Orlo Vista Water Yield Analysis:

Enhancing Flood Resilience while Developing an Alternative Reuse Supply

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Florida Stormwater Association
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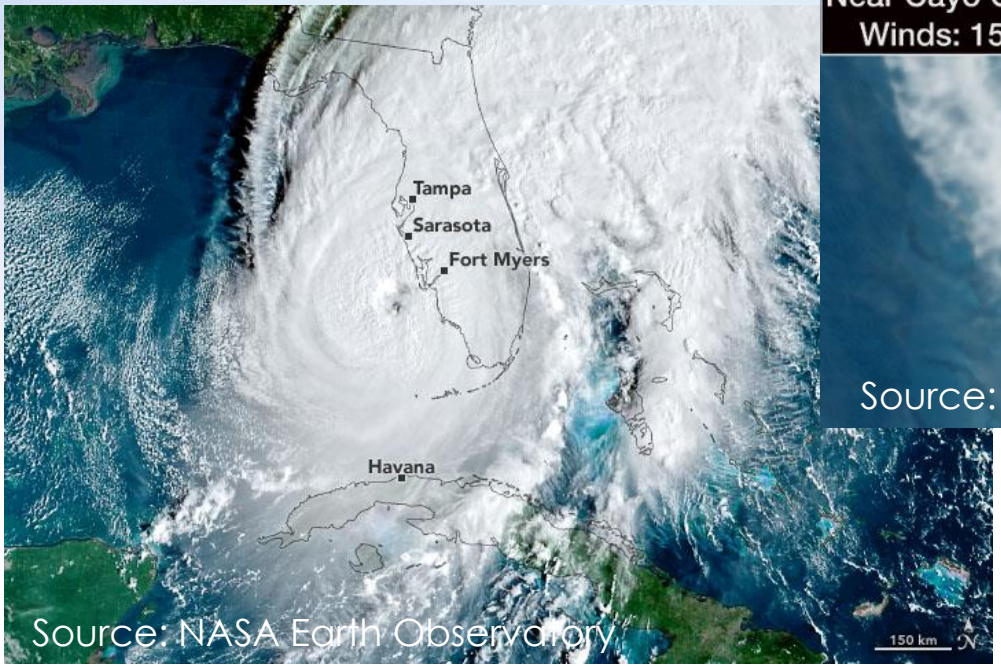
Background

Orlo Vista neighborhood

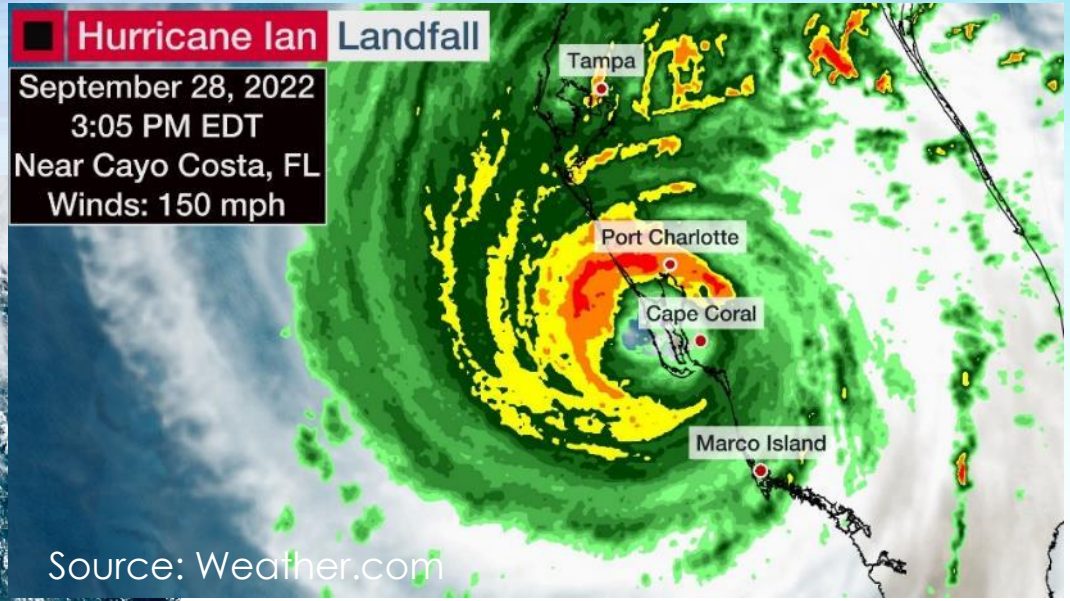
- Homes built in 1950s and 1960s
- Closed hydrologic unit at the northern extent of the Shingle Creek basin – no natural discharge
- Many homes within floodplain
- Community subject to repeated flooding
- Orlo Vista is located within Central Florida Water Initiative (CFWI) where water supply is constrained

