



A Modern Hydrologic Monitoring System in an Urban Environment

2019 FSA Winter Conference

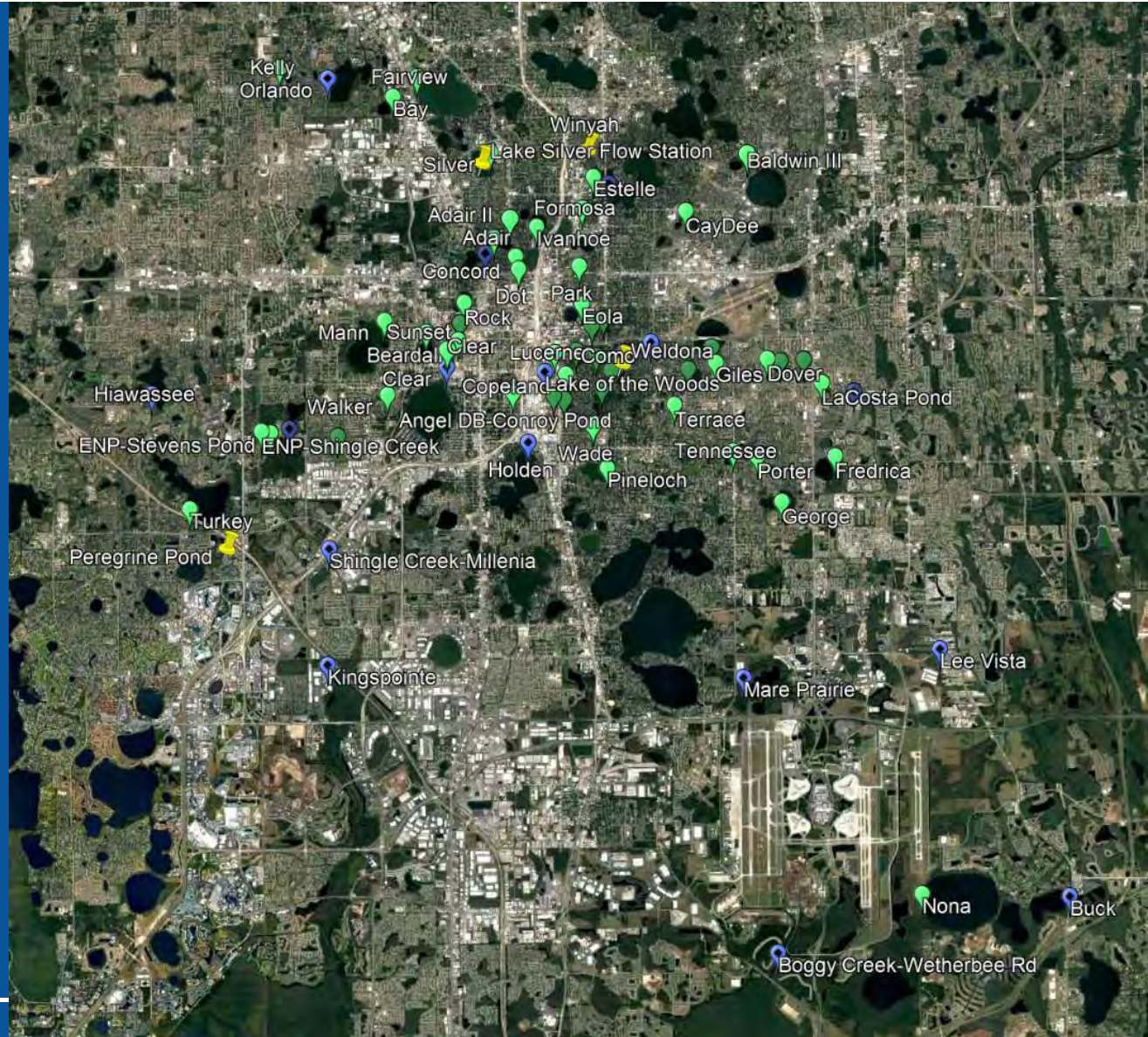
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The City of Orlando
Routinely Monitors
Nearly 100 Lakes
and Several Creeks
Throughout the City



Usefulness of a Remote Monitored System?

