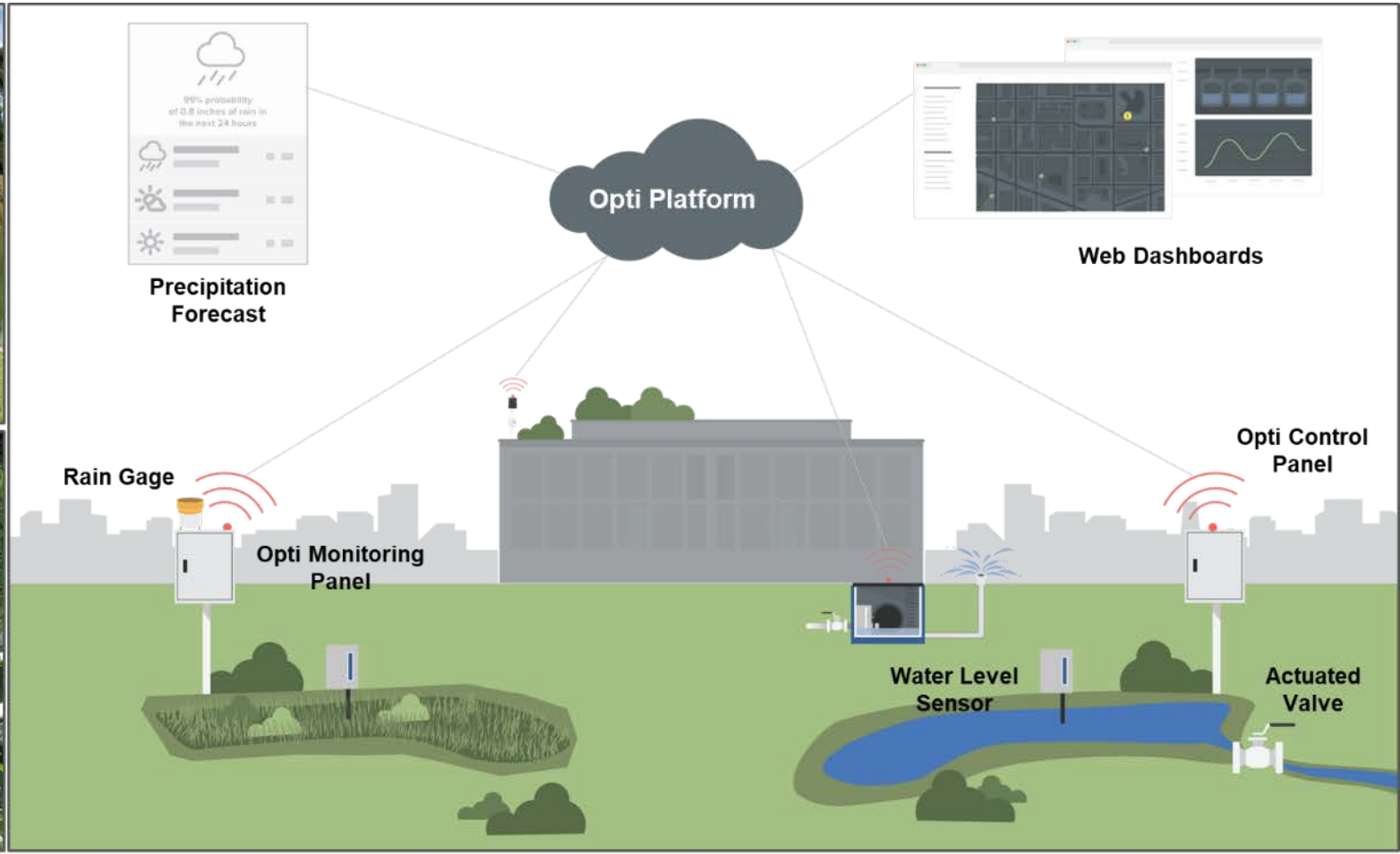
Data Management with Continuous Monitoring and Adaptive Control

Seth Bryant, OptiRTC, Inc

Opti Control

Opti Monitoring



Data Utilized by CMAC

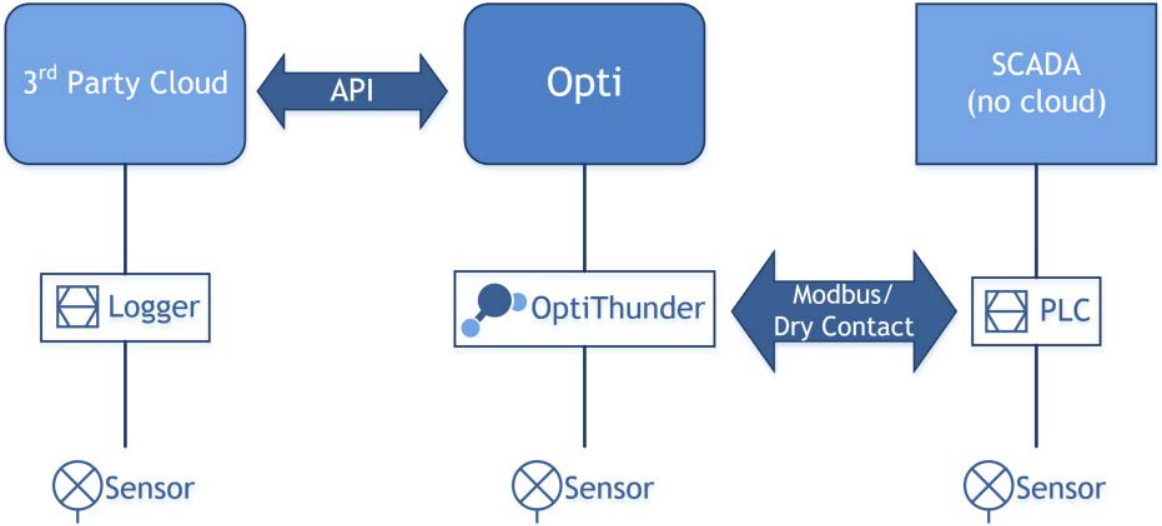
- Water level
- Valve / pump status
- Weather forecasts
- Site metadata
  - Drainage area hydrology
  - Stage-storage relationship
  - Stage-discharge relationship

→

- Collected on a minutely basis
- Used to inform / update control decisions
- Stored as a historic record