Background

Hurricane Ian, September 2022, Cat 4

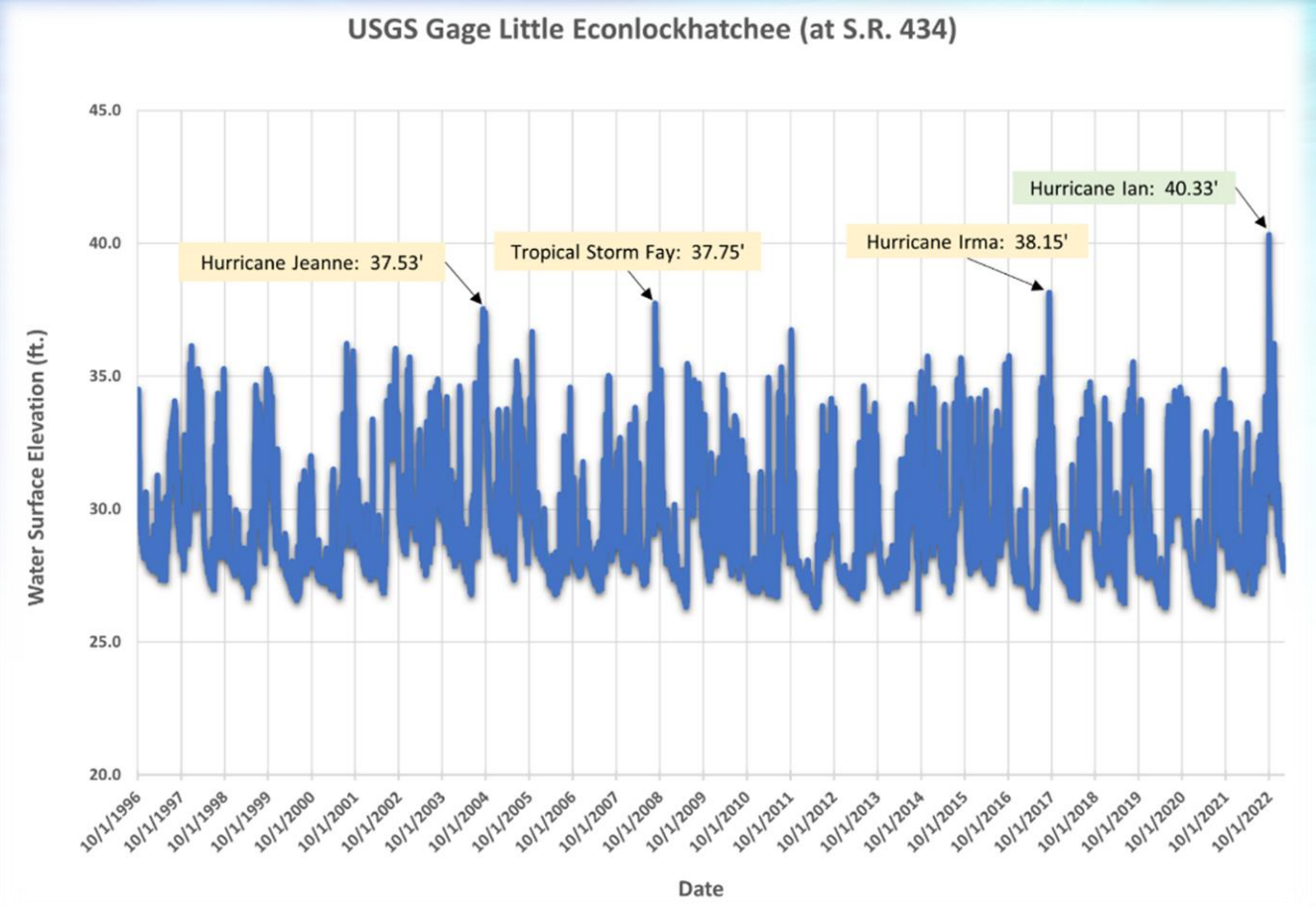


Source: NASA Earth Observatory



Source: Weather.com

Background


USGS Gage Little Econlockhatchee (at S.R. 434)
Water Surface Elevation (ft.)
45.0
40.0
35.0
30.0
25.0
20.0
Hurricane Jeanne: 37.53'
Tropical Storm Fay: 37.75'
Hurricane Irma: 38.15'
Hurricane Ian: 40.33'
10/1/1996
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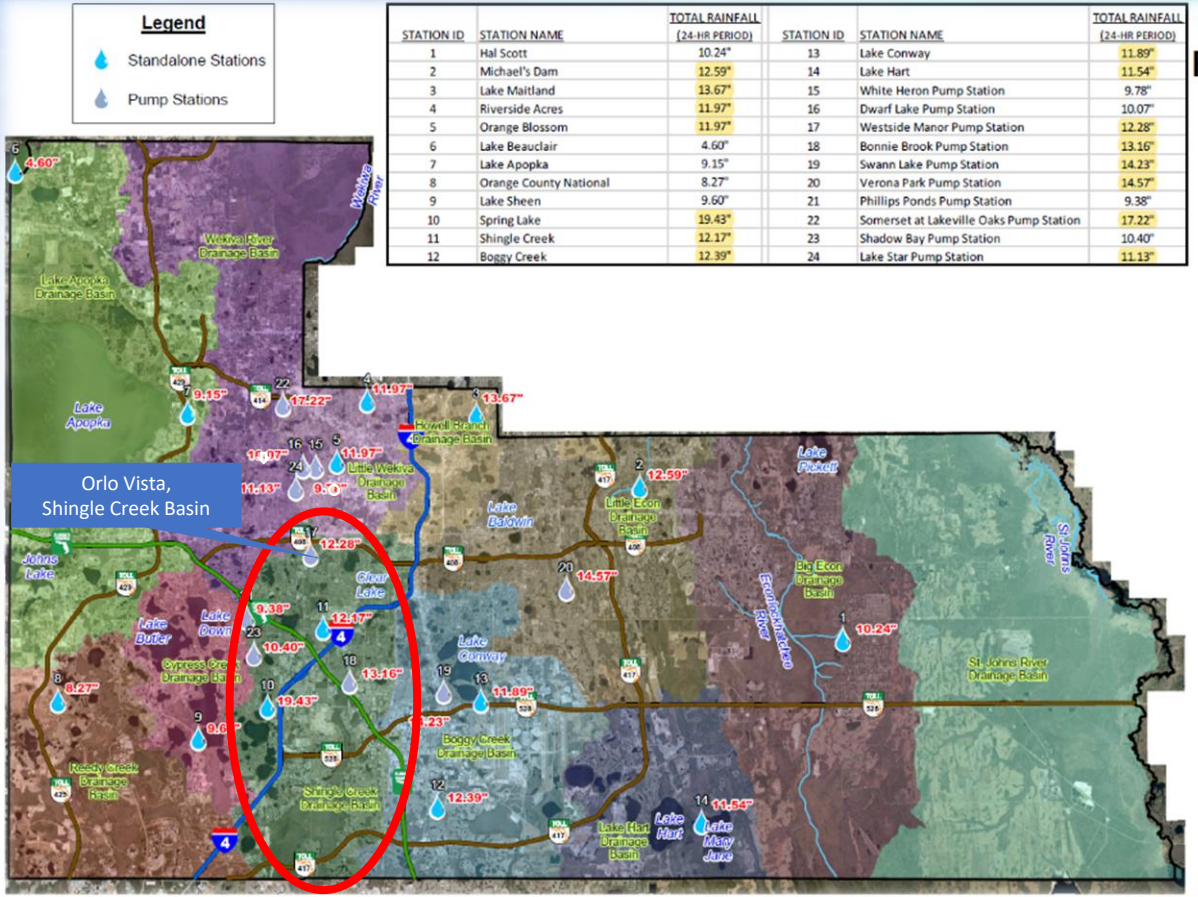
10/1/2018
10/1/2019
10/1/2020
10/1/2021
10/1/2022
Date

Background

Hurricane Ian

- Almost 20” rainfall in 24-hour period in parts of Orange County
- 4.6” in other parts
- Flooding in areas outside the floodplain
- Not your uniform design storm!



STATION ID	STATION NAME	TOTAL RAINFALL (24-HR PERIOD)	STATION ID	STATION NAME	TOTAL RAINFALL (24-HR PERIOD)
1	Hal Scott	10.24"	13	Lake Conway	11.89"
2	Michael's Dam	12.59"	14	Lake Hart	11.54"
3	Lake Maitland	13.67"	15	White Heron Pump Station	9.78"
4	Riverside Acres	11.97"	16	Dwarf Lake Pump Station	10.07"
5	Orange Blossom	11.97"	17	Westside Manor Pump Station	12.28"
6	Lake Beauclair	4.60"	18	Bonnie Brook Pump Station	13.16"
7	Lake Apopka	9.15"	19	Swann Lake Pump Station	14.23"
8	Orange County National	8.27"	20	Verona Park Pump Station	14.57"
9	Lake Sheen	9.60"	21	Phillips Ponds Pump Station	9.38"
10	Spring Lake	19.43"	22	Somerset at Lakeville Oaks Pump Station	17.22"
11	Shingle Creek	12.17"	23	Shadow Bay Pump Station	10.40"
12	Boggy Creek	12.39"	24	Lake Star Pump Station	11.13"

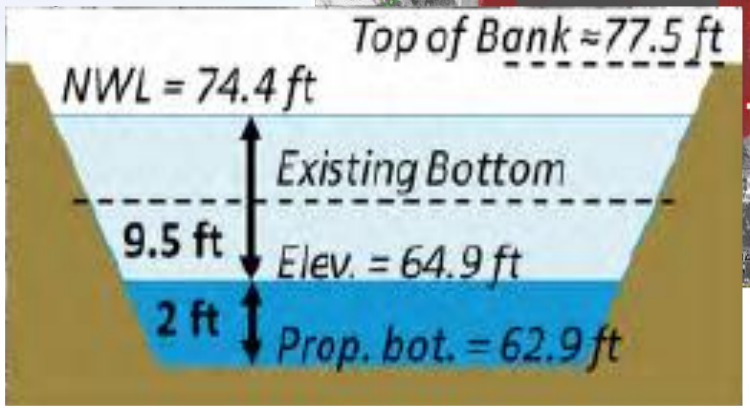
Background

During Hurricane Ian 148 homes in Orlo Vista flooded despite early pumping to Shingle Creek

Background

Flood Attenuation Project

- Excavation and slope armoring of existing stormwater ponds, installation of new pump station with force main to Shingle Creek
- Provides a higher level of flood protection (100yr/72hr)
- Pumping schedule creates attenuation volume by lowering water elevation by 11.5’. It takes 4 days to lower water level prior to storm event
- No downstream impact



Can we do more?