- Flood Warning
- Turbidity Warning
- MS4 Permitting and Compliance
 - TMDL Monitoring
 - Reasonable Assurance Plans (Nutrient Reduction Program)
 - Boggy Creek and Shingle Creek
 - Basin Management Action Plans (BMAP)
 - Lake Jesup and Wekiva River



Prior City of Orlando Hydrologic Monitoring Stations Installed 2004 - 2008

- Tipping Bucket Rain Gauge
- Pressure Transducer
- Radio Transmission at Time of Event
(Per bucket tip or 0.1' change in stage)

Pros:

- Low power consumption

Cons:

- Difficult to maintain or repair
- Data transmission unreliable and occasionally corrupt
- Dependent on radio receiver and server for data acquisition
- Lack of complete "Data Ownership"



Upgraded City of Orlando Hydrologic Monitoring Stations Installed 2018-2019

- Rainfall recorded per bucket tip
- Stage acquired every 15 minutes
- Transmits data via cellular radio every 60 minutes to cloud service

Pros:

- Modular
- Easier to maintain
- Reliable
- Complete control of data acquisition

Cons:

- Increased visibility
- Higher power consumption requires reliable insolation



Capabilities of the City of Orlando Water Monitoring Network

- Meteorological
 - Tipping Bucket Rain Gauges
- Water Elevation
 - Pressure Transducers
- Water Quality
 - Multi-Parameter Sondes (pH, turbidity, nutrients, etc)
- Stream Flow
 - Acoustic Doppler Velocimeter (ADV) flowmeters
- Water Sampling
 - Refrigerated Autosamplers with rain or flow triggers



Components Integrated into Upgraded Water Monitoring Network

- All Sites (65+)
 - Campbell Scientific CR300 Datalogger
 - Sierra Wireless RV50 Cellular Modem
 - 30 Watt Solar Panel
 - Sunsaver 6L Solar Regulator
 - Ott and Campbell Scientific Pressure Transducers
 - 12V 35 Ah Sealed Lead Acid Battery
 - Lightning and Electrical Surge Protection
- Select Sites (23+)
 - Texas Electronics 0.01" Tipping Bucket Rain Gauge (with bird deterrent spikes)
- TMDL Monitoring Sites (2 Currently)
 - Sontek IQ ADV Flow Measurement
 - Relative Stage (Weir Equation Flow)
 - QCEC Refrigerated Vacuum Auto-sampler