Traditional Flow of Information

Integrations with External Data Sources

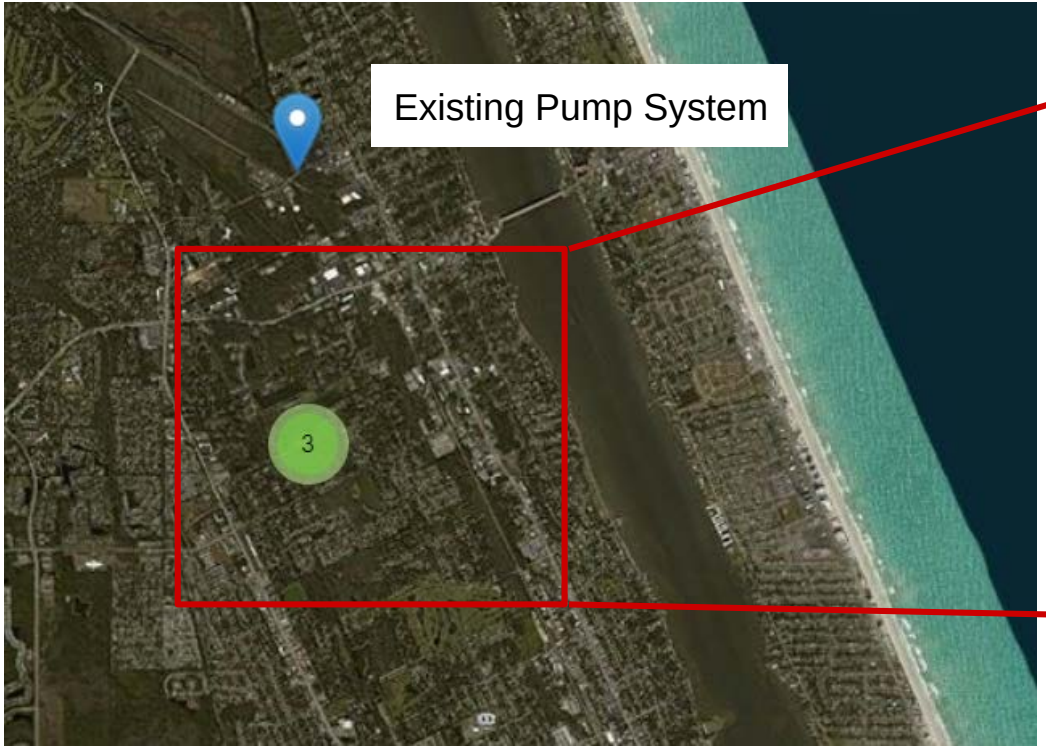


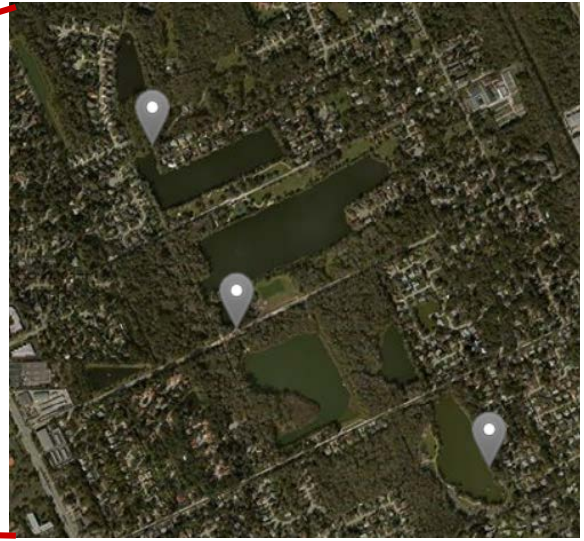
Communication options include:

- Modbus
- Digital and analog IO
- API

Allows for integration with majority of commercially available monitoring sensors