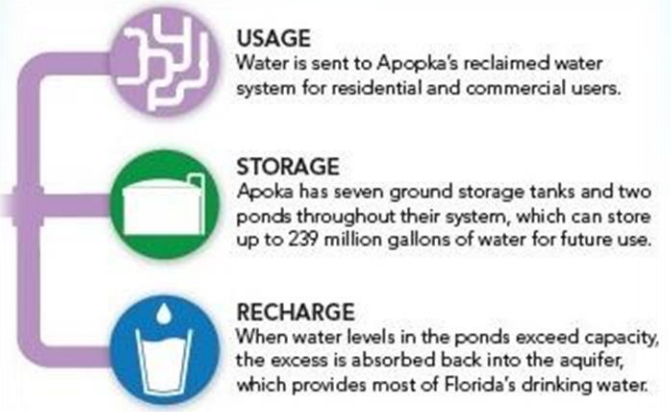
Integrated Water Resources

Using excess surface waters to provide flood control AND alternative reuse supply

- Slightly lowering surface water body throughout the year, creating more flood attenuation volume
- Surface water withdrawn is used to supplement the reclaimed water system or to recharge the aquifer elsewhere
- Similar project (A-FIRST) implemented before for I-4 Ultimate and closed basin in Altamonte Springs
- Successful operations for over 6 years, including Hurricanes Matthew, Irma, and Ian

A-FIRST
Altamonte Springs-FDOT Integrated Reuse and Stormwater Treatment

INNOVATE TODAY FOR *Water Tomorrow*



Integrated Water Resources

Conserv II Aquifer Recharge

- Largest aquifer recharge facility in the State
- Major component for addressing regional water supply and MFLs
- Serving two RWRFs:
  - Orange County Utilities SWRF, 56 MGD
  - City of Orlando (Conserv II 25 MGD)
- 5,000 acres for irrigation and RIBS
- 158 acres existing RIBS
- Permitted for 80.6 MGD, with 43.3 MGD RIBS

Integrated Water Resources

Orlo Vista IWR Concept

- Slightly lowering normal water level in ponds by pumping a baseflow throughout the year
- Provides additional flood attenuation volume in ponds
- Pumped baseflow is discharged to Shingle Creek headwaters, but instead of being discarded, flows are recovered 7 miles downstream at the South Water Reclamation Facility (SWRF – largest WRF in Central Florida)
- Flows are recovered prior to reaching Osceola County, eliminating downstream flood concerns
- Flows treated at SWRF to meet reclaimed water standards and beneficially used for irrigation and aquifer recharge
- Win-win solution with added sustainability and resiliency!

Can it work?

Integrated Water Resources

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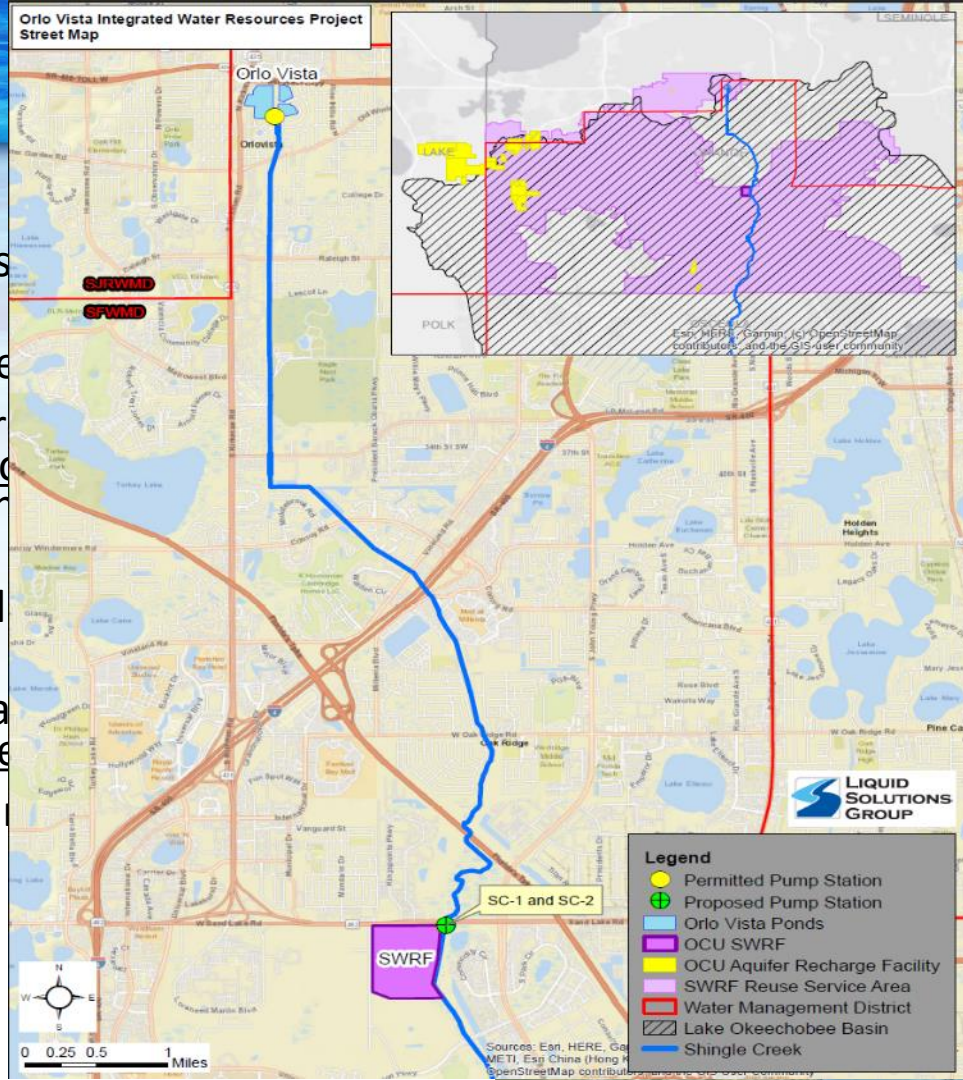


Overview – Water Budget Analysis

Orlo Vista Stormwater Pond System

An Ongoing Flood Control Project

Feasibility Analysis

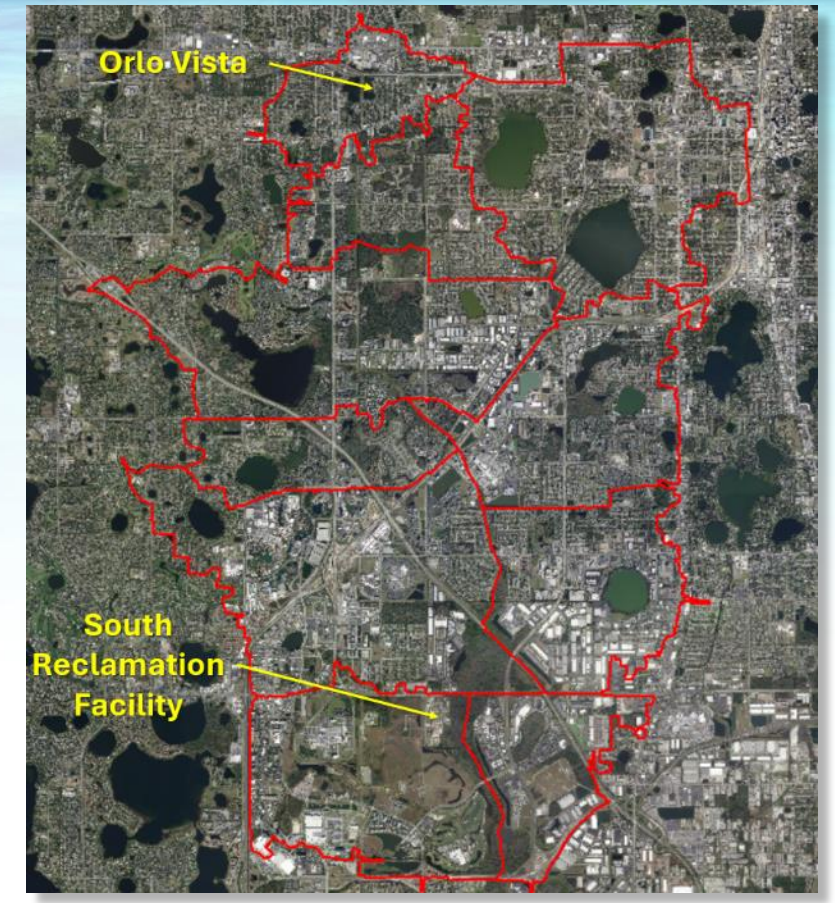
Pump 2.5 MGD into Shingle Creek (Orlo Vista PS)