Drawings Provided For Installation

Diagram "B"
Single Pole
Stage Only

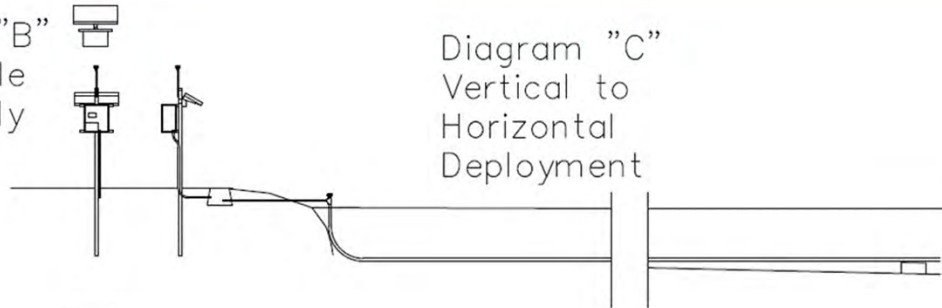


Diagram "C"
Vertical to
Horizontal
Deployment

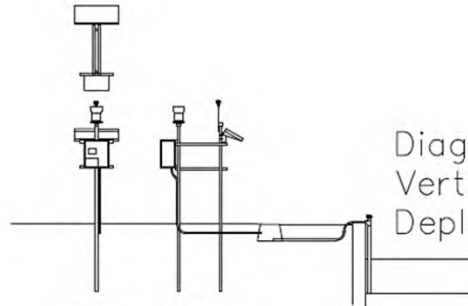


Diagram "D"
Vertical
Deployment

Diagram "A"
Two-Pole
Stage and
Rais

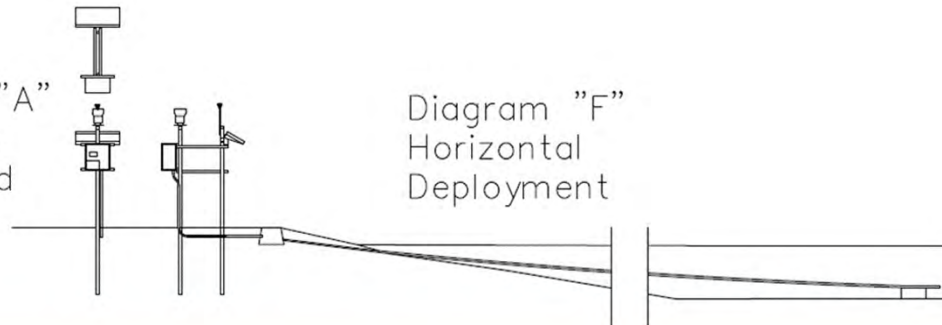


Diagram "F"
Horizontal
Deployment



Sensor Deployment Methods Changed According to Specific Site Conditions



Horizontal Deployment



Vertical Deployment

Vertical to Horizontal
Deployment for Shallow
Waters at a Seawall



Data Management, Visualization and Alerts

The City of Orlando uses Aquatic Informatics products “AQUARIUS Time-Series” and “AQUARIUS Samples” with public WebPortal access

- City of Orlando personnel receive text and email alerts that can indicate the need to collect from an automated sampler, or that a water body is approaching flood stage
- Using the WebPortal, City of Orlando personnel and the public can obtain current and past lake levels, and rainfall reports in a user-friendly interface



Public WebPortal [HTTPS://hydrology.orlando.gov/](https://hydrology.orlando.gov/)



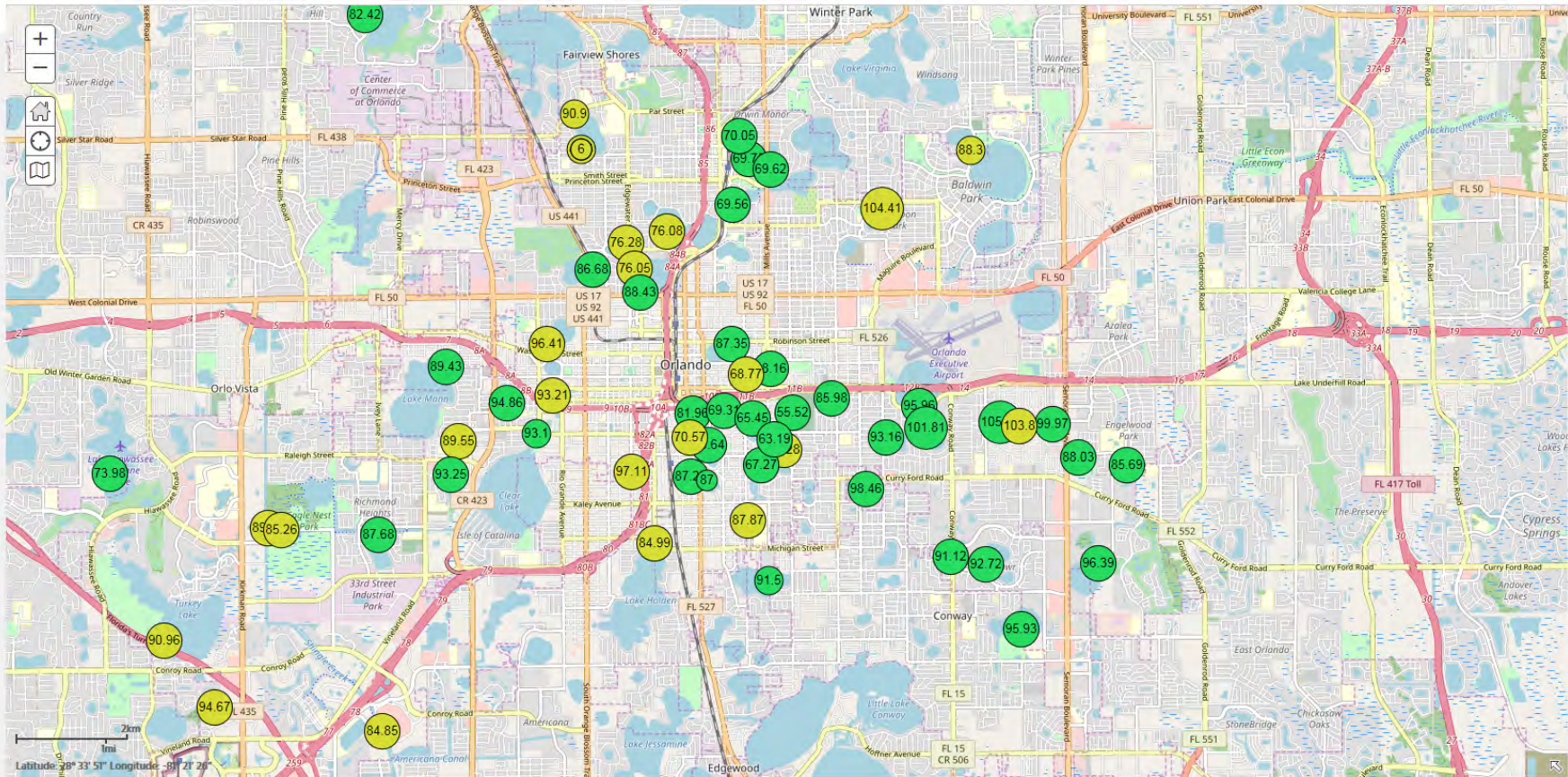
City of Orlando Streets & Stormwater Hydrologic Monitoring System
Rainfall and Lake Data