Case Study: Ormond Beach

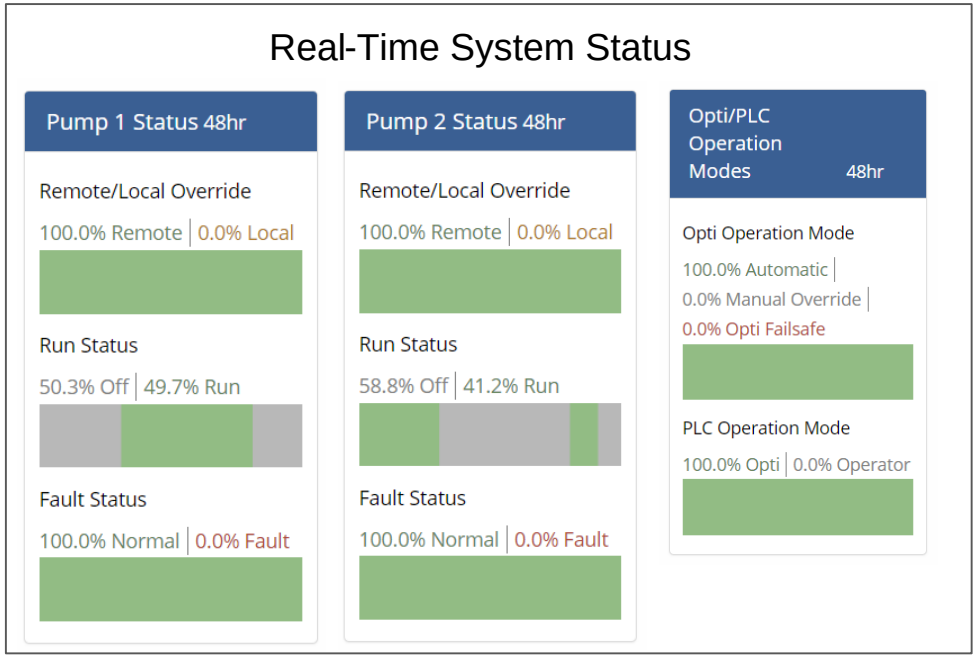


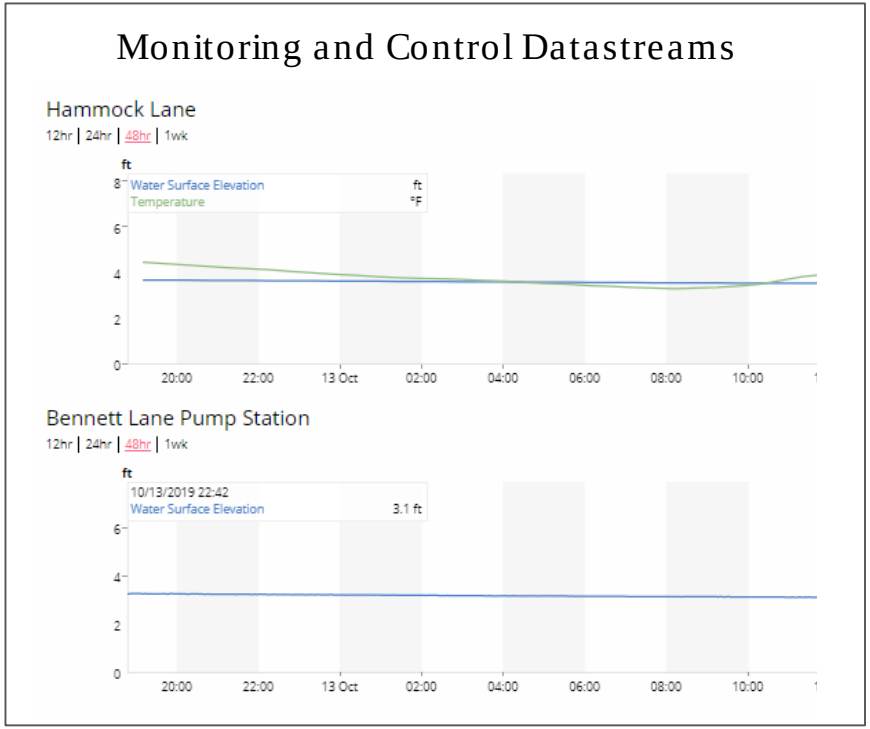


3 Distributed
Monitoring Stations

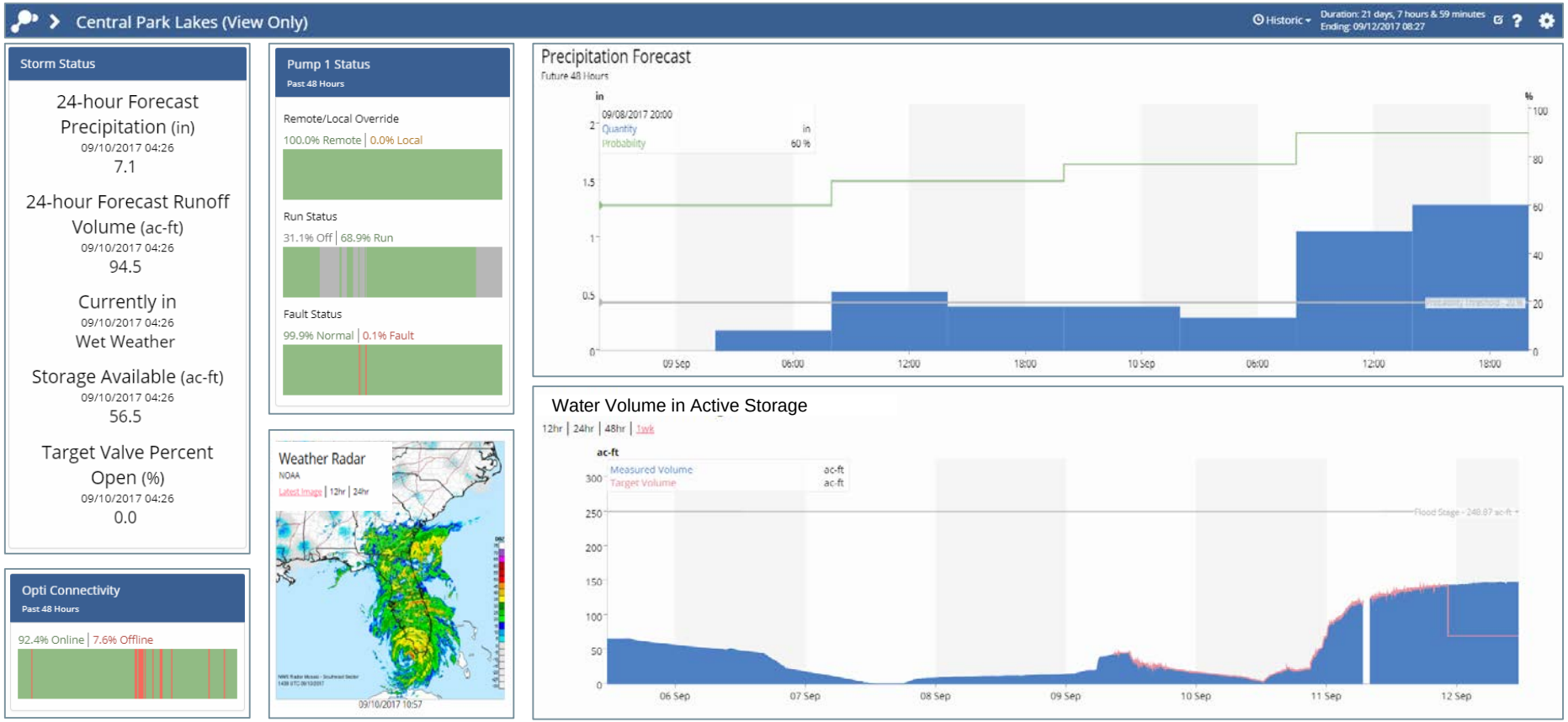
Case Study: PLC Integration at Ormond Beach

- Opti hardware communicates via modbus, read and write access to city's PLC
- 4 monitoring locations, 1control