Withdraw/Treat 2.5 MGD baseflow from Shingle Creek (7 miles downstream)

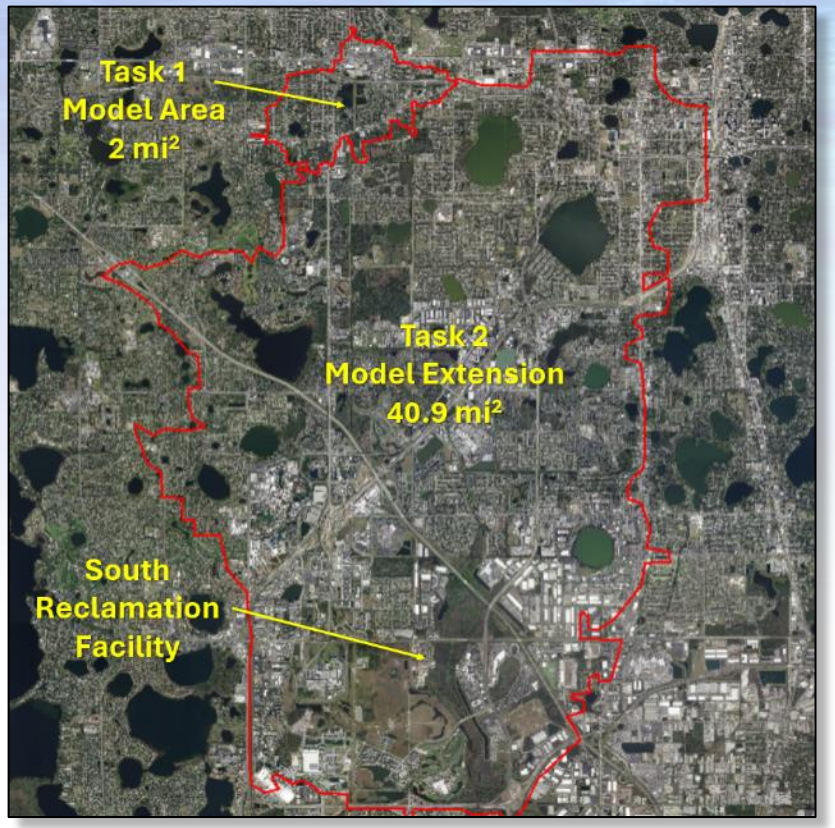
South Water Reclamation Facility (SWRF)

Excess water removed

Irrigation / Stored / Aquifer Recharge



Water Budget Model Development



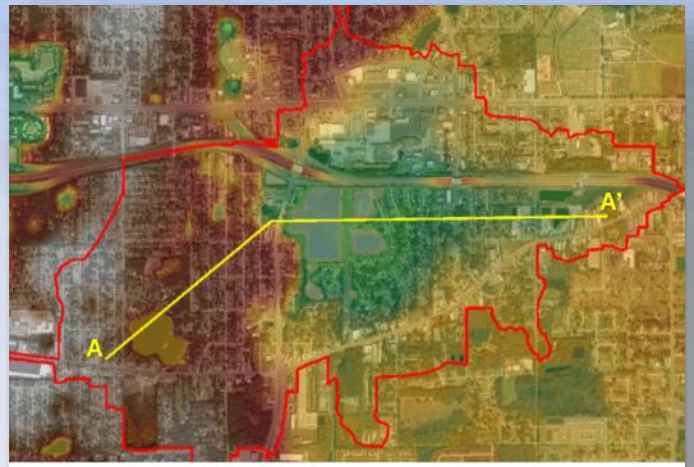
Objectives

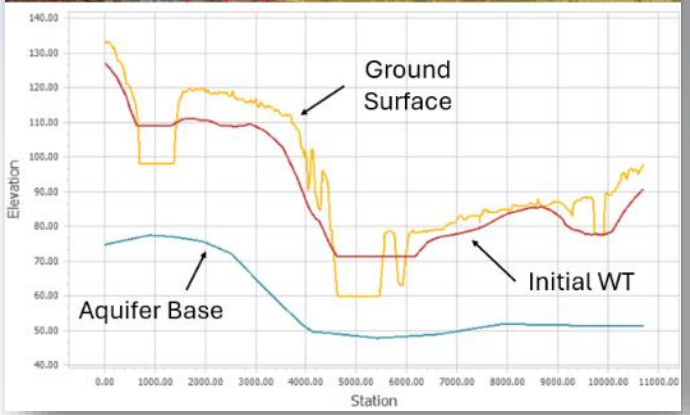
- Feasibility of withdrawing 2.5 mgd from Orlo Vista pond system
- Water gains and losses between pump discharge point and SWRF

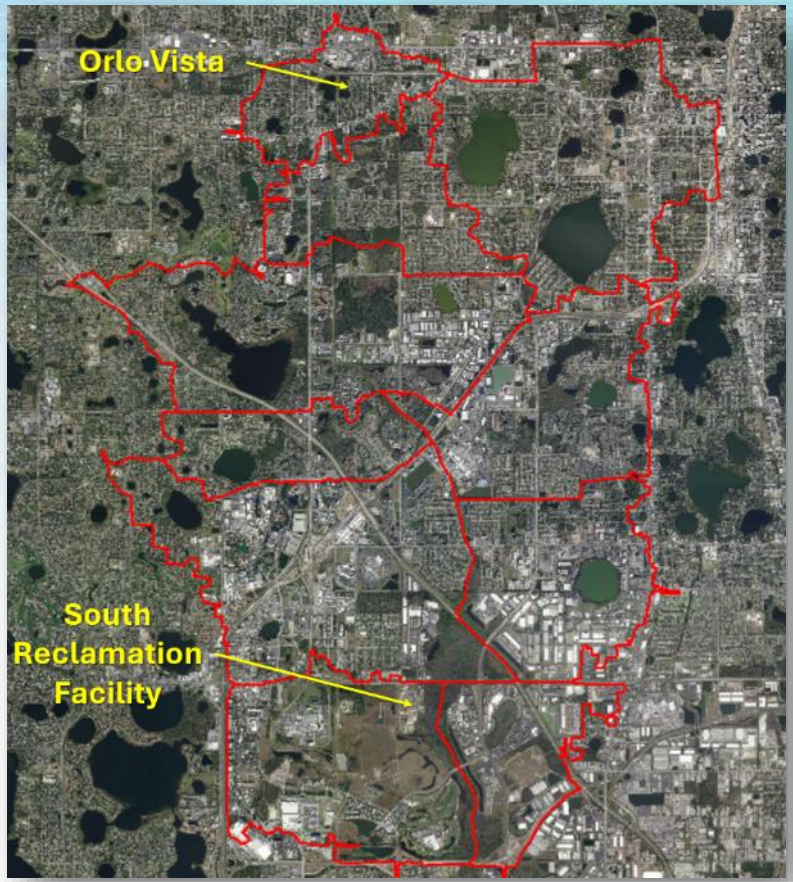
Simplify Interim Geosyntec Model

- Reduce number of channel links by combining shorter channels
- Eliminate storm sewer systems
- Remove small stormwater ponds
- Remove areas that do not drain to Shingle Creek