Data

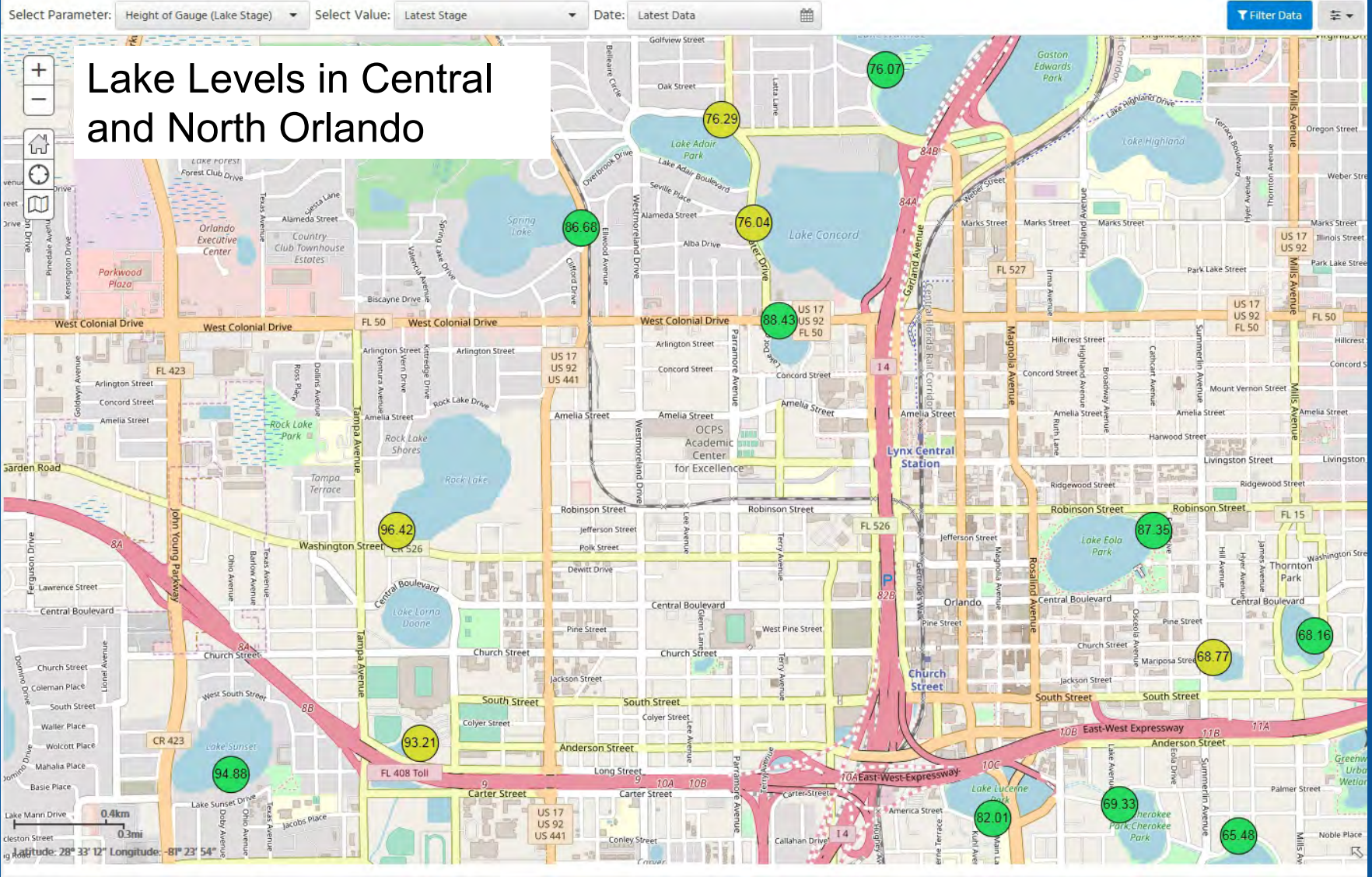
Select Parameter: Height of Gauge (Lake Stage) Select Value: Latest Stage Date: Latest Data

