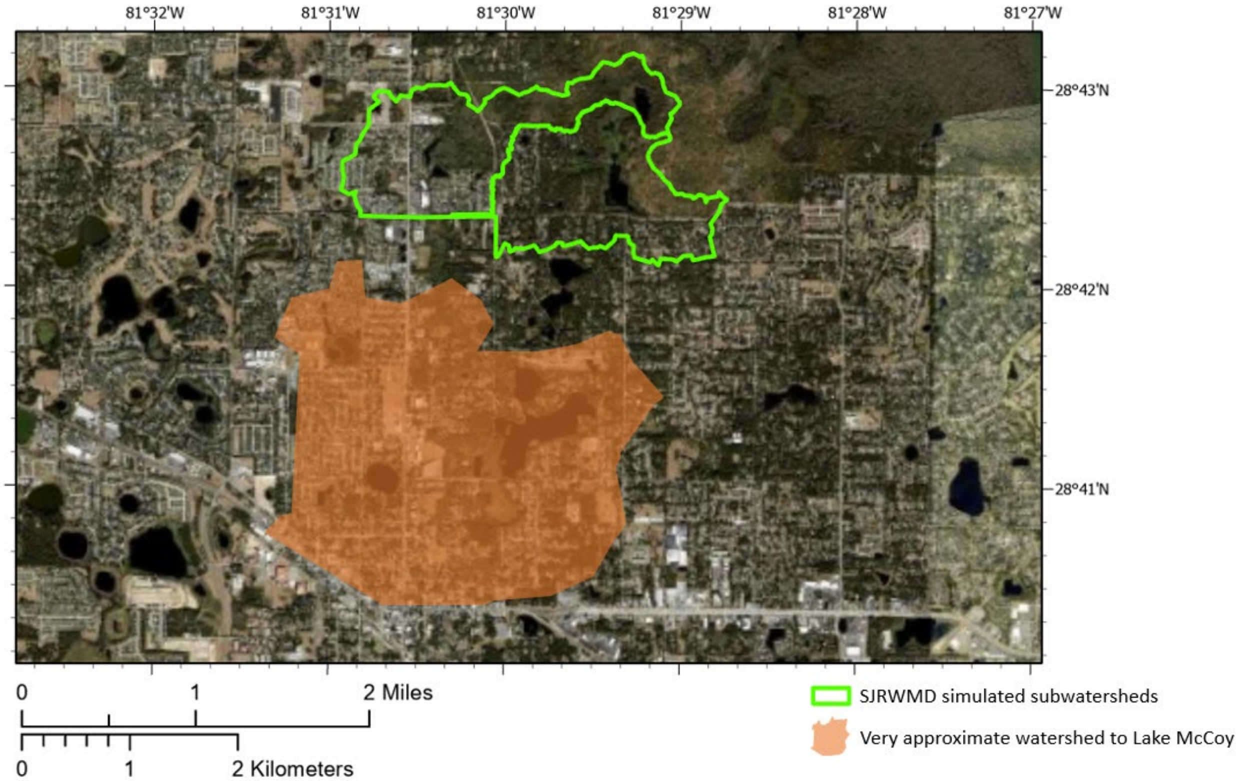


Figure 5. Lake McCoy watershed (orange polygon) and sub-watersheds simulated by Sarker and others (2023) (green polygons). Lake McCoy watershed boundary delineation is very approximate, and loosely based on Professional Engineering Consultants (1997a).

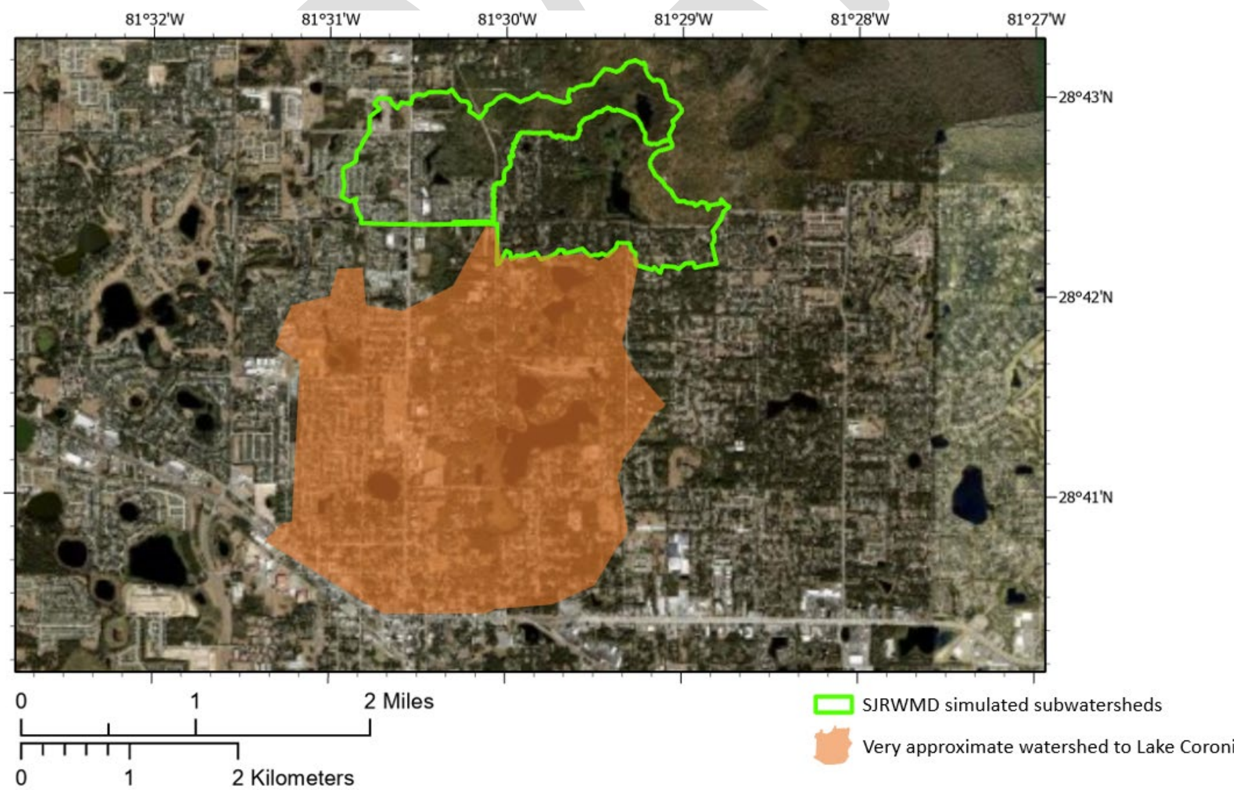


Figure 6. Lake Coroni watershed (orange polygon) and sub-watersheds simulated by Sarker and others (2023) (green polygons). Lake Coroni watershed boundary delineation is very approximate, and loosely based on Professional Engineering Consultants (1997a).

4. Stormwater management systems exist in the Lake Prevatt watershed, which detain or retain stormwater (**Figure 7**). Natural ponds also exist in the Lake Prevatt watershed. These ponds likely retain or detain surface-water flows from the watershed to Lake Prevatt. SJRWMD may wish to revise the simulation to include constructed stormwater management systems and natural ponds, to quantify detention or retention of surface-water flow to Lake Prevatt.

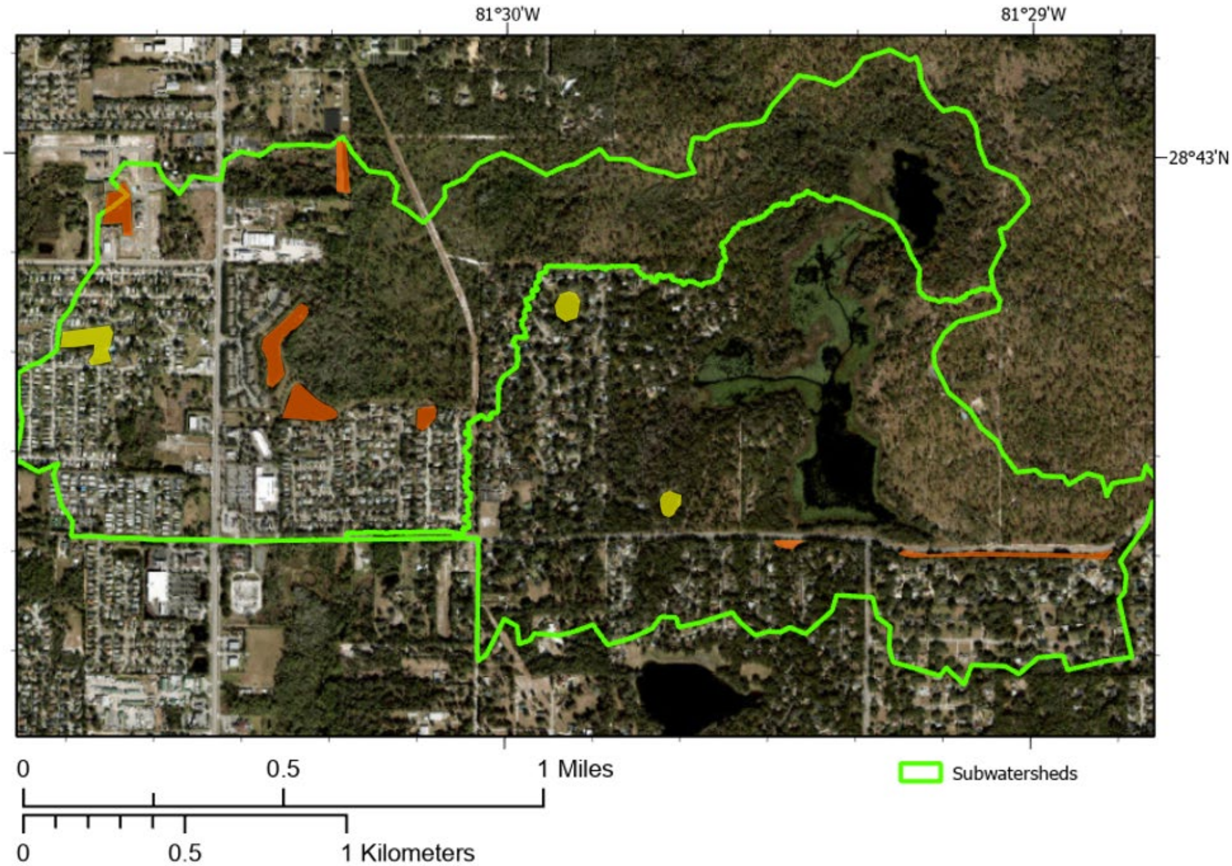


Figure 7. Lake Prevatt sub-watersheds (green polygons) delineated by Sarker and others (2023), over a January 28, 2021 aerial photograph attributed to Orange County; constructed stormwater management ponds (orange polygons) in the Lake Prevatt watershed; and natural ponds (yellow polygons) in the Lake Prevatt watershed.