Groundwater Integration







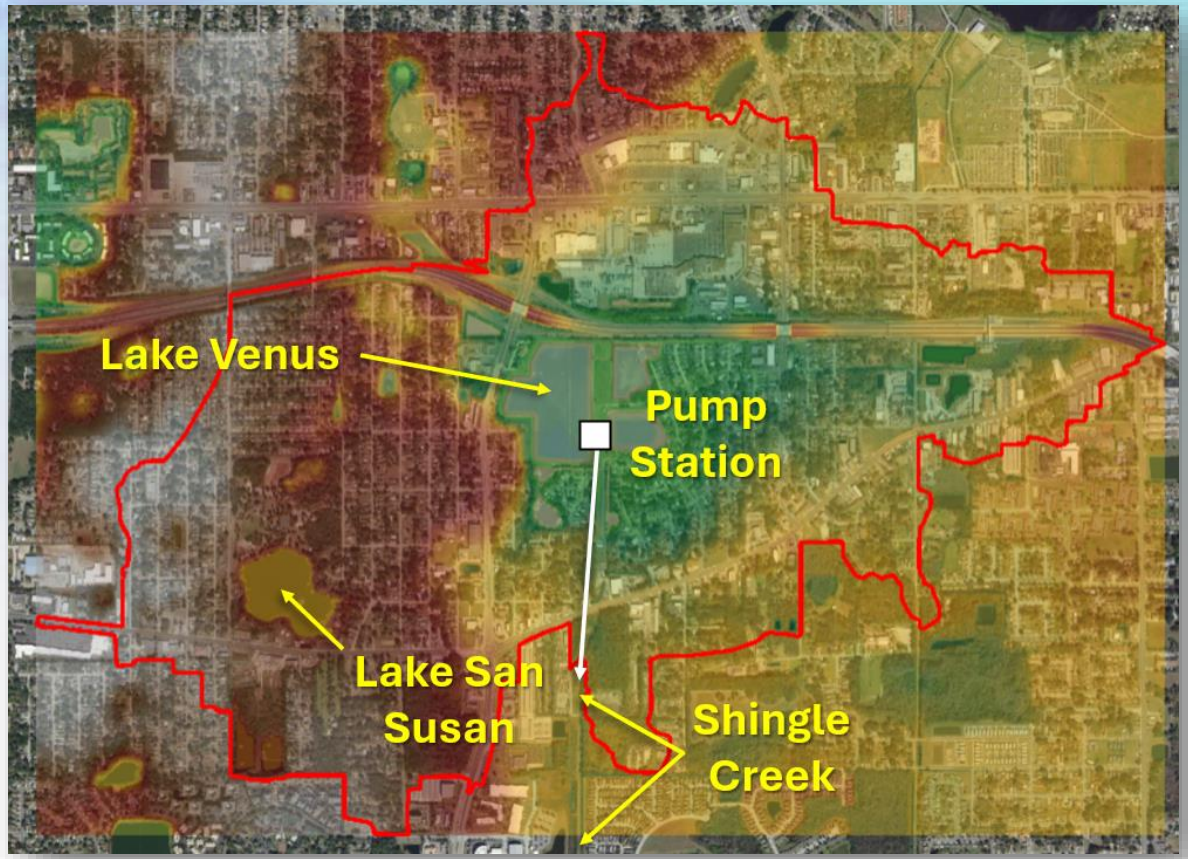
Model Domain

Orlo Vista Area

20-Year Simulation

Sim 1: Permitted triplex pump station operations without 2.5 mgd utility pump (lowest control elev 74.4')

Sim 2: Permitted triplex pump station operations with 2.5 mgd utility pump (lowest control elev 71.0')



Hydrologic Water Balance
20-Year Simulation

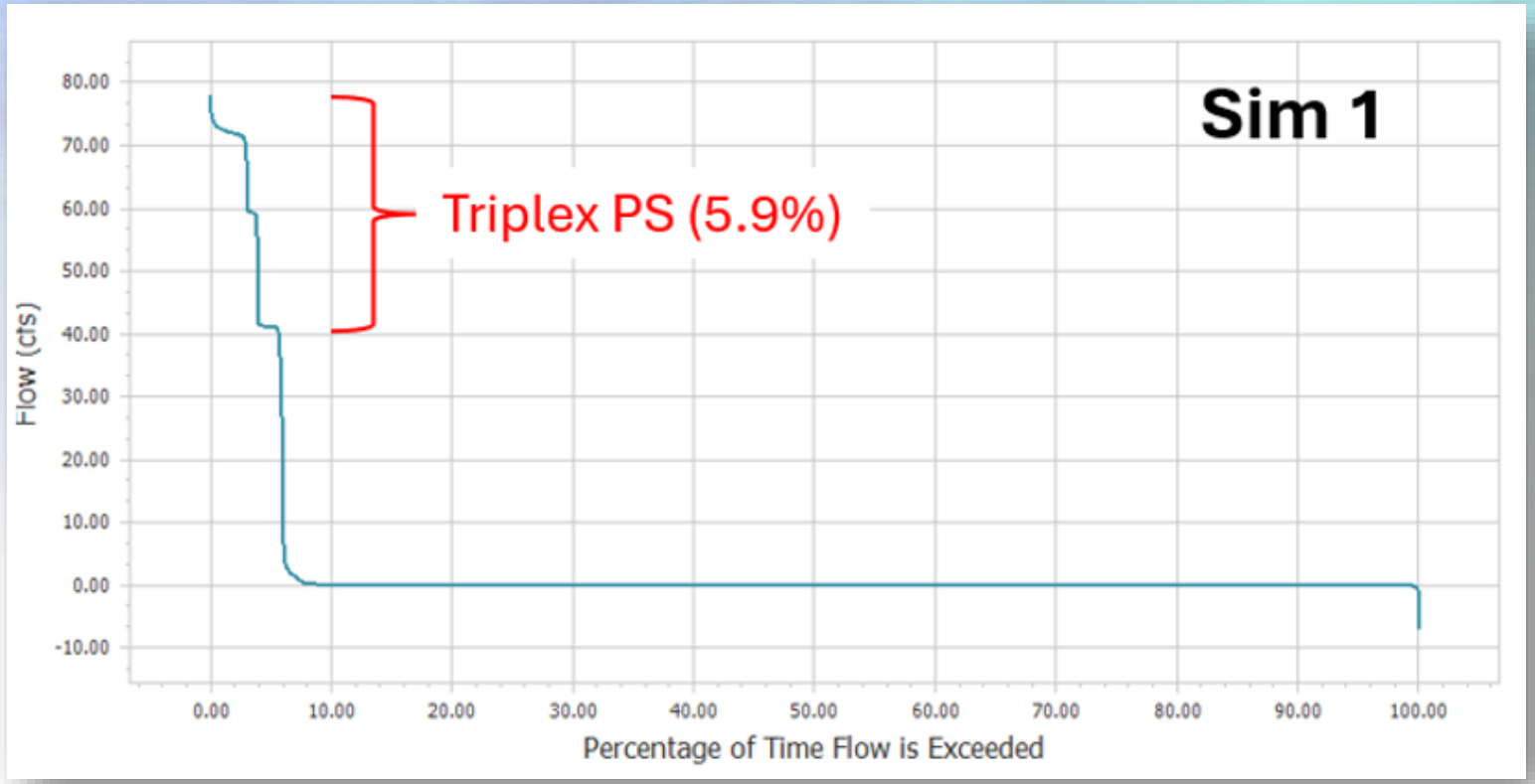
Streamline TECHNOLOGIES

Parameter	Volume (in)	Avg Annual (in)
Rainfall	997.25	49.86
Surface Runoff	529.25	26.46
ET	426.94	21.35
GW Recharge	55.71	2.79
Stored Volume	-14.64	-0.73

Mass Balance Error: 0.12% for the 20-year simulation (negligible)