Filter Data

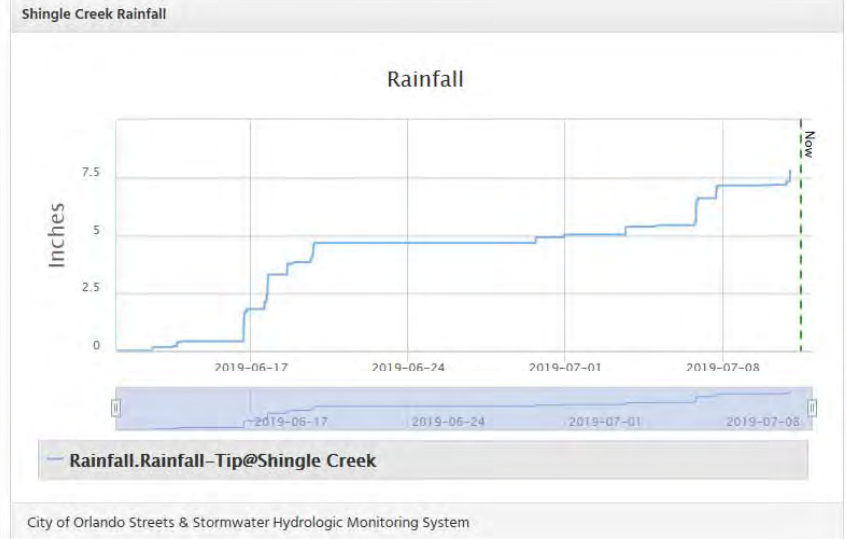
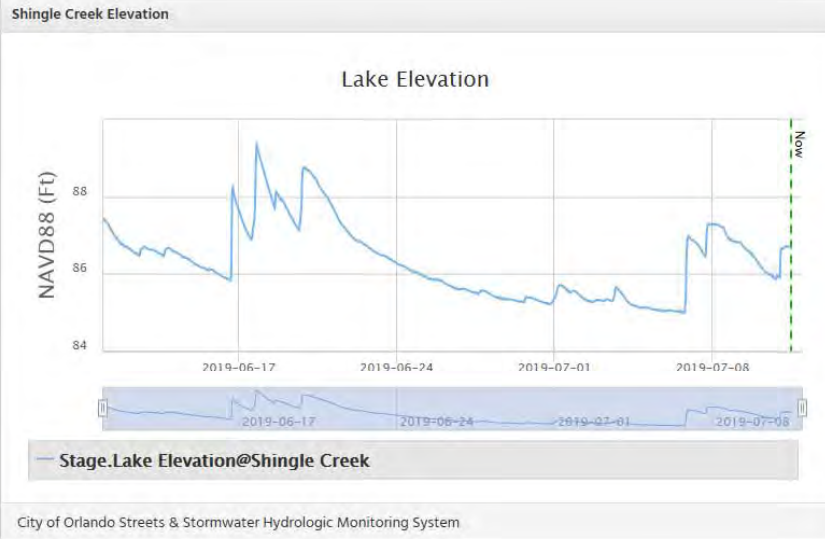
- Map
- List
- Location
- Data Set
- Chart
- Reports
- Dashboards