B. Information Deficiencies

5. All necessary information is available to develop, calibrate, and verify the simulation.

C. Discarded Information

6. Measured water-surface elevations in Lake Prevatt were available from December 2020 to December 2023 (comment 1). Sarker and others (2023) did not incorporate measured water-surface elevation in Lake Prevatt during this period, into calibration or validation elevation time series. One logical, reasonable explanation is that December 2020 was a practical, recent, end of the measured water-surface elevation time series used for calibration and validation. SJRWMD may wish to extend the calibration or validation time series with additional elevation measurements.

7. Sarker and others (2023) did not use Professional Engineering Consultants (1997a) stormwater management plan to inform watershed delineation or to populate stormwater detention, retention, or conveyance system attributes (comment 3). Sarker and others (2023) did not explicitly acknowledge awareness of Professional Engineering Consultants (1997a), or explicitly reject Professional Engineering Consultants (1997a). SJRWMD may wish to use Professional Engineering Consultants (1997a) stormwater management plan to inform watershed delineation or to populate stormwater detention, retention, or conveyance system attributes.

8. Sarker and others (2023) did not cite technical support information or calculations from environmental resource permits as references for watershed delineation or to populate stormwater detention, retention, or conveyance system attributes (comment 3). Sarker and others (2023) did not explicitly acknowledge awareness of technical information associated with environmental resource permits, or explicitly reject this information. SJRWMD may wish to use permits as references for watershed delineation or to populate stormwater detention, retention, or conveyance system attributes.

D. Effect of Discarded Information on Results

9. SJRWMD may wish to revise the simulation described in Sarker and others (2023) to include surface-water conveyance infrastructure, stormwater detention infrastructure, stormwater retention infrastructure in areas that drain to Lake Prevatt (comment 4, **Figure 7**).

   SJRWMD state in work order 1 that "[l]ong-term simulations are important because MFLs assessments often require frequency analysis of lake levels."

   Sarker and others (2023) quantified measured and simulated, Lake Prevatt south lobe water-surface elevation exceedance probability (**Figure 8**). For example, Sarker and others (2023) show that a measured 48-foot water-surface elevation above NAVD88 has a 90-percent chance of being exceeded from 2008 to 2021. Sarker and others (2023) show that the simulated water surface elevation is as much as two feet greater than the measured water surface elevation, at the relatively lower-elevation, dryer side of the elevation-probability relationship. Restated: the simulation is wetter than measurements, during relatively lower stages, less than about 52 feet above NAVD88. Consequently, a tool that is wetter than the actual lake level, at the same exceedance probability, will inform a specified, regulatory, minimum lake level.

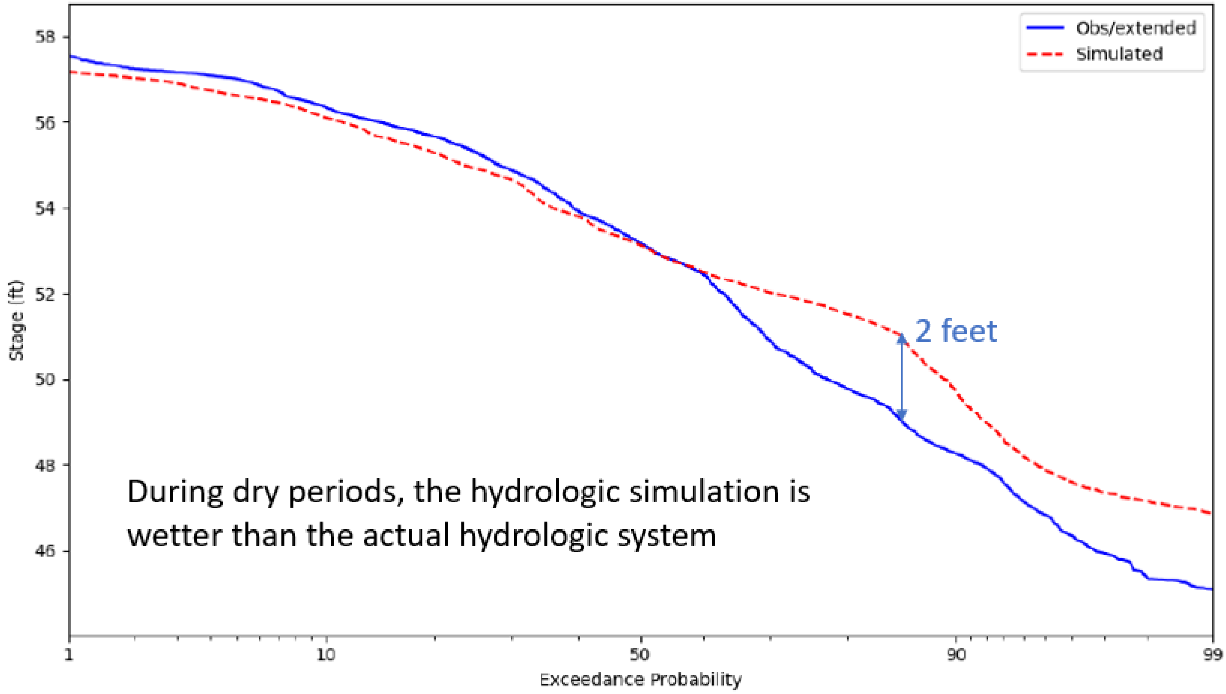


Figure 8. Water-surface elevation exceedance probability of Lake Prevatt south lobe simulated (red dashed polyline), and measured or extended (blue solid line), in feet above NAVD88, from Sarker and others (2023, figure 20), with text annotation relevant to this memorandum. Sarker and others (2023) simulated water-surface elevation from 2008 to 2021.

SJRWMD may wish to revise the simulation described in Sarker and others (2023) to include surface-water conveyance infrastructure, stormwater detention infrastructure, stormwater retention infrastructure in areas that drain to Lake Prevatt, some surface water may be detained, or retained in the upper watershed, south of Welch Road East, in the pond in front of Manager Brooks' residence, in a natural pond near Cedar Glen Drive, in stormwater management facilities north of Boulder Creek Court and east of Sunset Palm Drive, in a wetland north of Boulder Creek Court and east of Sunset Palm Drive, in a natural pond west of West Dottie Street, in a stormwater management facility west of Emerald Springs Drive, in wetland west of Tanglewood Lane, and in a wetland west of Jolly Avenue (**Figure 7**).

If SJRWMD make this revision the simulated exceedance probability relationship may fit better, the measured exceedance probability relationship (**Figure 9**).

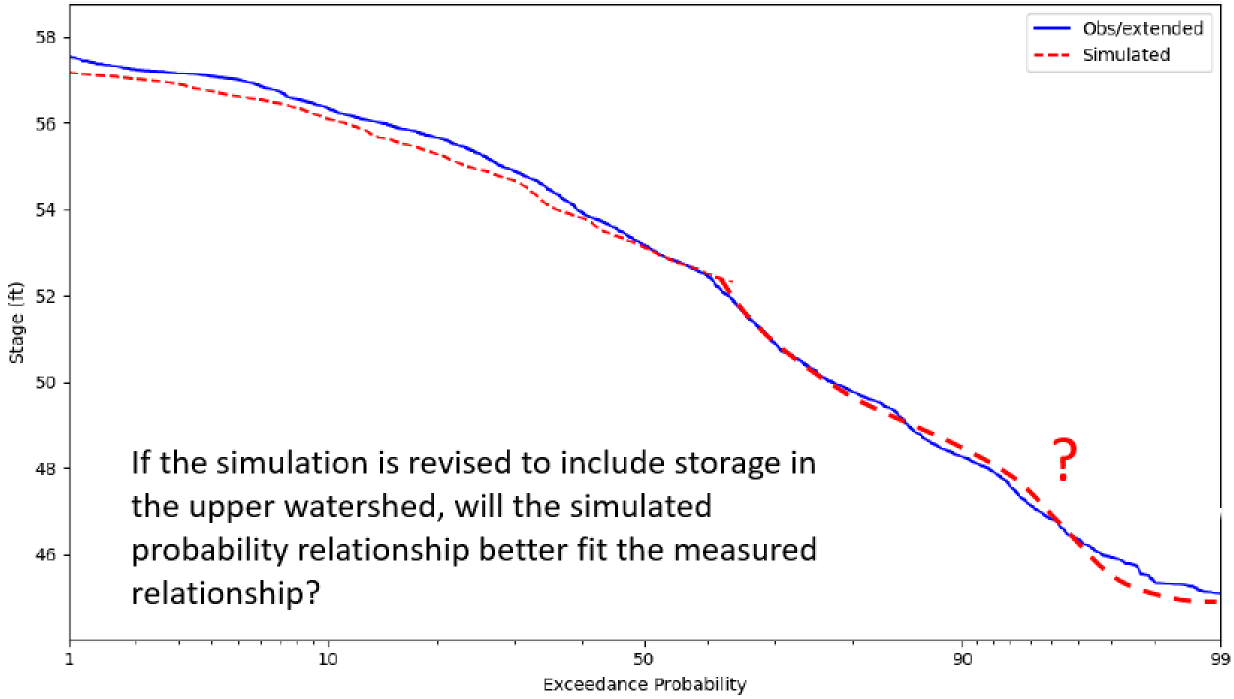


Figure 9. Water-surface elevation exceedance probability of Lake Prevatt south lobe conceptually postulated (red dashed polyline), and measured or extended (blue solid line), in feet above NAVD88, from Sarker and others (2023, figure 20), with text annotation relevant to this memorandum. Sarker and others (2023) simulated water-surface elevation from 2008 to 2021. The exceedance probability of the conceptually postulated water-surface elevation is speculated based on inclusion of additional storage in the upper watershed, in which the baseline condition of no storage in the upper watershed is represented in Figure 8.