Discharge Reliability

Orlo Vista Pump Station



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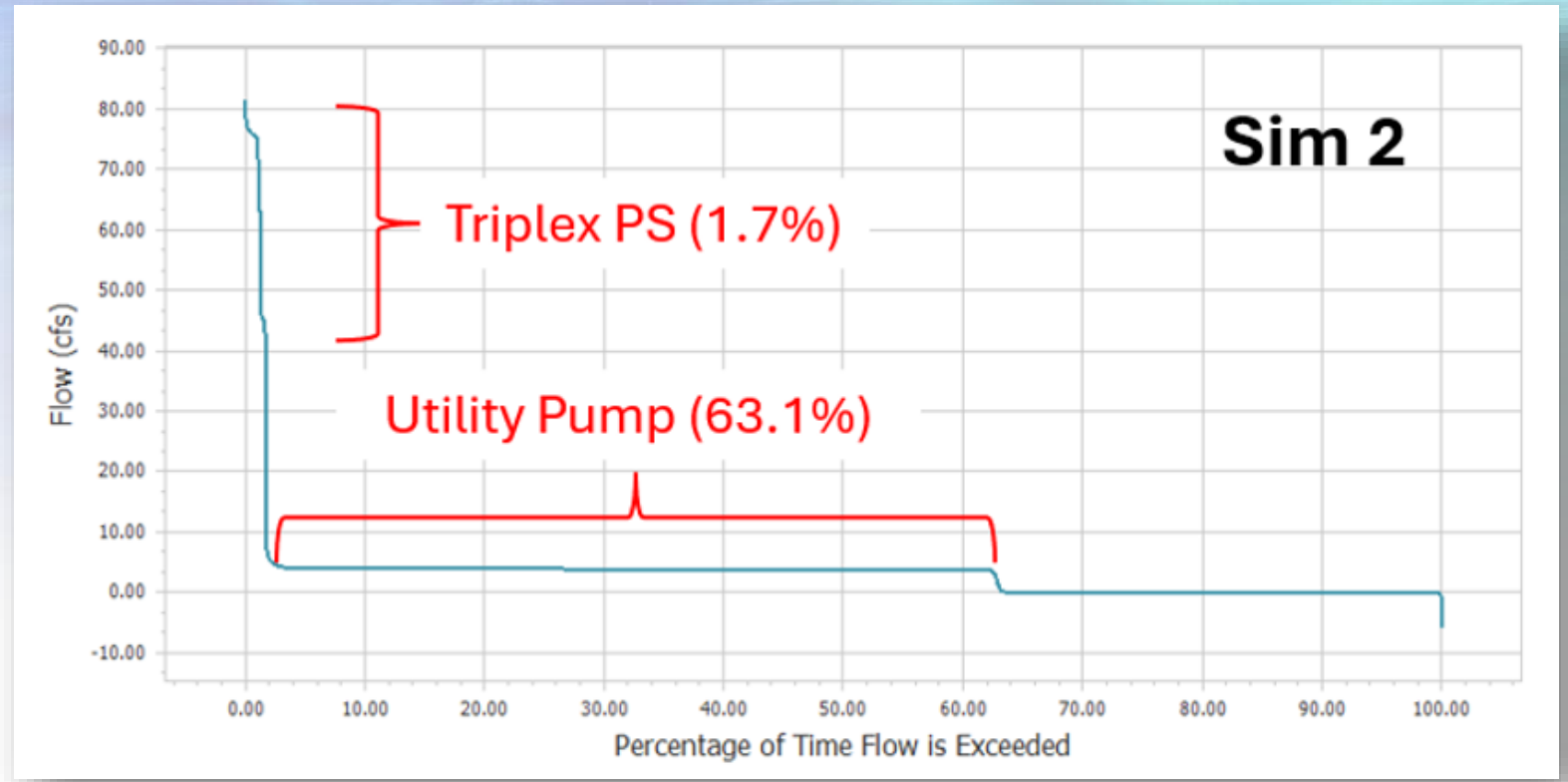
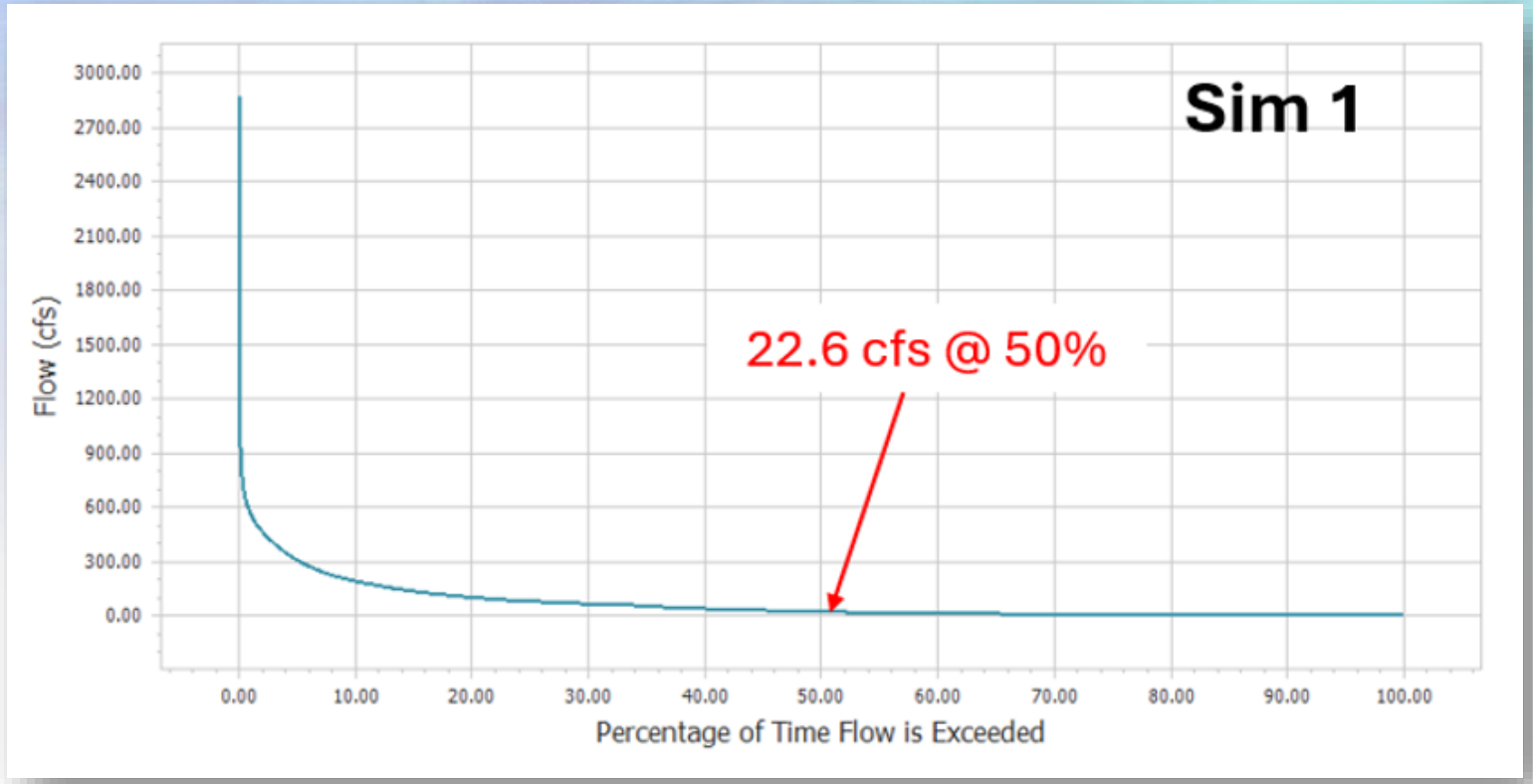