Lake Levels in Central and North Orlando

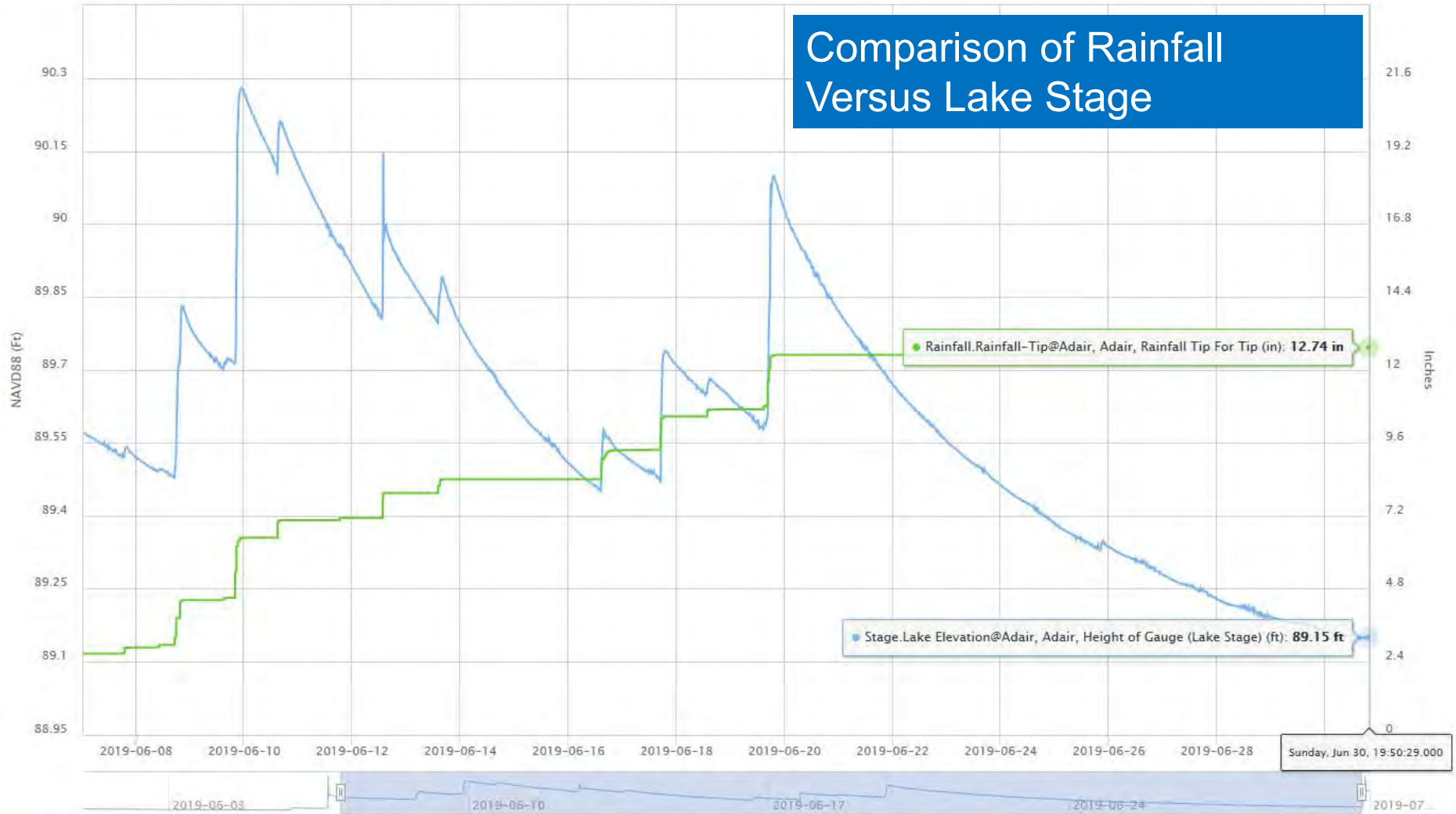


- Key
- Kingspointe
- LaCosta Wetlands
- Lake of the Woods
- Lancaster
- Lawsona
- Lee Vista
- Lucerne
- Lurna
- Mann
- Mare Prairie
- Monterey
- Nona
- Olive
- Orlando
- Park
- Peregrine
- Pineloch
- Porter
- Richmond
- Rock
- Rowena
- Shingle Creek
- Silver
- Spring NW
- Sunset
- Tennessee
- Terrace
- Turkey
- Underhill
- Wade