10. Sarker and others (2023) did not delineate wetland west of Tanglewood Lane, a wetland west of Jolly Avenue, and a wetland south of Welch Road East between Rock Springs Road and Ustler Road as draining to Lake Prevatt. Professional Engineering Consultants (1997a) delineated (**Figure 10**) wetland west of Tanglewood Lane (basin LP01), a wetland west of Jolly Avenue (basin LP01), and a wetland south of Welch Road East between Rock Springs Road and Ustler Road (basins MN13, LP08, and LP12) as draining to Lake Prevatt. SJRWMD may wish to re-delineate and refine sub-watersheds to include these areas as draining to Lake Prevatt, and revise the simulation described in Sarker and others (2023) accordingly.

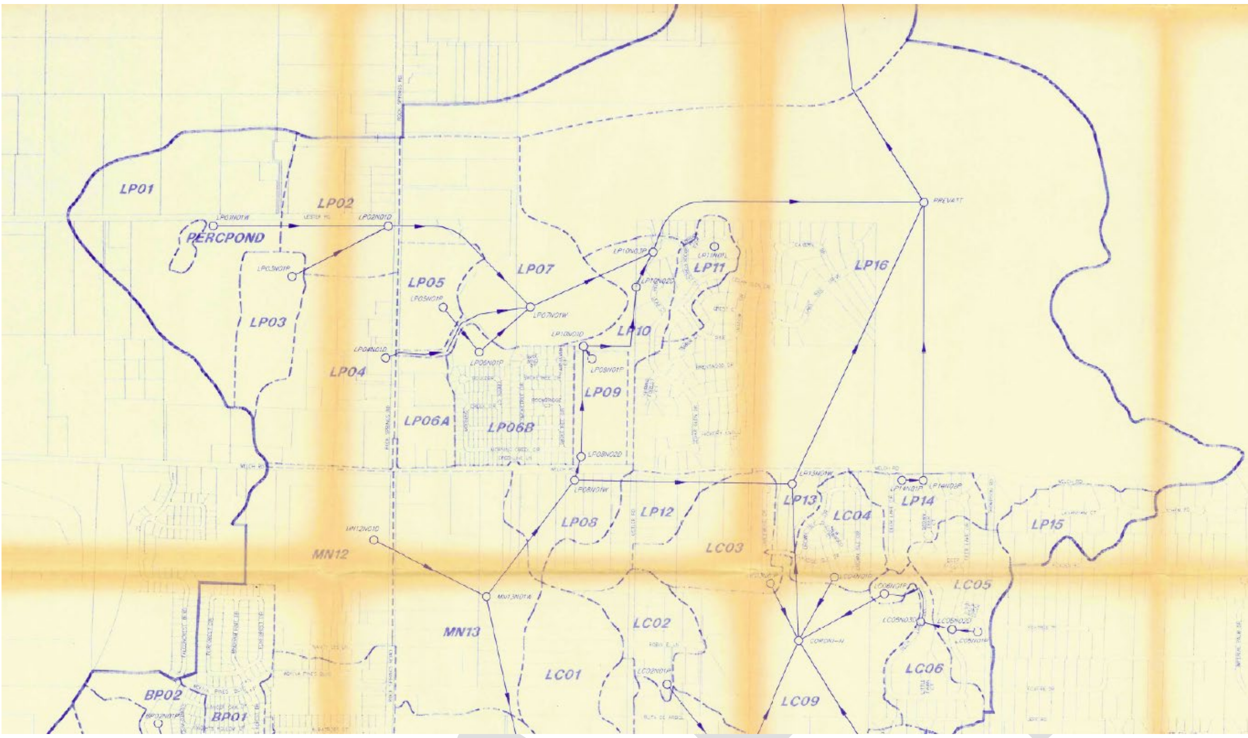


Figure 10. Professional Engineering Consultants, Inc., node-reach diagram for a simulation of surface-water flows and elevations an area near Welch Road East.

11. Sarker and others (2023) did not delineate areas that drain to Lake Coroni or Lake McCoy as periodically draining to Lake Prevatt, during, for example, rare, episodic events with annual exceedance probabilities greater than, say, 30 percent. Professional Engineering Consultants (1997a) delineated (**Figure 10**) areas that drain to Lake Coroni and Lake McCoy as draining to Lake Prevatt (**Figure 4**).

    If SJRWMD make this revision the simulated exceedance probability relationship may change (**Figure 11**).

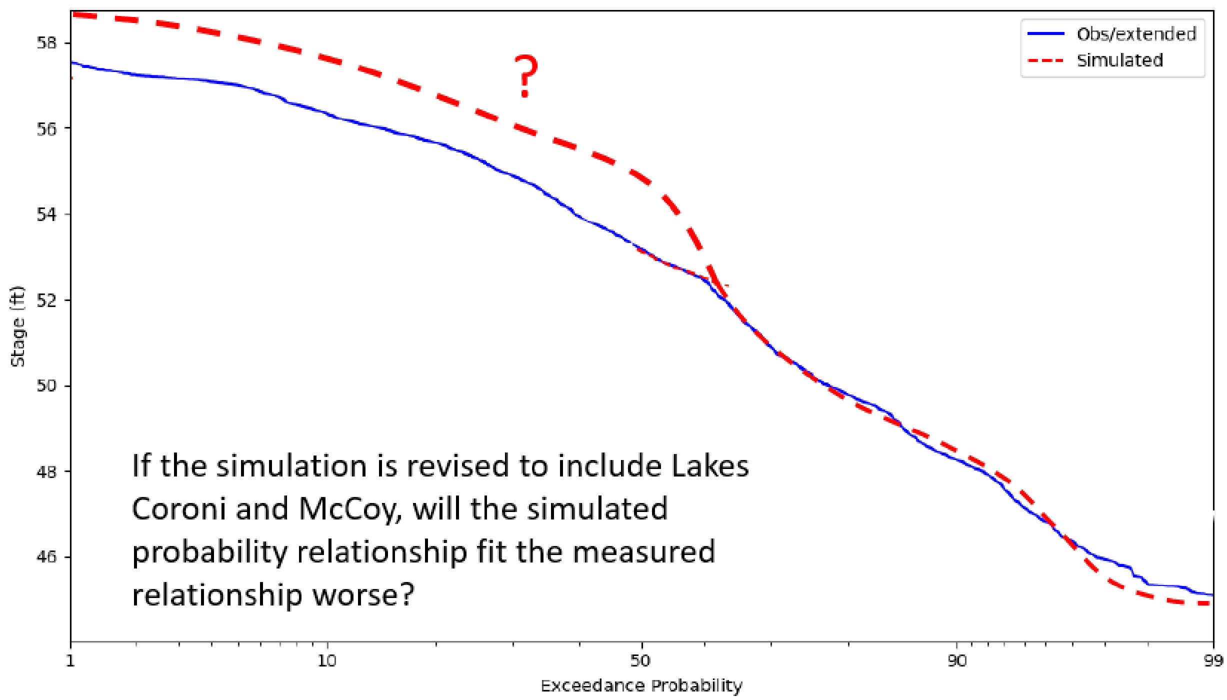


Figure 11. Water-surface elevation exceedance probability of Lake Prevatt south lobe conceptually postulated (red dashed polyline), and measured or extended (blue solid line), in feet above NAVD88, from Sarker and others (2023, figure 20), with text annotation relevant to this memorandum. Sarker and others (2023) simulated water-surface elevation from 2008 to 2021. The exceedance probability of the conceptually postulated water-surface elevation is speculated based on inclusion of areas that drain to Lake Coroni and Lake McCoy and associated inter-lake hydraulic connections, in which the baseline condition excluding areas that drain to these lakes is represented in Figure 8.

SJRWMD may wish to delineate areas that drain to Lake Coroni and Lake McCoy as draining to Lake Prevatt. SJRWMD may wish to revise the simulation described in Sarker and others (2023) to include Lake McCoy and Lake Coroni watersheds, and include surface-water conveyance infrastructure, stormwater detention infrastructure, stormwater retention infrastructure in areas that drain to Lake McCoy and Lake Coroni.

Simulation

This simulation element of the independent technical peer review addresses the validity, defensibility, and appropriateness of the following review items: (E) model development, (F) calibration, (G) validation, and (H) results.

E. Development

Geosyntec Consultants independently executed each simulation (**Figure 12**, **Figure 13**, **Figure 14**, and **Figure 15**). Our execution of these simulations did not result in model continuity warnings, convergence warnings, continuity errors, convergence errors, or other errors. Simulated volumes are reasonable. Each simulation ran to completion. Simulated water-surface elevations were stable.