Discharge Reliability

South Water Reclamation Facility



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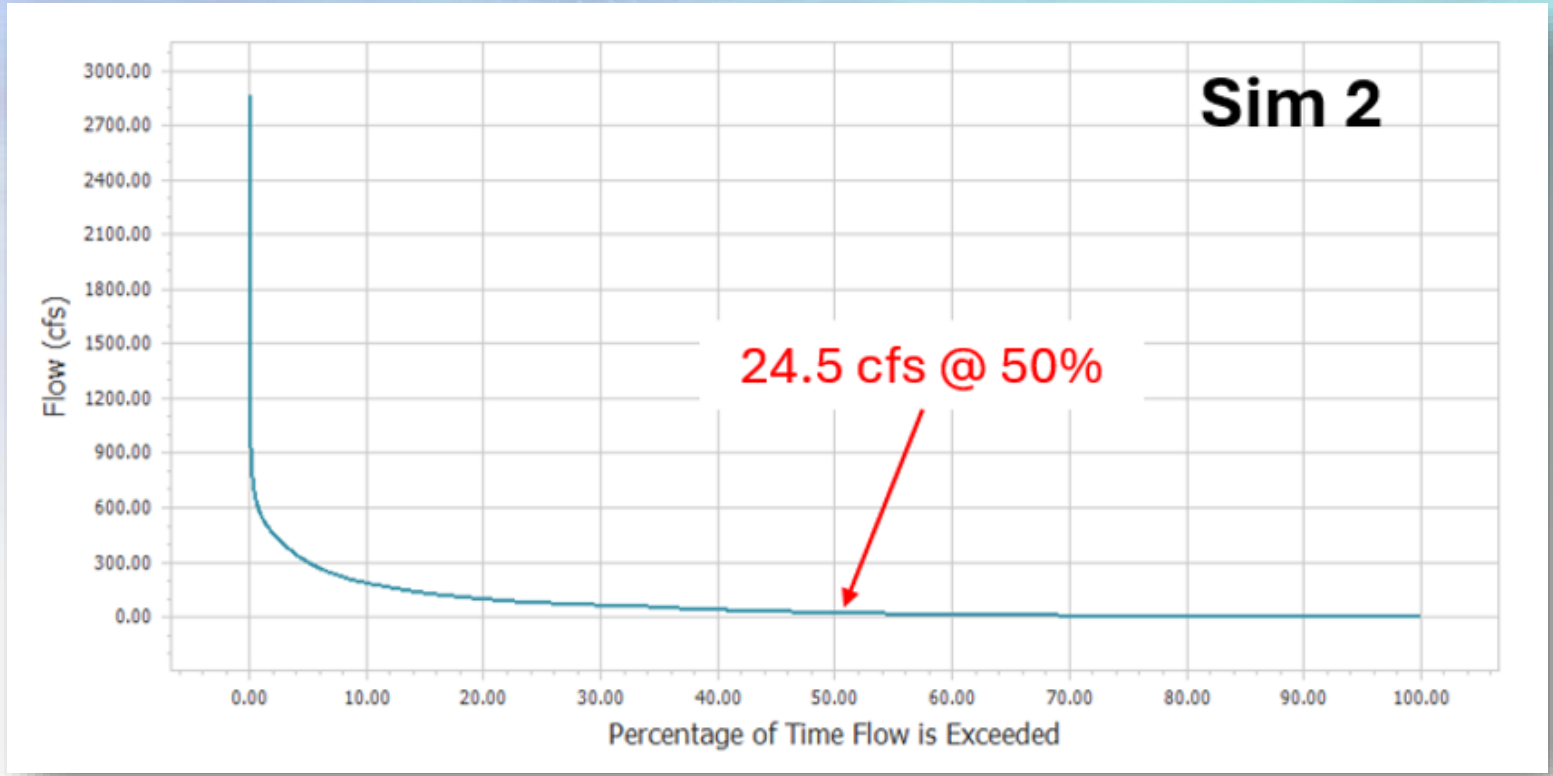


Discharge Reliability

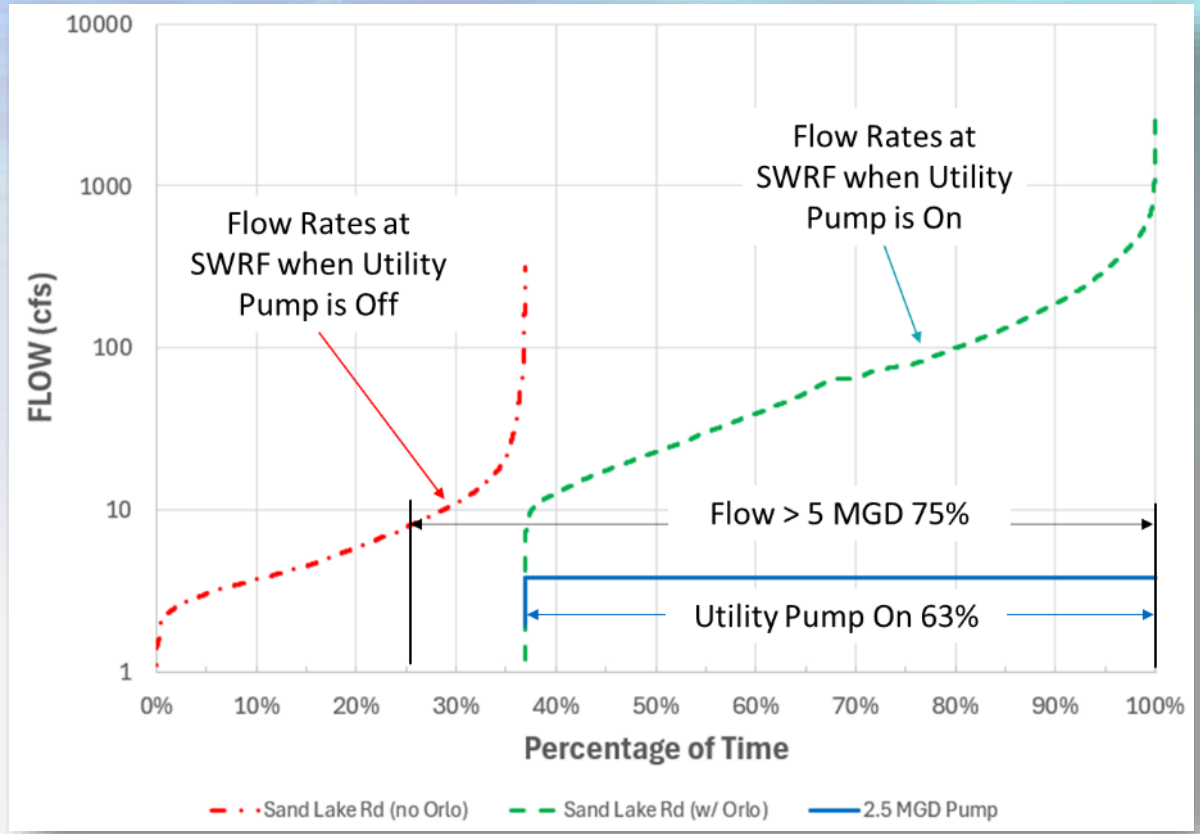
South Water Reclamation Facility

Exceedance Probability (%)	Sim 1 (cfs)	Sim2 (cfs)
10	191.8	188.1
25	79.0	78.8
50	22.6	24.5
75	6.9	7.8
90	3.7	3.7