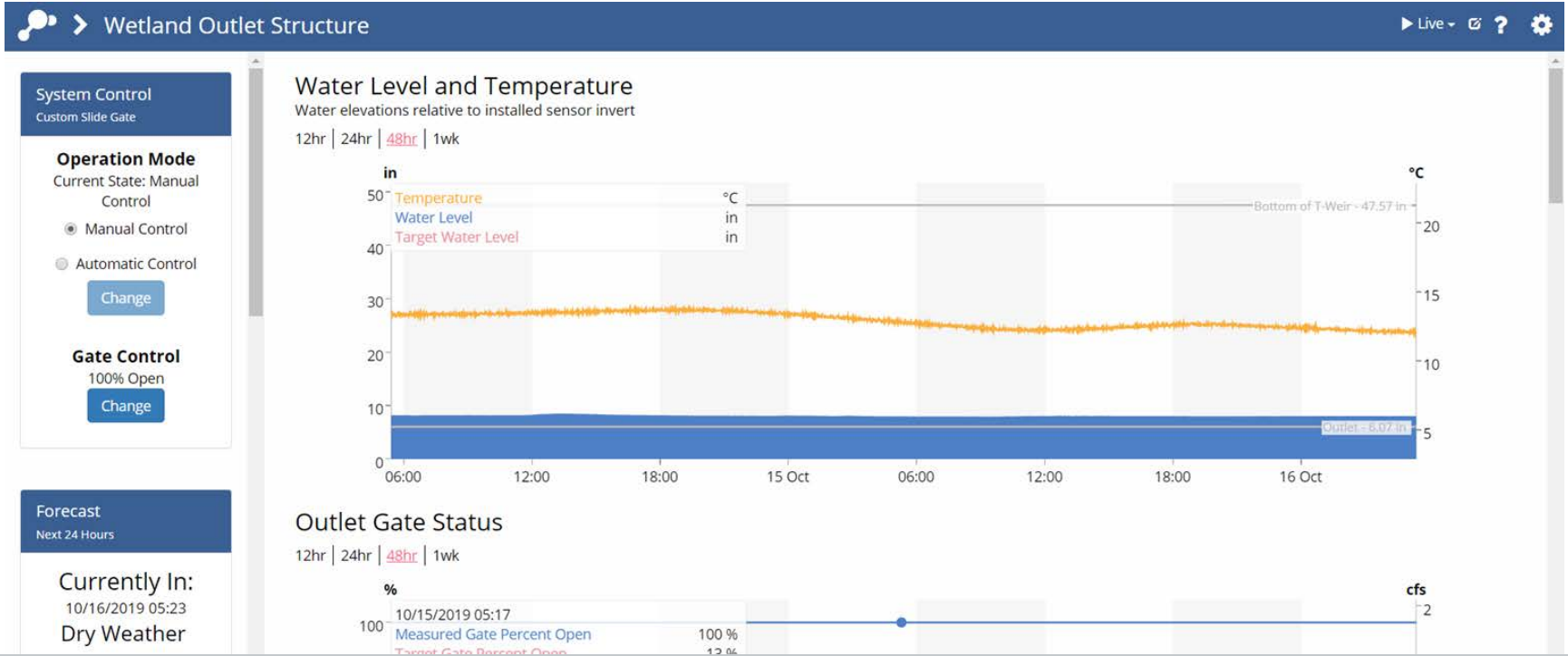


Ormond Beach - 2017 Hurricane Irma



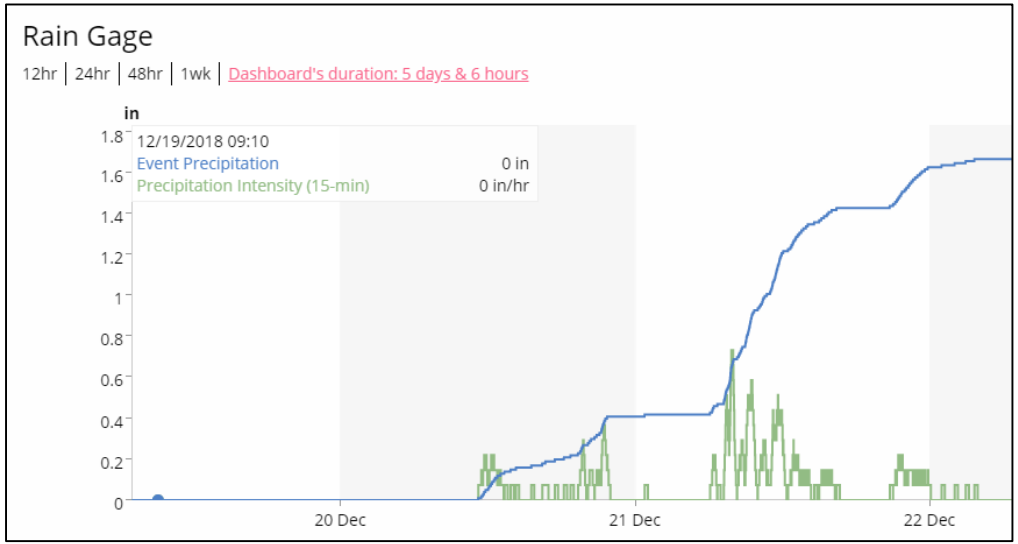
Goals

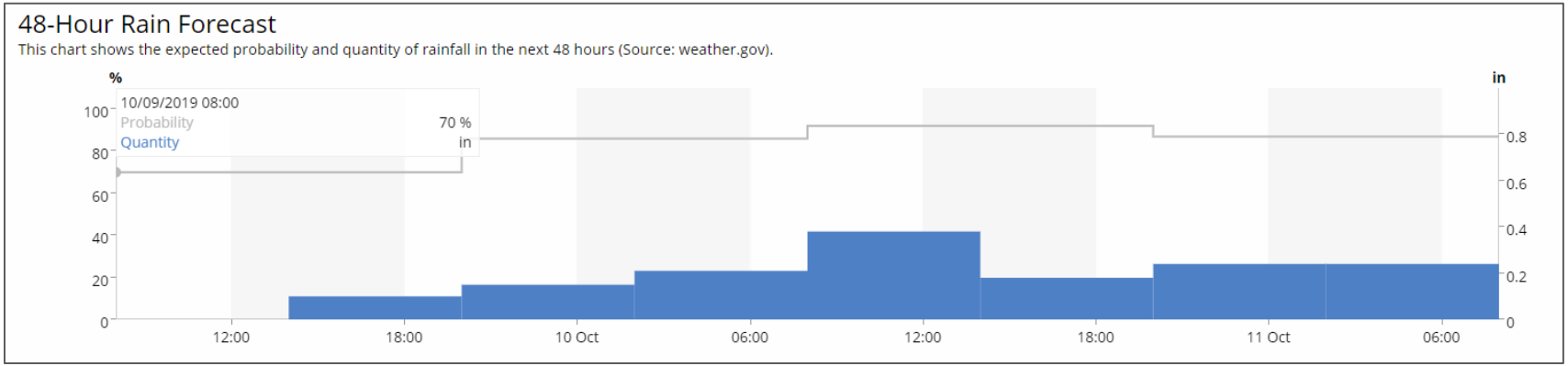
- Enable engineers to understand performance of stormwater infrastructure
- Make connections on a watershed scale
- Provide feedback for new infrastructure
- Optimize existing infrastructure