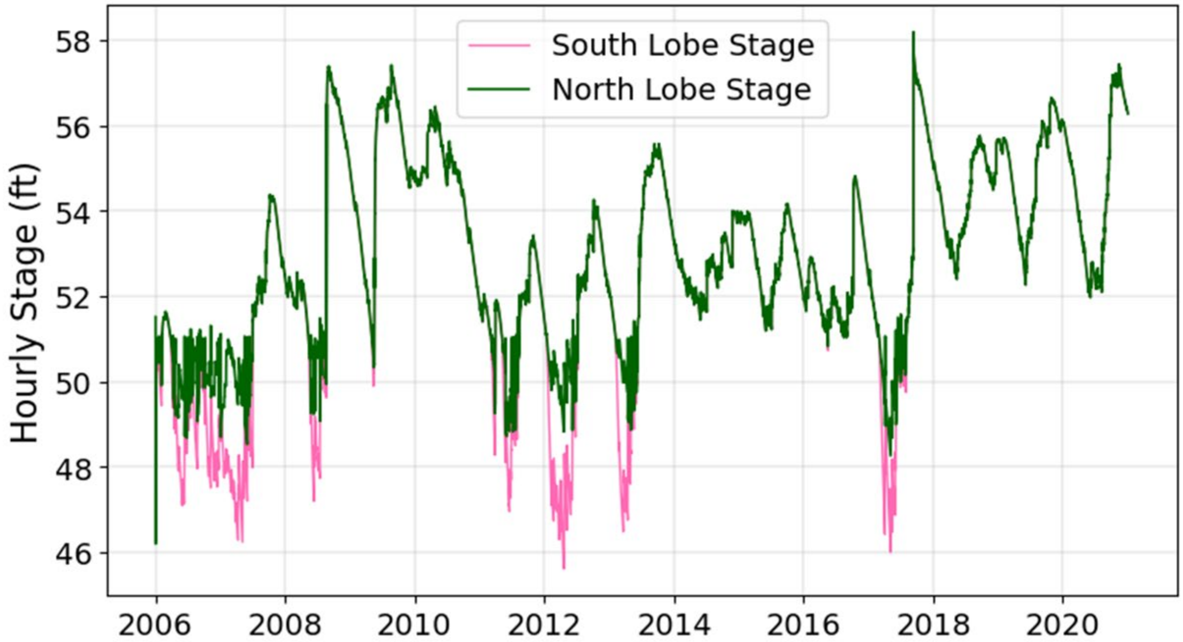


Figure 12. Simulated water-surface elevation in the south lobe of Lake Prevatt (pink polyline) and in the north lobe of Lake Prevatt (green polyline), in feet above NAVD88, from 2006 to 2020; in which the plotted time series are from a simulation described by Sarker and others (2023), executed and plotted by Geosyntec Consultants.

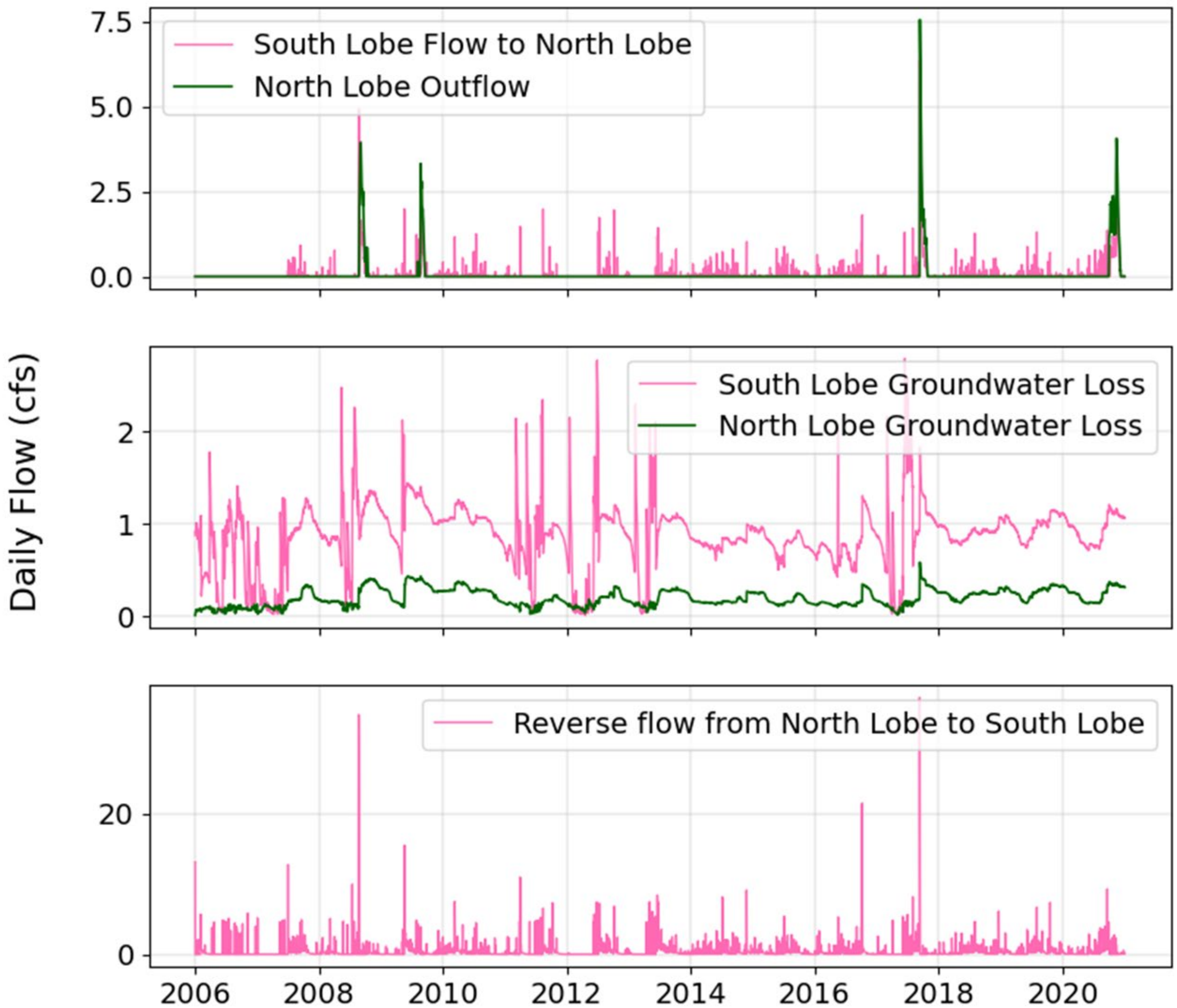


Figure 13. Simulated *daily* flow rate from the Lake Prevatt south lobe to the north lobe (pink polyline, upper panel), from the Lake Prevatt north lobe to Carpenter Creek (green polyline, upper panel), from the Lake Prevatt south lobe to the subsurface (pink polyline, central panel), from the Lake Prevatt north lobe to the subsurface (green polyline, central panel), and from the Lake Prevatt north lobe to the south lobe (pink panel, lower panel), all in cubic feet per second, from 2006 to 2020; in which the plotted time series are from a simulation described by Sarker and others (2023), executed and plotted by Geosyntec Consultants.

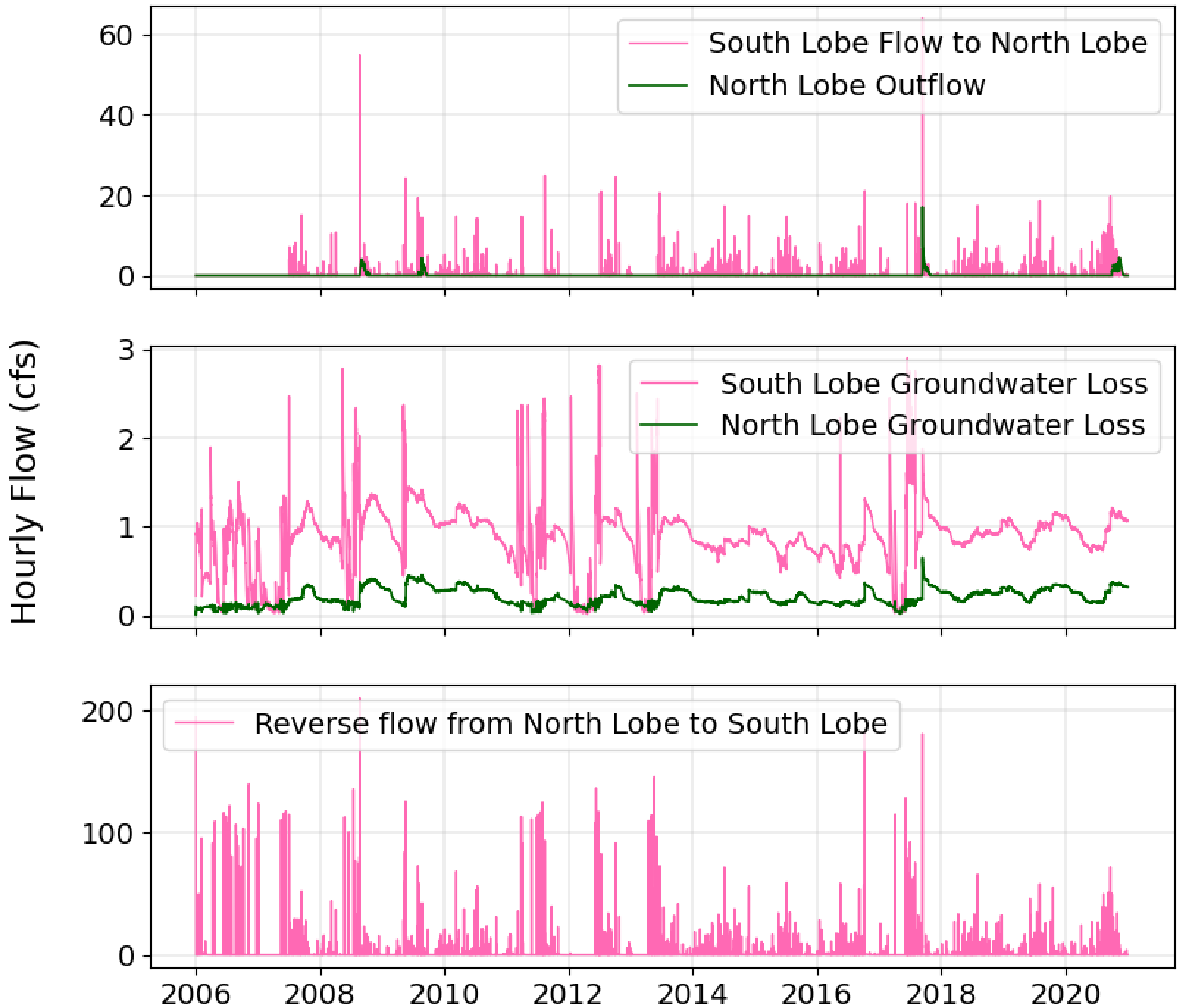


Figure 14. Simulated *hourly* flow rate from the Lake Prevatt south lobe to the north lobe (pink polyline, upper panel), from the Lake Prevatt north lobe to Carpenter Creek (green polyline, upper panel), from the Lake Prevatt south lobe to the subsurface (pink polyline, central panel), from the Lake Prevatt north lobe to the subsurface (green polyline, central panel), and from the Lake Prevatt north lobe to the south lobe (pink panel, lower panel), all in cubic feet per second, from 2006 to 2020; in which the plotted time series are from a simulation described by Sarker and others (2023), executed and plotted by Geosyntec Consultants.