~ 5 MGD
F.O.S. = 2.0

Discharge Reliability

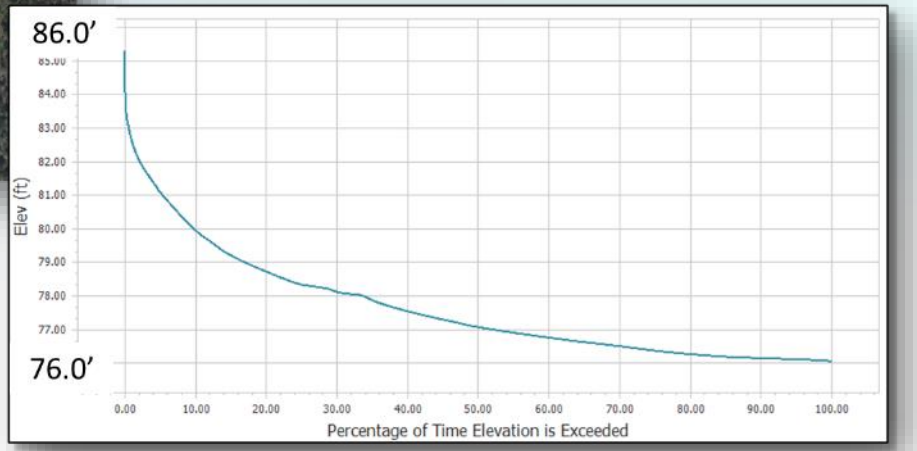
South Water Reclamation Facility



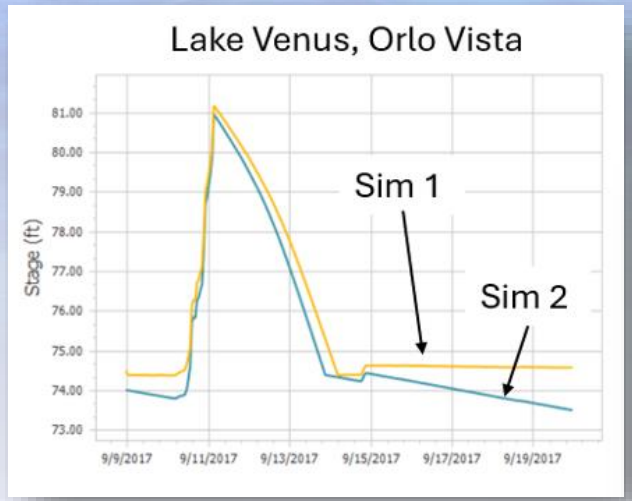
Water Depths

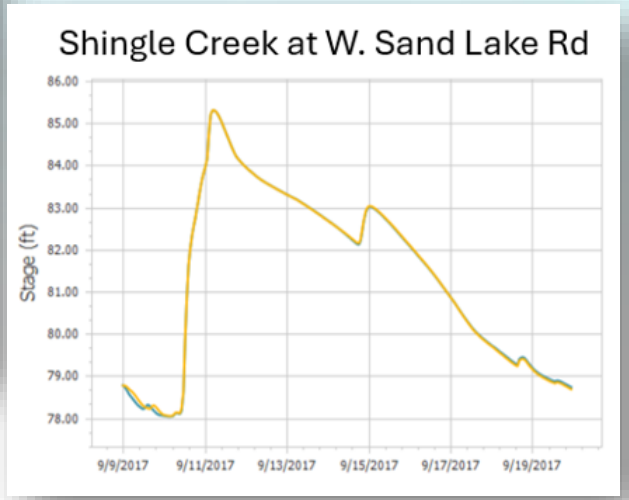
South Water Reclamation Facility

Water depths are expected to be 1.0 to 1.5 feet or more most of the time



Flooding Impact

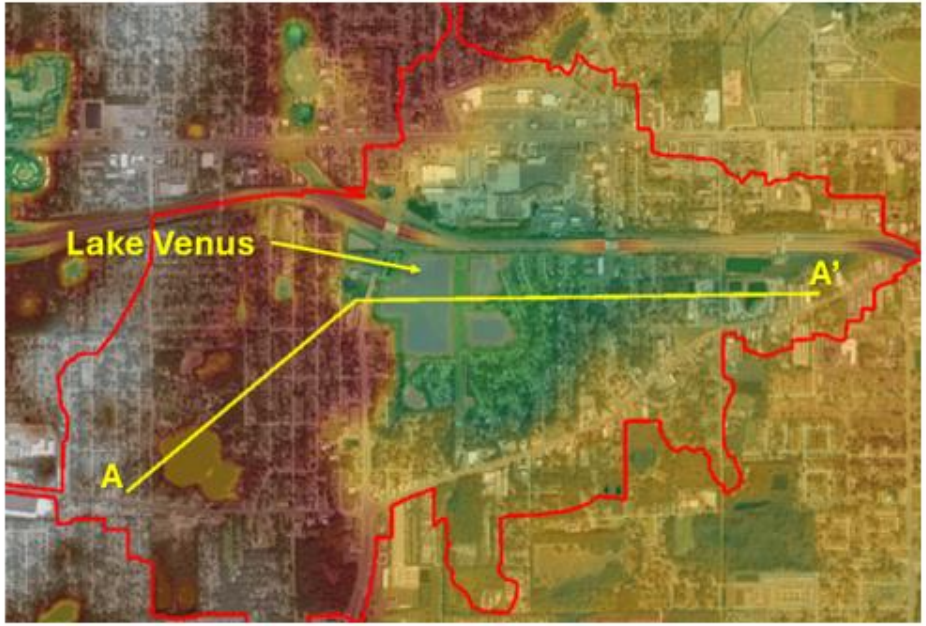




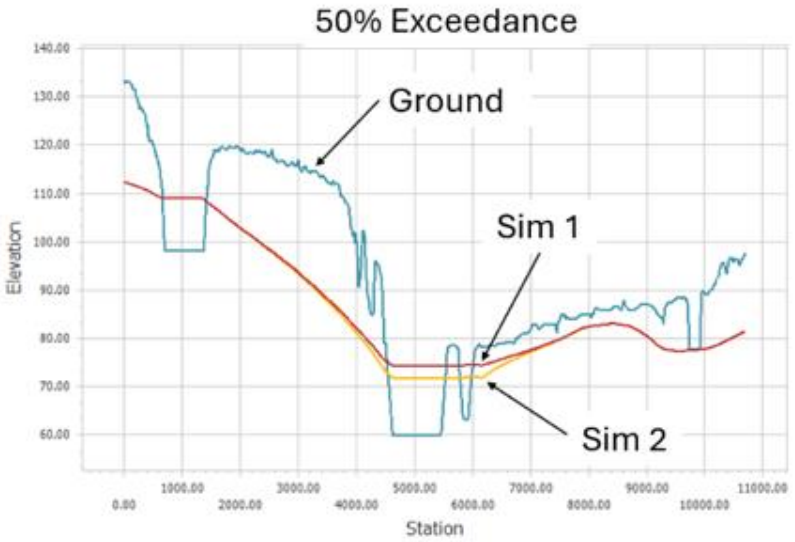
Hurricane Irma

Groundwater Impact

Orlo Vista



The zone of influence is approximately 1,000 feet from the edge of the lake.



Conclusions

1. Sim 2 – Reliable base flow
   - Utility pump operates approximately 63% (Sim 2)
   - Triplex pump station operates only 5.9% of the time (Sim 1)
   - Adequate flow at the South Reclamation Plant for 2.5 mgd withdrawal ~ 75% of the time on average (Sim 2)
2. Sim 2 – Flood Protection
   - Increases flood protection in the Orlo Vista neighborhood
   - Adds “buffer” storage for short-duration, high-intensity storms
   - Shortens drawdown time of the ponds by 24 hrs for major storm systems
3. Sim 2 – No additional flood risk along Shingle Creek

Conclusions – Value Added

Fiscal Perspective

- Alternative Water Supply Options ~ $26.5M per 1 MGD
  - Brackish groundwater
  - Surface water
  - Potable reuse
- Orlo Vista IWR ~ $5M per 1 MGD

Grants

- FDEP AWS and CDBG-DR grants for 100% of estimated construction costs ~ $12.5M

Load Reduction

- TSS 27,549 lbs/yr
- TN 5,790 lbs/yr
- TP 631 lbs/yr

Tripple Bottom Line

- Improved Flood Protection
- Water Quality Improvements
- Alternative Water Supply

Can we do more?