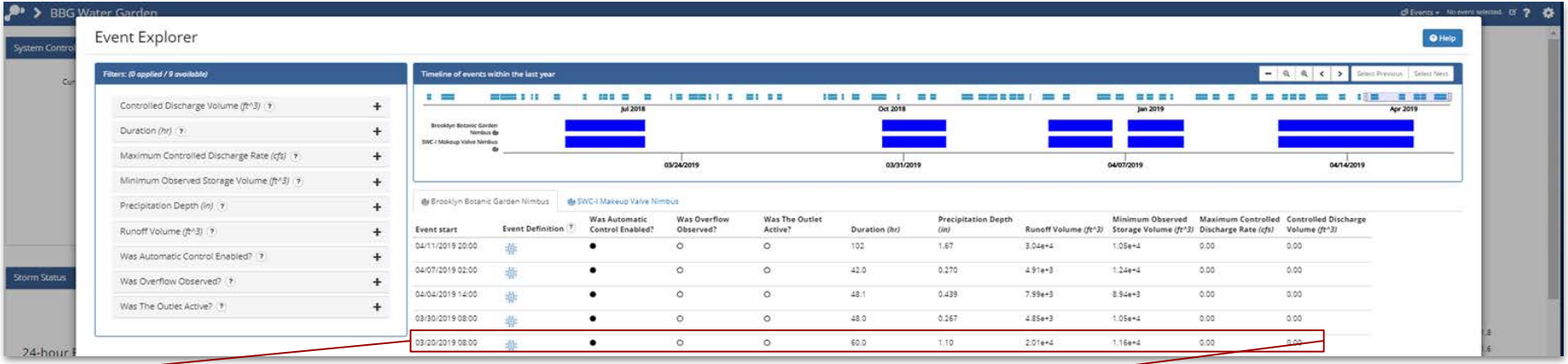
Event Analysis

- Many stormwater analyses use events rather than time as a basis
- Data to delineate events already exists for Opti installations

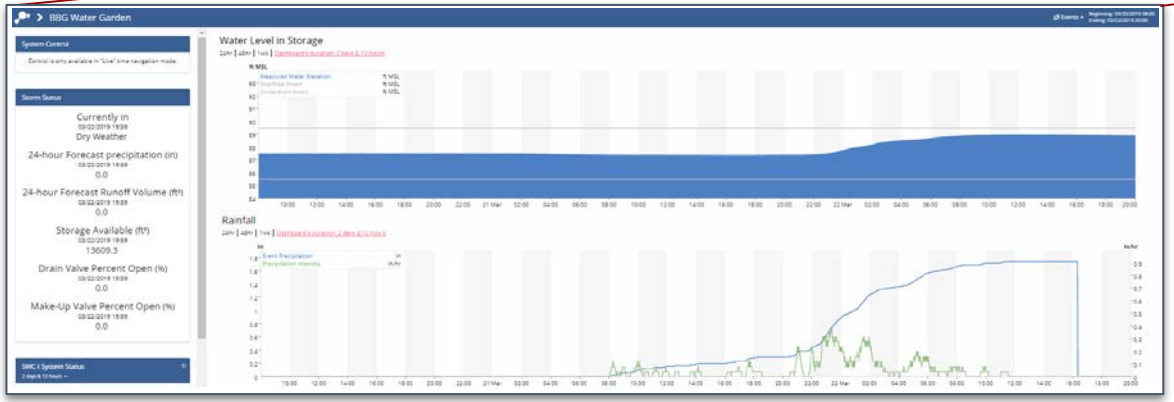




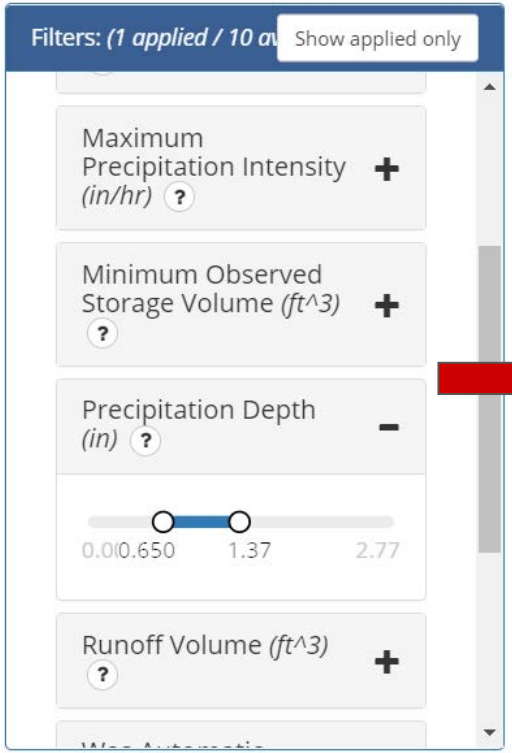
Event Explorer

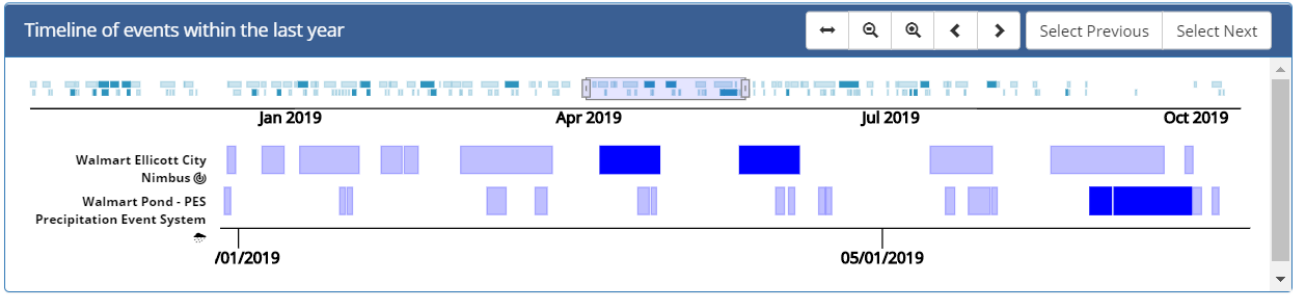


Event start	Event Definition	Was Automatic Control Enabled?	Was Overflow Observed?	Was The Outlet Active?	Duration (hr)	Precipitation Depth (in)	Runoff Volume (ft^3)	Minimum Observed Storage Volume (ft^3)	Maximum Controlled Discharge Rate (cfs)	Controlled Discharge Volume (ft^3)
04/11/2019 20:00		●	○	○	102	1.67	3.04e+4	1.05e+4	0.00	0.00
04/07/2019 02:00		●	○	○	42.0	0.270	4.91e+3	1.24e+4	0.00	0.00
04/04/2019 14:00		●	○	○	48.1	0.439	7.99e+3	8.94e+3	0.00	0.00
03/30/2019 08:00		●	○	○	48.0	0.267	4.85e+3	1.05e+4	0.00	0.00
03/20/2019 08:00		●	○	○	60.0	1.10	2.01e+4	1.16e+4	0.00	0.00