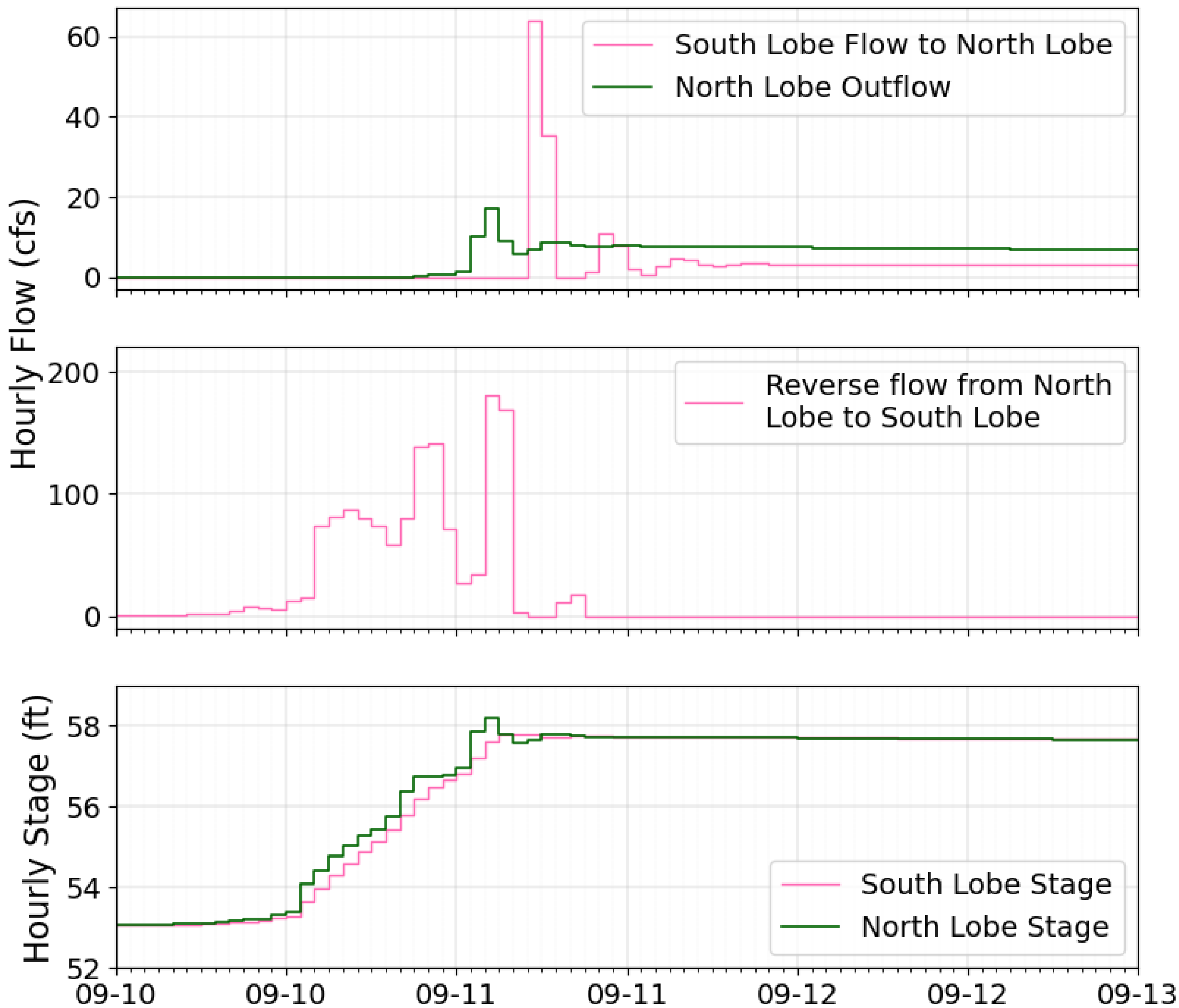


Figure 15, Simulated *hourly* flow rate from the Lake Prevatt south lobe to the north lobe (pink polyline, upper panel), from the Lake Prevatt north lobe to Carpenter Creek (green polyline, upper panel), from the Lake Prevatt south lobe to the subsurface (pink polyline, central panel), from the Lake Prevatt north lobe to the subsurface (green polyline, central panel), and from the Lake Prevatt north lobe to the south lobe (pink panel, lower panel), all in cubic feet per second, from September 10 to September 13, 2017; in which the plotted time series are from a simulation described by Sarker and others (2023), executed and plotted by Geosyntec Consultants.

Lake Prevatt has a transmissive connection to the Floridan aquifer system. Lake Prevatt may be vulnerable to aquifer pumping. HSPF was used to simulate surface-water elevations in Lake Prevatt. SJRWMD did not simulate water-surface elevations in stormwater management facilities in the Lake Prevatt watershed. SJRWMD did not simulate flow rates in major surface-water conveyance features in the Lake Prevatt watershed. SJRWMD did not simulate water-table elevations in the aquifer or flows in the surficial aquifer system.

12. SJRWMD used measured groundwater elevations as the bottom boundary condition in the HSPF simulation. SJRWMD plan to use simulated Upper Floridan aquifer potentiometric surface elevations from the East Central Florida transient expanded model (ECFTx) as the bottom boundary condition for MFL determination. SJRWMD plan to force ECFTx with pumping scenarios, to develop a minimum lake level for Lake Prevatt.

Sarker and others (2023) did not dynamically link the Lake Prevatt HSPF simulation was to ECFTx. Sarker and others (2023) did not determine whether measured groundwater elevations near Lake Prevatt match simulated potentiometric surface elevations in ECFTx.

In preparation for a Lake Prevatt MFL, SJRWMD may wish to consider whether simulated potentiometric surface elevations in ECFTx match measured potentiometric surface elevations at well ORO893, which taps the Upper Florida aquifer system beneath Lake Prevatt. If simulated potentiometric surface elevations in ECFTx do not match well, measured potentiometric surface elevations at well ORO893, some difference may exist between simulated, contemporary Lake Prevatt water-surface elevation and simulated, no-pumping Lake Prevatt water-surface elevation that is attributed to differences between measured potentiometric surface elevations at well ORO893 and simulated potentiometric surface elevations at well ORO893. SJRWMD may wish to re-tune ECFTx to improve the fit between simulated and measured potentiometric surface elevations at well ORO893, to eliminate or minimize error associated with replacing the measured bottom boundary condition with a simulated bottom boundary condition.

13. Leakance is the quotient of hydraulic conductivity and hydrogeologic unit thickness. Leakance parameterizes the flow of water between a lake and an underlying hydrogeologic unit or aquifer system. More water flows through a hydrogeologic unit with a relatively greater leakance than through a unit with a relatively lesser leakance, forced by the same hydraulic gradient.

    Sarker and others (2023) found that the simulation of Lake Prevatt water-surface elevation is most sensitive to (a) leakance between Lake Prevatt and the Floridan aquifer system and (b) a lower zone evapotranspiration parameter.

    SJRWMD may wish to determine whether the hydraulic gradient between Lake Prevatt and surrounding water bodies—such as Lake Coroni, Lake McCoy, and wetlands in Wekiva Springs State Park—force groundwater flow to or from Lake Prevatt? Given the sensitivity of simulated Lake Prevatt water-surface elevation to leakance, SJRWMD may wish to accurately simulate hydraulic gradients to and from Lake Prevatt, which are both a function of potentiometric surface elevation in water bodies near Lake Prevatt.

14. Sarker and others (2023) stated that “calibrated parameter values from the Middle St. Johns River Basin (MSJRB) HSPF model were used as a starting point for our calibration of the Prevatt model.” Sarker and others (2023) did not tabulate calibrated parameter values from the Middle St. Johns River Basin HSPF model, or calibrated parameter values from other studies with geographic, or hydrologic relevance, such as ECFTx and NFSEG.

    SJRWMD may wish to justify Lake Prevatt simulated parameter values by comparing these values to other studies with geographic, or hydrologic relevance, such as ECFTx and NFSEG. For example, the southeastern side of the NFSEG simulation domain is about ten miles northwest of Lake Prevatt. SJRWMD and SRWMD simulated water-surface elevations in lakes in the Ocala National Forest—in the southeastern part of the NFSEG simulation domain—with a dynamic link between HSPF and MODFLOW. Simulated leakance between these lakes in the Ocala National Forest may inform simulated leakance in Lake Prevatt.

15. Sarker and others (2023) stated that an "extended South Lobe timeseries was generally lower than the North Lobe data, even at North Lobe stages above 51 ft, where the two should be connected. The difference in average stage was generally about 1 foot. Therefore, we further adjusted the overall extended South Lobe data upward by 1 ft. The North Lobe stage and the extension of the South Lobe stage, before and after adjustment, are shown in Figure 10." This ad-hoc adjustment is not ideal.

    Precision in elevation measurement is important. SJRWMD may wish to precisely survey the elevation of active and historic water-surface elevation measurement devices in both the south lobe and the north lobe, and to precisely survey the elevation of the natural weir that connects the north lobe and the south lobe. SJRWMD may wish to document these surveys in reports that support MFL development. A precise understanding of device and weir elevations may be necessary to best extend the south lobe time series.

    The moment at which SJRWMD measure an elevation is important. SJRWMD may wish to consider south lobe time series extension by considering whether correlation should only be done at moments in which water surface elevation was synoptically measured in both the south lobe and north lobe, and at elevations greater than the interconnecting weir elevation. SJRWMD may introduce unnecessary inaccuracies if water-surface elevation measurements greater than the weir elevation and at different moments are compared, with an expectation that these elevations be equivalent. If either water-surface elevation is less than the weir elevation, the elevations may not be expected to be equivalent, as water is flowing from one lobe to the other lobe. If both water-surface elevations are greater than the weir elevation, but were not measured at the same moment, the elevations may not be equivalent, as inflows or outflows may have caused one water-surface elevation to change, over the duration between the non-synoptic measurements.