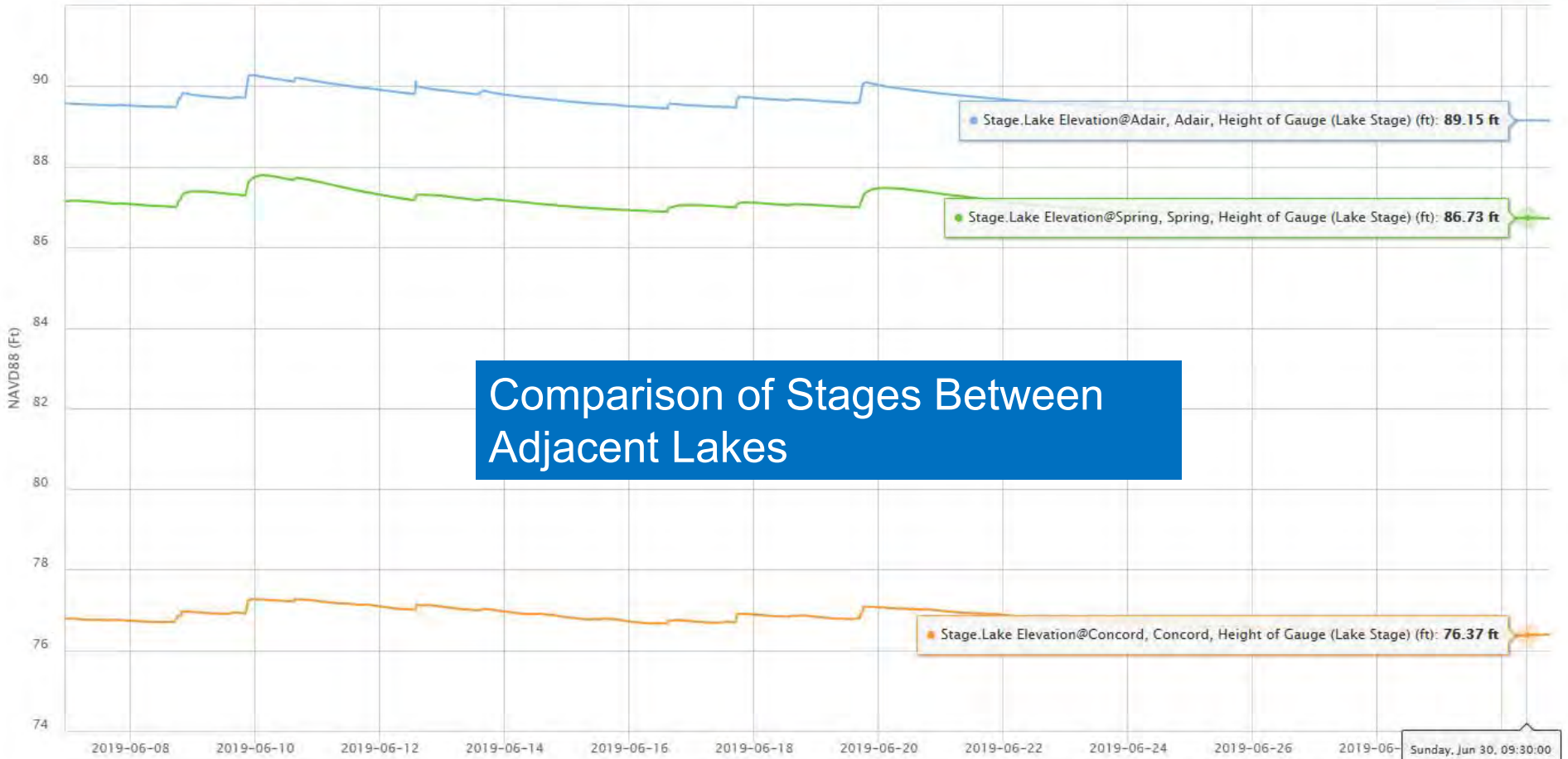


Data is Readily Visualized on the Dashboard

Comparison of Rainfall Versus Lake Stage



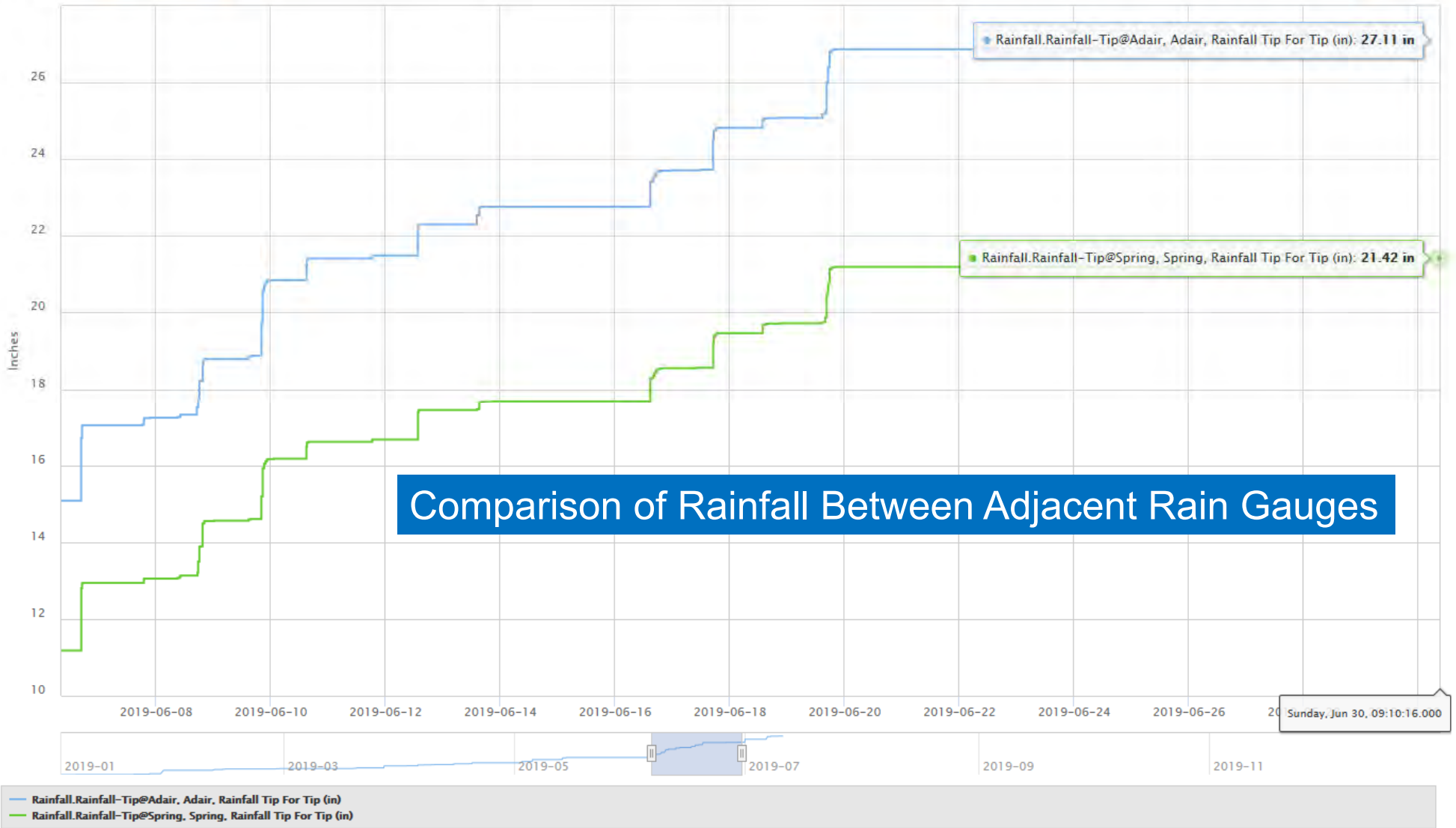
Stage.Lake Elevation@Adair, Adair, Height of Gauge (Lake Stage) (ft)
Rainfall.Rainfall-Tip@Adair, Adair, Rainfall Tip For Tip (in)



Comparison of Stages Between Adjacent Lakes

Legend:

- Stage.Lake Elevation@Adair, Adair, Height of Gauge (Lake Stage) (ft)
- Stage.Lake Elevation@Spring, Spring, Height of Gauge (Lake Stage) (ft)
- Stage.Lake Elevation@Concord, Concord, Height of Gauge (Lake Stage) (ft)



Recommendations and Closing Thoughts

- Establish an appropriate monitoring site installation location early on
- Design for flexibility, ease of maintenance, durability, and the possibility of future upgrades and modifications
- Ensure adequate clearance for rain gauges
- Ensure adequate insolation of solar panels in both winter and summer
- An aesthetically pleasing view of the water and its natural surroundings is important to the public
- Routine maintenance and periodic data review is required





Thank You!