Event Explorer



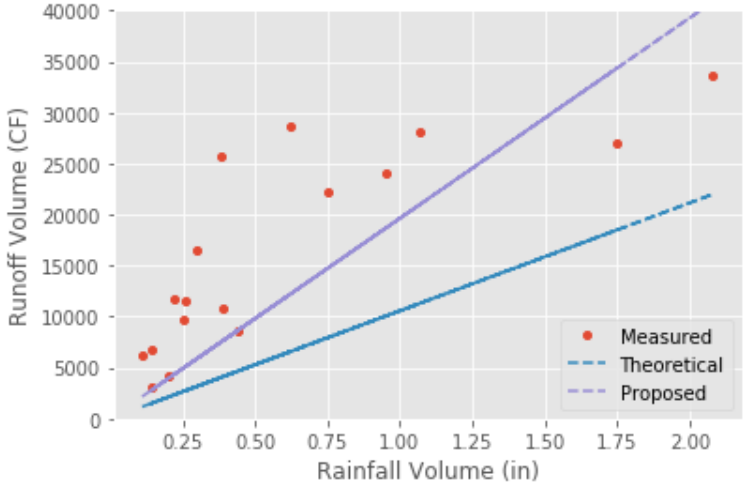


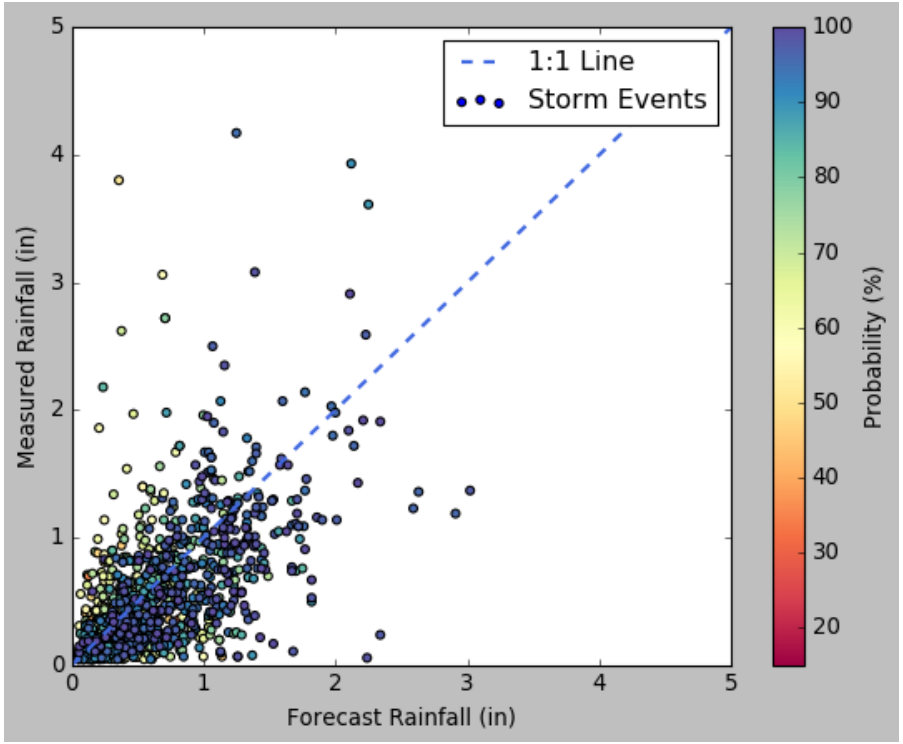
Walmart Ellicott City Nimbus | Walmart Pond - PES Precipitation Event System

Event start	Event Definition	Duration *(hr)*	Precipitation Depth *(in)*	Runoff Volume *(ft^3)*	Maximum Precipitation Intensity *(in/hr)*
05/11/2019 19:07		86.3	1.09	8.76e+4	0.0800
05/10/2019 16:04		24.0	0.910	7.31e+4	0.360

Event Specific IDs

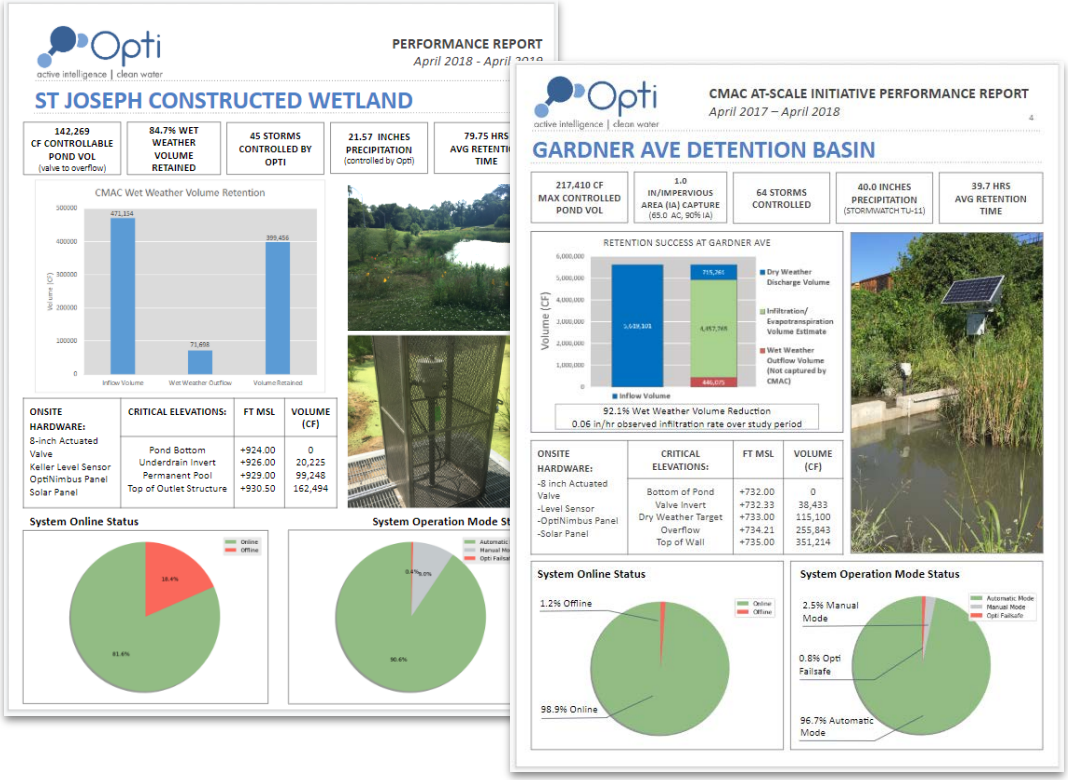
- Available in all data exports
- All for grouping in custom analyses
- Can be matched to Event Explorer exports