    The one-foot upward adjustment is not precisely documented. SJRWMD may wish to clarify and document whether the one-foot difference in average stage between the north lobe and south lobe water-surface elevations includes measurements both above and below the weir elevation, or only includes moments when the measured water-surface elevation in both lobes was above the weir elevation. SJRWMD may wish to clarify and document whether measurements were synoptic. SJRWMD may wish to report the difference to the nearest 0.1 foot, or the nearest 0.01 foot; reporting the difference to the whole foot is less precise.

16. Sarker and others (2023, figure 9) correlated (a) measured Lake Prevatt *south lobe* water-surface elevation and measured potentiometric surface elevation in well ORO984 and (b) measured Lake Prevatt *north lobe* water-surface elevation and measured potentiometric surface elevation in well ORO984. Sarker and others (2023) show that the south lobe correlation is linear, based on a relatively shorter period of record than was used in the north lobe correlation. Sarker and others (2023) suggest that the north lobe correlation is linear, based on a relatively longer period of record than used in the south lobe correlation; however, the north lobe

time series appears to have two distinct regions: one region at north lobe water-surface elevations greater than about 52.5 feet above NAVD88 and another region at north lobe water-surface elevations less than about 52.5 feet above NAVD88. SJRWMD may wish to explain the relevance of these two regions. SJRWMD may wish to explain why the relationship is apparently linear with a 0.5 positive slope (rise 4 ft over 54 to 58 y-domain; run 8 feet over 50 to 58 x-domain) in the region greater than about 52.5 feet above NAVD88 and non-linear in the region less than about 52.5 feet above NAVD88. SJRWMD may wish to consider whether two relationships should be defined, one greater than 52.5 and one less than 52.5.

17. Sarker and others (2023) globally reference datum, stating that "all elevation data in this report, whether groundwater (GW) levels, lake levels, or topography, are in feet above the North American Vertical Datum (NAVD), 1988."

    Sarker and others (2023) explicitly referenced NAVD88 twice. SJRWMD do not explicitly reference datum in figures or tables. Sarker and others (2023) do not reference NAVD88, or datum, in the input files.

    Although the global statement minimally suffices, SJRWMD may improve simulation input files and simulation documentation by explicitly citing NAVD88 throughout input files, documentation, in tables, and on figures. This may be particularly important in model input files, where the generic statement in the report may not effectively communicate datum to some subsequent users of the model. Some readers consider figures and tables to be independent elements that do not rely on statements or context from the associated report text, such that datum should be explicitly stated on all figures and in all tables.

18. SJRWMD may wish to document surveyor, survey dates, publication dates, survey methods, survey owner, resolution, reference publication, and other relevant metadata for specific, important simulation inputs, including but not limited to the NRCS soils survey, the digital elevation model, bathymetric elevations, and structural dimensions and elevations of water control structures, such as culverts and drop structures.

19. Sarker and others (2023) stated that the "lake edge was defined by a combination of these data and heads-up digitization of aerial photography taken in 1984 and 2014-2017." SJRWMD may wish to further detail "heads-up" digitization. Some future readers of this report may not be explicitly familiar with "heads-up digitization."

20. Sarker and others (2023) stated that "site visits were done to verify the watershed boundary as well as the structure's location and the lake's discharge point." SJRWMD may wish to revise the report to further detail the structure at the lake's discharge. Is this structure a culvert? If yes, what is the size of the culvert? From what material is the culvert constructed? What elevation above NAVD88 are the inverts for this culvert? Was the culvert ever overtopped during the period of record? If yes, at what elevation does the culvert overtop? If yes, what are the dimensions of the overland flow weir that convey surface water over the culvert, to a region downstream of the culvert?

21. Sarker and others (2023) stated that "stage-flow relationships for each lobe were derived from an Interconnected Channel and Pond Routing (ICPR v4) model."

SJRWMD did not provide this model, for review. SJRWMD may wish to revise the report to tabulate the ICPR4 model inputs and plot the stage-flow relationship.

22. Sarker and others (2023, figure 15 and figure 16) plotted stage area relationships for Lake Prevatt north lobe and south lobe. Sarker and others (2023) show that 40 acres are inundated by a water-surface elevation about 59 feet above NAVD88 in the north lobe and that 40 acres are also inundated by a water-surface elevation about 69 feet above NADV88 in the north lobe; such that—conceptually—a vertical wall exists around the north lobe, in which increases in water surface elevation from about 59 feet above NAVD88 to about 69 feet above NAVD88 do not result in more area inundated. Intuitively, this does not seem possible; the SJRWMD topographic-bathymetric DEM conflict with this uniform, prismatic relationship. Sarker and others (2023) show a similar, prismatic relationship in the south lobe. Sarker and others (2023, figures 17 and 19) do not simulate a water surface elevation greater than 59 feet above NAVD88, such that the relationship between 59 feet and 69 feet is computationally irrelevant. SJRWMD may wish to revise the report, simulation, and attachment 1 to reflect a stage-area relationship with a maximum stage of 59 feet above NAVD88, or to reflect a stage-area relationship in which area increases accurately with increasing stage, to whatever elevation SJRWMD choose to specify as the maximum stage in the relationship.
23. Sarker and others (2023) stated that "the area of the surrounding wetland is expected to fluctuate. This variation in areal coverage of the wetlands was simulated in the model through HSPF's Special Actions." SJRWMD may wish to further describe this fluctuation, to characterize this fluctuation with maps and plots, and to further describe the special action.
24. In a December 26 email to SJRWMD, Mr. Dan Schmutz, Vice President, Chief Environmental Scientist, Greenman-Pederson, Inc., asked whether leakance in Lake Prevatt changed over the period of record, or whether leakance has not changed over the period of record. SJRWMD may wish to revise the report to discuss whether land use changes in the watershed may have caused leakance to change over time. SJRWMD may wish to determine whether lakebed thickness was measured at different moments in the period of record, from which a transient leakance might be postulated.

F. Calibration

25. In a December 26 email to SJRWMD, Mr. Dan Schmutz, Vice President, Chief Environmental Scientist, Greenman-Pederson, Inc., asked whether SJRWMD incorporated sampling density into calibration, particularly with respect to calibration metrics. Sarker and others (2023) do not discuss non-uniform calibration weights, in which measurements during periods of sparse measurement resolution are weighed more than measurements during periods of dense measurement resolution. For example, consider 12 water-surface elevation measurements, made one per month, in 1975; and 35,040 water-surface elevation measurements, made every 15 minutes, in 2019. If simulated water-surface elevation were compared to these 35,052 measurements, in which each measurement is weighed equally, the comparison would collectively devalue measurements in 1975 due to the relatively sparser measurement resolution (one measurement every month) compared to 2019 (one measurement every 15

minutes). If simulated water-surface elevation were compared to these 35,052 measurements, in which each measurement in 1975 is weighed 2,920 more than each measurement in 2019, the comparison would value equally the 12 measurements in 1975 and the 35,040 measurements in 2019.

SJRWMD may wish to specify whether measurements used for calibration or validation in periods of relatively sparser measurement resolution are weighed equally to measurements used for calibration or validation in periods of relatively denser measurement resolution. SJRWMD may wish to weigh measurements used for calibration or validation such that measurement resolution does not devalue measurements in periods of relatively sparser measurement resolution.

26. During the task A watershed visit on December 11 (King, 2023), Wekiva Springs State Park Manager Robert Brooks asserted that Lake Prevatt has dried during relatively dry periods. SJRWMD may wish to show that the simulated water-surface elevation in Lake Prevatt dries completely, during episodic drought conditions, as anecdotally suggested by Manager Brooks.

27. During the task A watershed visit on December 11 (King, 2023), Wekiva Springs State Park Manager Robert Brooks asserted that during or soon after rainfall events associated with 2010s and 2020s era hurricanes and tropical depressions, the maximum pond stage in response to this episodic discharge inundates the pond adjacent to the park manger's residence to a point that is equidistant between the normal pond shoreline and the park manager's residence. SJRWMD may wish to show that the simulated water-surface elevation in this achieves this elevation, as anecdotally suggested by Manager Brooks.

G. Validation

28. Sarker and others (2023) declined to validate the simulated Lake Prevatt south lobe water-surface elevation because SJRWMD (or some other entity) did not measure water-surface elevation in the south lobe during the validation period. In a December 26 email to SJRWMD, Mr. Dan Schmutz, Vice President, Chief Environmental Scientist, Greenman-Pederson, Inc., asked whether "relatively higher uncertainties about the water level data quality for the south lobe" result in "concerns bout the quality of the inferences obtained with respect to the south lobe." SJRWMD may wish to justify the quality of the extended Lake Prevatt south lobe water-surface elevation, and then validate the simulation to this extended time series.

H. Results

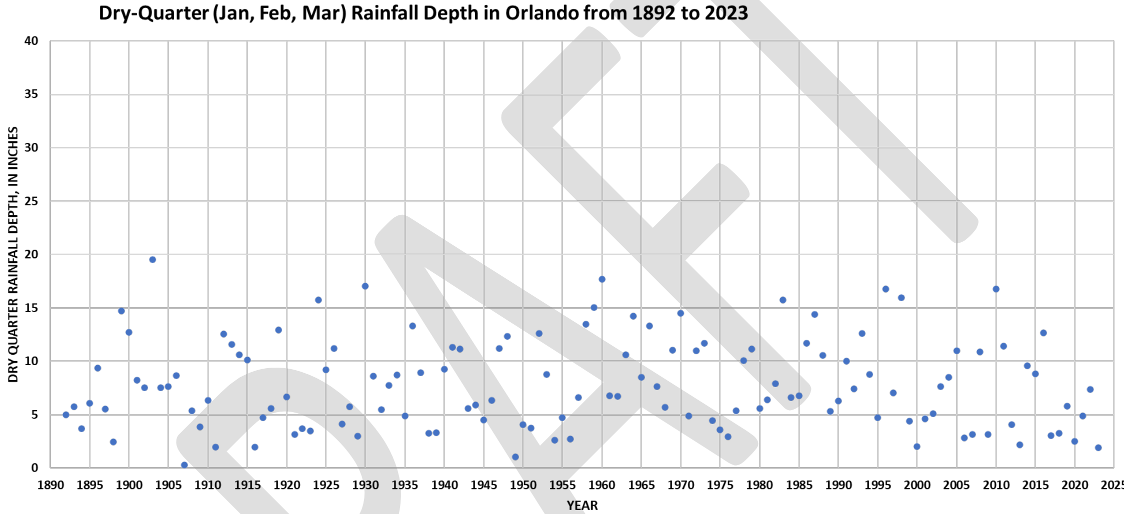
29. In the December 11 kickoff meeting, I asked whether Lake Prevatt meteorological forcing is statistically stationary.

SJRWMD responded that (i) the historic record reflects relatively wet periods and relatively dry periods; and that acceptable simulation during these relatively dryer and relatively wetter periods justifies the performance of the simulation; (ii) downscaling global climate models is challenging and difficult to deploy at the Lake Prevatt scale; (iii) SJRWMD does not know whether the future climate in central Florida will be wetter or dryer; and (iv) SJRWMD uses adaptive management to periodically revisit water management decisions relative to non-stationarity in meteorological forcing, such that the SJRWMD may adjust management in the future, based on future changes in meteorology.

In a December 26 email to SJRWMD, Mr. Dan Schmutz, Vice President, Chief Environmental Scientist, Greenman-Pederson, Inc., noted that a downward trend appears to exist in the potential evapotranspiration time series at Lisbon.

In the January 16 workshop, during which I presented initial comments, I shared a plot of dry quarter and wet quarter rainfall depth for Orland, from 1892 to 2023 (**Figure 16**). Strictly, these plots are not a rigorous examination of non-stationarity in meteorological forcing. However, visual inspection of these plots suggests that the historical variation in rainfall during the wet quarter appears to be stationary; and the historical variation in rainfall during the dry quarter also appears to be stationary.

(A)



(B)

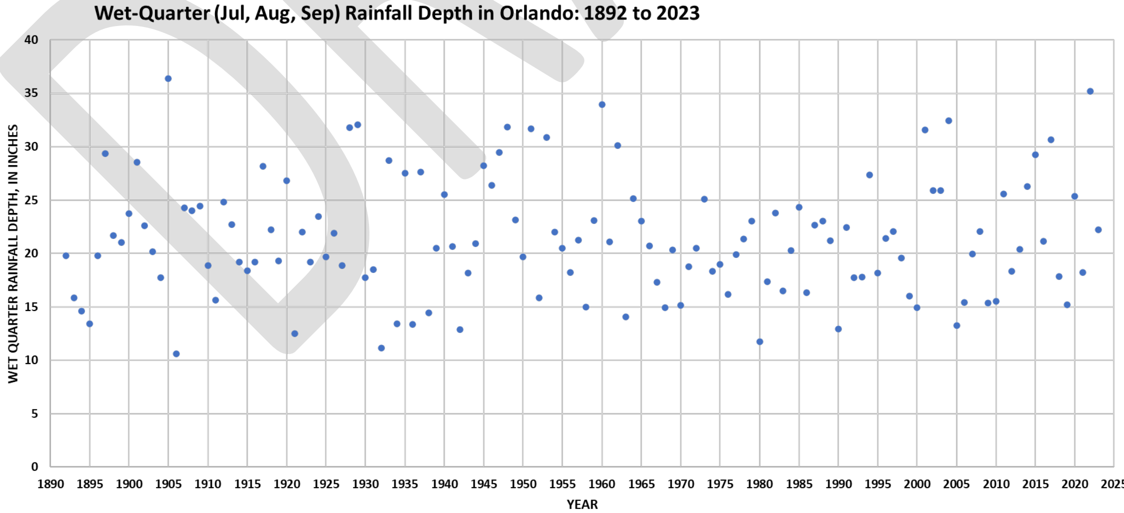


Figure 16. Rainfall depth during the (A) dry quarter of each year, in January, February, and March; and (B) wet quarter of each year, in July, August, and September, from 1892 to 2023. Rainfall depth from the Florida Climate Center (2023).

Regardless of SJRWMD's use of adaptive management and regardless of downscaling challenges associated with use of global-climate models at a regional scale, SJRWMD may wish to scientifically determine whether Lake Prevatt meteorological forcing statistically stationary or statistically non-stationary. SJRWMD may wish to use a more rigorous examination than simply plotting measurements, as I have done in **Figure 16**.

30. Sarker and others (2023) used a one hour computational time step. Maximum flow rate from the Lake Prevatt south lobe to the north lobe was about 60 cubic feet per second, calculated at a one hour resolution, for one hour in late 2017 (**Figure 14**). Integrated over one day, this maximum reduces to below 2.5 cubic feet per second (**Figure 13**). Maximum flow rate from the Lake Prevatt north lobe to the south lobe was about 200 cubic feet per second, calculated at a one hour resolution, for one hour in 2008 (**Figure 14**). Integrated over one day, this maximum reduces to about 35 cubic feet per second (**Figure 13**). Both the 60 cubic foot per second flow rate from the south lobe to the north lobe and the 200 cubic foot per second flow rate from the north lobe to the south lobe are, intuitively, not likely. The computational time step may contribute to these, perhaps, unrealistic flows from one lake lobe to the other lake lobe. Plotting one event at an hourly plot resolution (**Figure 15**) shows that stage differences of tenths of one foot force hourly flow rates of hundreds of cubic feet per second. SJRWMD may wish to reduce the computational time step from one hour to, perhaps, 15 minutes or 5 minutes. This shorter duration computational time step may allow water-surface elevations to equilibrate, reducing the duration over which a head difference between lobes maintained. This relatively shorter computational time step may reduce peak flow rates between lobes.
31. Sarker and others (2023) did not publish a table of contents, list of figures, list of tables, or list of acronyms and abbreviations. SJRWMD may wish to revise the report to publish a table of contents, list of figures, list of tables and list of acronyms and abbreviations, to aid document readers.
32. Sarker and others (2023) referenced both Lake Prevatt and Prevatt Lake. Resource documents also refer to both Lake Prevatt and Prevatt Lake. SJRWMD may wish to ensure that the water body under consideration is consistently referenced by one name throughout all publications, for consistency and to avoid any potential confusion. SJRWMD may wish to acknowledge that the water body is referred to in resource documents as both Lake Prevatt and Prevatt Lake, but that SJRWMD adopts a chosen name, for consistency and to avoid confusion.
33. Sarker and others (2023) used the line of organic correlation method to determine correlations between proximate and distal groundwater wells. Sarker and others (2023) invoke the acronym LOC without defining the acronym. SJRWMD may wish to ensure that all acronyms are properly defined, and to publish a list of acronyms in the frontmatter.
34. Sarker and others (2023) typeset figure 16 caption and figure 16 on different pages. SJRWMD may wish to typeset the caption and figure on the same page.
35. Sarker and others (2023) referenced "pressure head in the UFA." Head in Darcy's Law includes both pressure and elevation. SJRWMD may wish to reference *head in the UFA*, in place of *pressure head in the UFA*.

36. Sarker and others (2023, table 4) tabulated a range of calibrated lower zone nominal soil moisture storages for uplands, a range of calibrated indices to infiltration capacity for uplands, a range of calibrated upper zone nominal soil moisture storages for uplands, a range of calibrated lower zone evapotranspiration, and a range of calibrated leakance. SJRWMD may wish to map these heterogenous parameters over the domain. If ranges are cited because the north lobe sub-watershed has a different calibrated value than the south lobe sub-watershed, SJRWMD may wish to refine table 4 to list a single, separate value for each lobe. If ranges are the limits of calibration, SJRWMD may wish to identify these as limits, and publish the final, single, calibrated value.

37. Sarker and others (2023, table 4) stated the "model tended to overestimate the dry periods". What did the model overestimate? If the model overestimated water-surface elevation, SJRWMD may wish to explicitly state that water-surface elevation was overestimated. If some other parameter was overestimated, SJRWMD may choose to specify this parameter.

38. Sarker and others (2023) captioned figure 18 and figure 20 as observed and simulated daily stage-duration curves. Do figure 18 or figure 20 show the duration over which a water-surface elevation is realized, in some unit of time, such as hours or days? SJRWMD may wish to re-consider whether figure 18 and figure 20 are stage-duration curves, or whether figure 18 and figure 20 are exceedance probability curves. If SJRWMD wish to plot duration, SJRWMD may wish to plot the horizontal axis in some unit of time, such as days or hours.

39. Sarker and others (2023) used the phrase "across the board." This is not a technical term. SJRWMD may wish to replace this phrase with a more technical term, such as "throughout the full range of plotted probabilities."

40. Sarker and others (2023, page 20) characterized the model simulation of Lake Prevatt north lobe stage as adequate ("the model adequately simulated"). Given the importance of lake levels with relatively greater exceedance probabilities to developing a minimum lake level, SJRWMD may wish to revisit whether simulated water-surface elevations being uniformly less than measured water surface elevations in a validation simulation by as much as six inches over exceedance probabilities from about 90 percent to almost 99 percent is adequate. SJRWMD may wish to consider the influence of storage in the upper watershed on lake levels with relatively greater exceedance probabilities (comment 4; **Figure 7**).

41. Sarker and others (2023) stated that "most of the targeted values were achieved" for the Lake Prevatt north lobe. Table 5 of Sarker and others (2023) of shows that six of six targeted values were achieved. SJRWMD may wish to re-consider this "most" characterization.

42. Sarker and others (2023) stated that "many of the targeted values were achieved" for the Lake Prevatt south lobe. Table 6 of Sarker and others (2023) shows that two of six targeted values were achieved. SJRWMD may wish to re-consider this "many" characterization to quantitatively state "two of six targeted values were achieved," or qualitatively state "a few targeted values were achieved."

43. In tables 5 and 6, Sarker and others (2023) typeset percent of observations bracketed within one foot as a whole number percentage, such as 65.30 percent,

while other fit statistics are typeset with fractional representations of whole, such as 0.65. SJRWMD may wish to use a consistent expression of fraction of the whole.