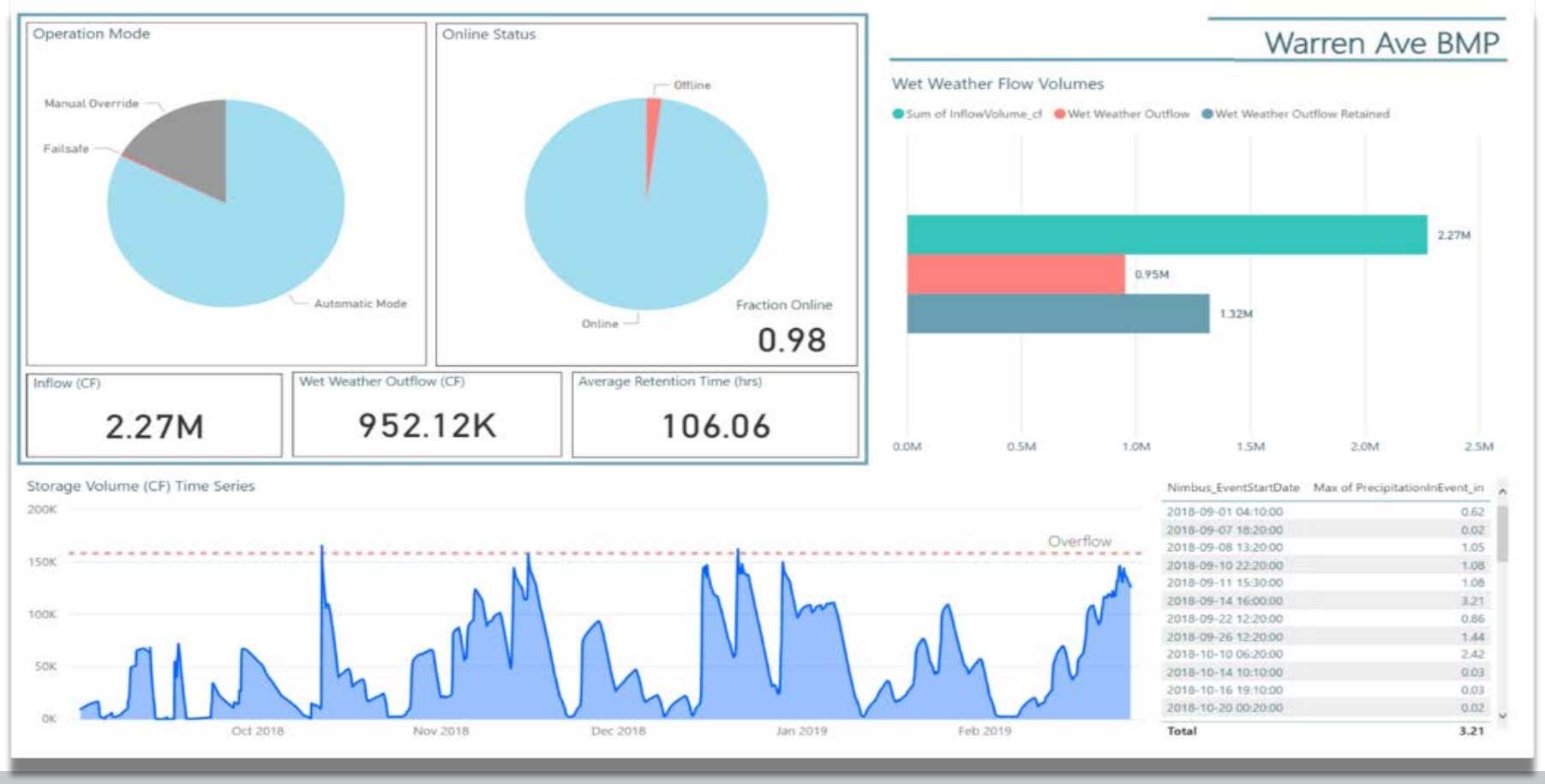


Advanced Data Export

- Summarize data on a set time interval
- Aggregate as:
  - Mean
  - Median
  - Sum
  - Max / min
  - Latest value
- Fill null data by:
  - Next / previous value
  - Linear interpolation
- Create and save template downloads