44. Sarker and others (2023) stated that the following factors contribute to uncertainty in a simulation of water-surface elevation in Lake Prevatt from 1953 to 2020: "estimated extensions of the groundwater boundary and South Lobe observed stages, the switch from NEXRAD rainfall used in calibration to a point station some distance from the watershed, and changing conditions on the watershed itself, such as land cover changes due to development." Sarker and others (2023) do not specify whether water-surface elevation measurements used for calibration and validation are also re-used for goodness-of-fit tests of this long-term simulation from 1953 to 2020. SJRWMD may wish to acknowledge the percentage of measurements used to judge goodness-of-fit of the long-term simulation were also used for calibration and validation. Sarker and others (2023) subsequently stated that the "fact that the metrics are still acceptable is evidence that the model is sufficient for predicting long-term behavior of the system outside of the calibration and validation periods." Sarker and others' (2023) assertion of sufficiency may not be firmly established, particularly given the apparent uniform weighting of measurements (comment 25), exclusion of areas that periodically drain to Lake Prevatt (comment 10 and 11), and exclusion of storage in the upper watershed (comment 9). Consequently, long-term simulation results may not be reasonable. SJRWMD may wish to establish sufficiency more firmly.
45. HSPF is an appropriate model, to simulate water-surface elevations in Lake Prevatt, over decades. HSPF is an appropriate model to inform and support minimum lake level determination, for State of Florida states in Water Resource Implementation Rule 62.40.473.
46. Sarker and others' (2023) use of HSPF to simulate water-surface elevation in Lake Prevatt may not be appropriate, defensible, or valid, to inform and support minimum lake level determination, for State of Florida states in Water Resource Implementation Rule 62.40.473, due to several comments detailed in the present memorandum. Revision to address the following comments may substantially change simulated Lake Prevatt water-surface elevation and the relationship between lake stage and exceedance probability: comment 9 related to storage in the upper watershed, comment 10 related to watershed delineation, comment 11 related to Lake McCoy and Lake Coroni, comment 25 related to calibration weights.
47. A simulation is an abstract representation of a more complex system. Simulations typically require assumptions that result in tractable solutions, but introduce abstractions. To simulate Lake Prevatt water-surface elevations, Sarker and others (2023) made several assumptions. For example, Sarker and others (2023) assumed leakance is constant over the duration of the simulation. Sarker and others (2023) did not systematically identify or justify assumptions. Because assumptions are not systematically identified and justified, reviewers of this simulation and the supporting document are challenged to methodically consider each assumption. SJRWMD may wish to revise the document that describes the simulation to systematically identify each assumption, and to explicitly justify each assumption.

Water Balance

In the 2006-to-2020 simulation, 76 percent of inflow to Lake Prevatt is runoff and 24 percent is rainfall (**Figure 17**). Total inflow to Lake Prevatt is the sum of runoff and rainfall. In the simulation, groundwater outflow from Lake Prevatt is equivalent to 69 percent of total inflow to Lake Prevatt. Rainfall on the surface of Lake Prevatt is about the same as evaporation from the surface of Lake Prevatt. Surface-water outflow from Lake Prevatt to Carpenter Branch in Wekiva Springs State Park is about 4 percent of total inflow to Lake Prevatt.

In the 2006-to-2020 simulation, runoff from the simulated Lake Prevatt watershed to Lake Prevatt is equivalent to about 20 percent of rain on the simulated watershed. In the simulation, evapotranspiration from the simulated Lake Prevatt watershed is equivalent to 74 percent of rain on the watershed. In the simulation, infiltration from the simulated Lake Prevatt watershed to the Florida aquifer system is equivalent to 6 percent of rain on the simulated watershed.

Runoff and infiltration volumes are reasonable.

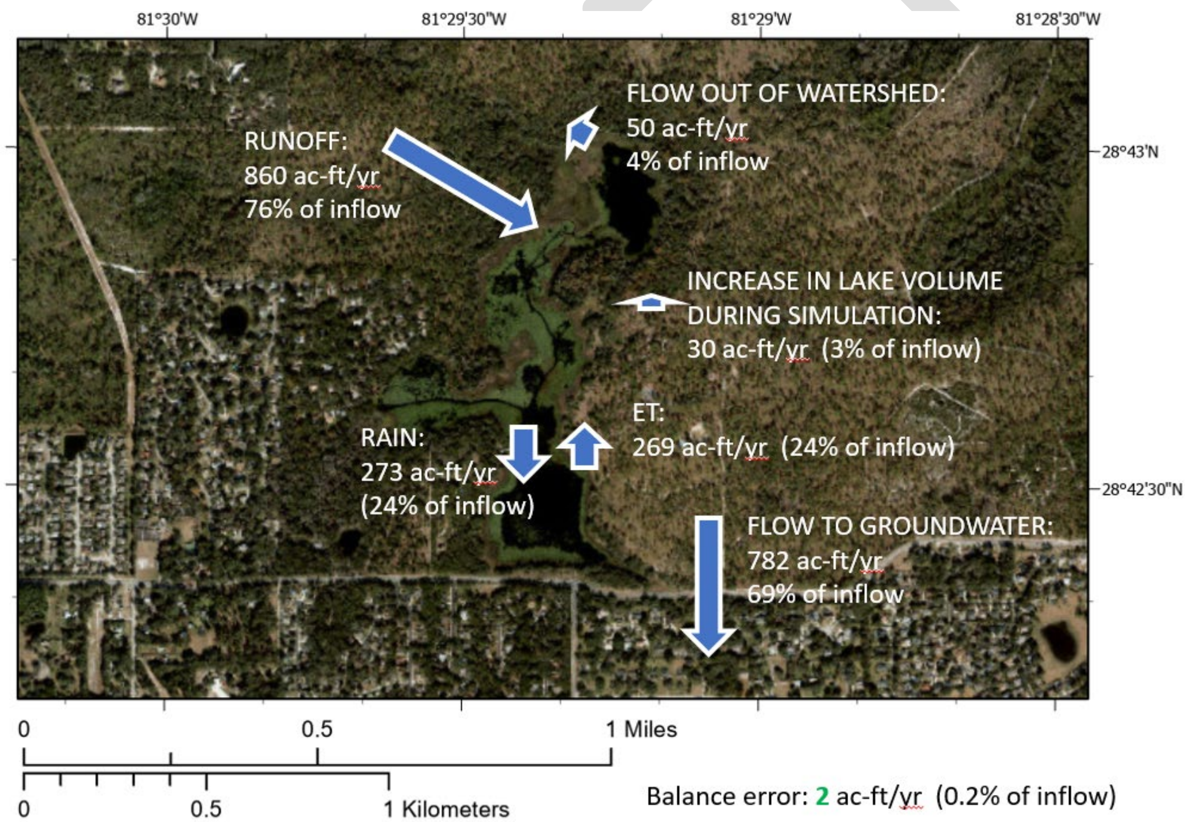


Figure 17. Simulated water balance in acre feet per year and as a percentage of inflow to the lake, to or from Lake Prevatt, from 2006 to 2020.

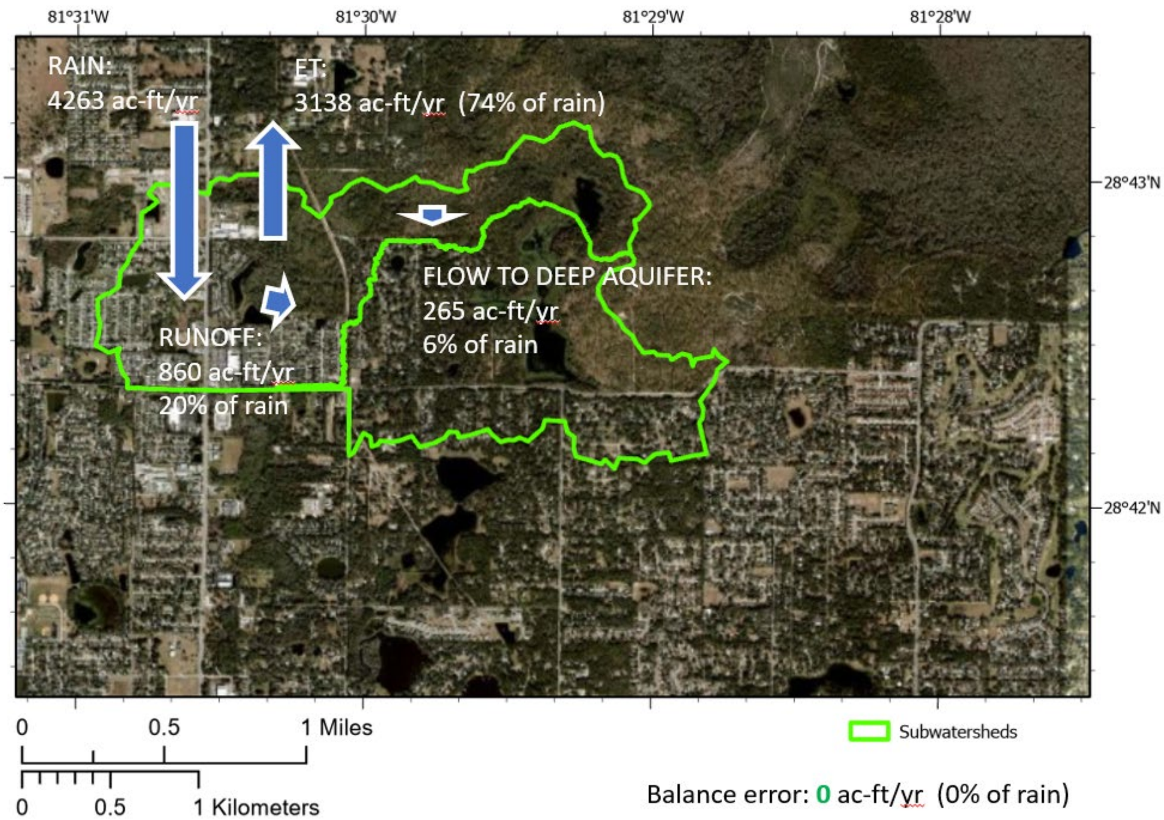


Figure 18. Simulated water balance in acre feet per year and as a percentage of rain, to or from the simulated Lake Prevatt watershed (green polygons), from 2006 to 2020.

References

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