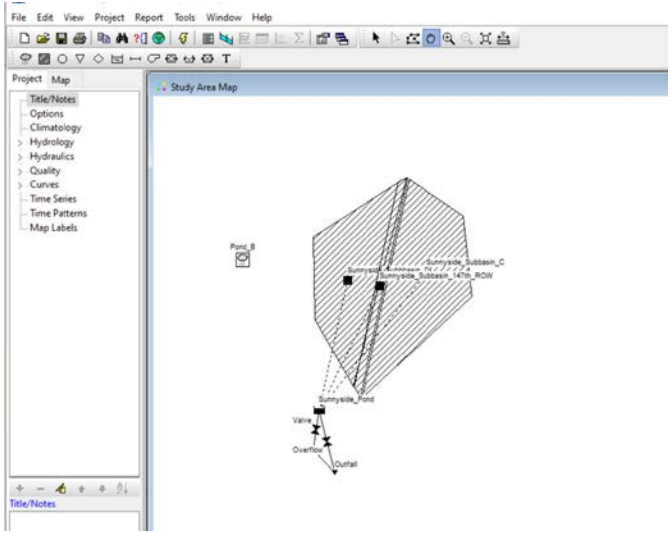


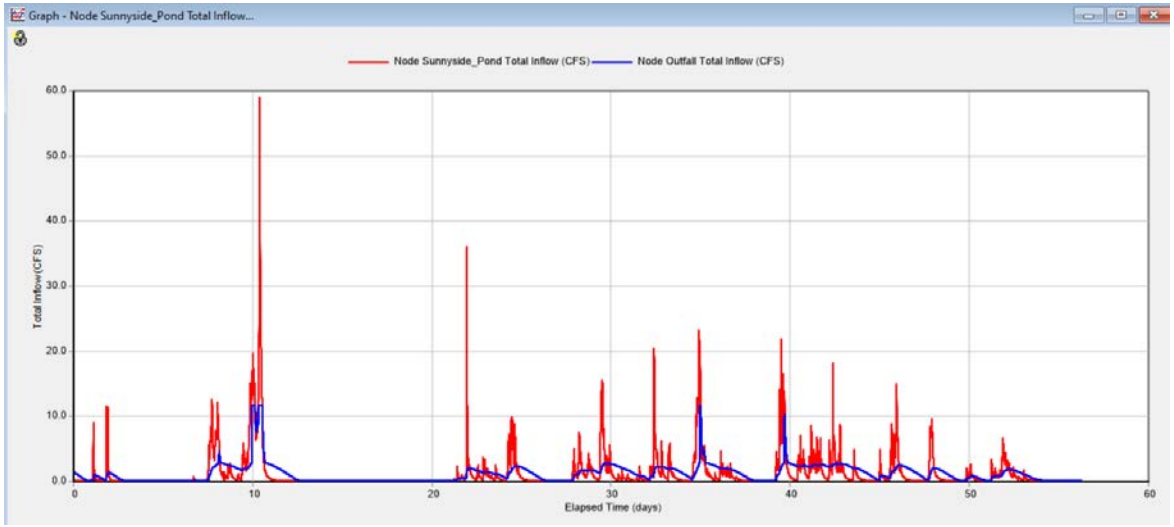
Power BI Integration



Integration with EPA SWMM

- Use monitoring data as inputs to SWMM models
- Formatted in .dat SWMM format
- Enable time series inputs of measured data for calibration





Export Data

Basic: A snapshot of your data as it is stored on the OptiPlatform

Export as:

Comma-Separated Values (CSV)

The CSV format is a general purpose text format that can be easily imported into spreadsheet software and data analysis tools.

Advanced: Task oriented views of your data

Export as:

Preprocessed Comma-Separated Values (CSV)

This option offers preprocessing that summarizes your data on regular time intervals. The CSV format is a general purpose text format that can be easily imported into spreadsheet software and data analysis tools.

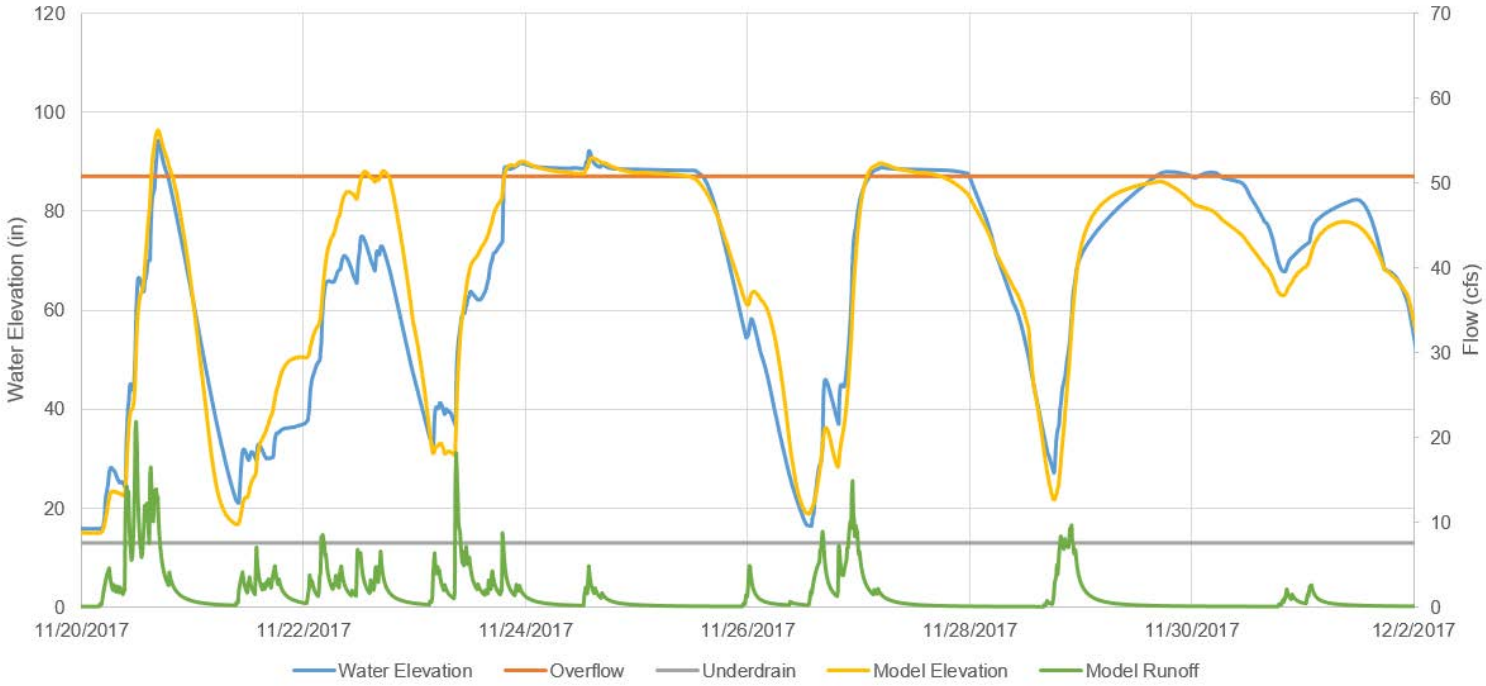
SWMM5 Rain Gauge File (.txt)

This option transforms data from one or more of your rain gauges into a SWMM5 Rain Gauge file that can be linked from a SWMM5 input file (.txt).

SWMM5 Time Series File (.dat)

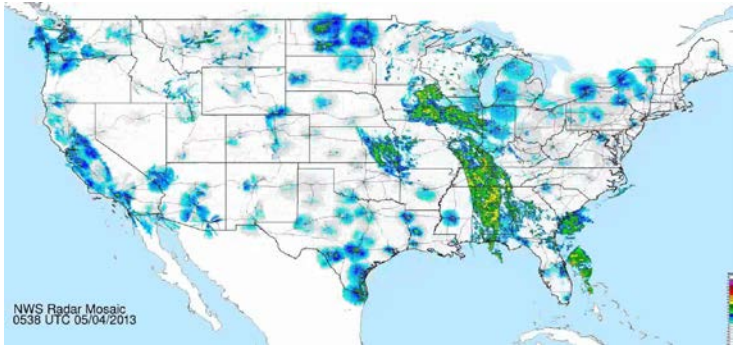
This option creates a generic SWMM5 time series file (.dat) that can be imported into any SWMM5 time series object. This format only supports one datastream per file, but can represent rainfall, flows, or water level.

Example: Calibration of Hydrologic Model



Takeaways

- A variety of hydrologic data sources already exist in disparate places
- Many methods exist for data warehousing with the cloud
- Combining data with analysis tools allows for
  - Optimizing performance of existing infrastructure
  - Better design and selection of new infrastructure
  - Better understanding of watersheds



Questions & Contact Info

Seth Bryant

Deployment Engineer, Opti

sbryant@optirtc.com