# Session #8
# Continuous Monitoring/Sensors: Using, Managing, and Interpreting Temporally Dense Data Sets

**2019 NATIONAL TRAINING WORKSHOP FOR**

**CWA 303(d) LISTING & TMDL STAFF**

May 31, 2019

# Session Outline:

- Introduction: *Bill Richardson, EPA R3*
- Data Storage/Management: *Dwane Young, EPA HQ*
- Process and Experience: *Mark Hoger, PADEP*
- EPA's Research/Tools: *Britta Bierwagen, EPA HQ*

# Introduction Outline

- What is continuous monitoring?
- Challenges associated with continuous monitoring data
- Benefits of continuous monitoring data

# What is continuous monitoring?

- Water quality data collected via unattended instruments at a frequent basis (e.g.: every 15 minutes)
- Sondes measure pH, dissolved oxygen, temperature, conductivity, turbidity, depth
- Generates large data sets (one month deployment will collect about 3K measurements at 15 minute interval)


# Continuous Monitoring/Sensor v. Discrete Data

- Data from common sensors:
  - Automated sensors
  - Temporally and/or spatially dense data sets with readings every few minutes to hourly
  - Large datasets

- v. Discrete
  - Typically bottle sampling or discrete sensor use
  - Snapshot of an short time frame-typically 1-3 measurements per site per month
  - Small datasets

Different sampling, calibration, and QA methods (and thus, metadata)

# Challenges Associated with Continuous Monitoring Data

*Data Collection*:

- Probe fouling
- QA/QC
- Frequency of readings vs battery life
- Capturing critical conditions

# Challenges Associated with Continuous Monitoring Data

*Assessment challenges*:

- Large datasets:
  - Data management/storage
  - Data processing: large datasets which assessment programs may not have experience evaluating
- Quality Assurance: no national standards for screening data

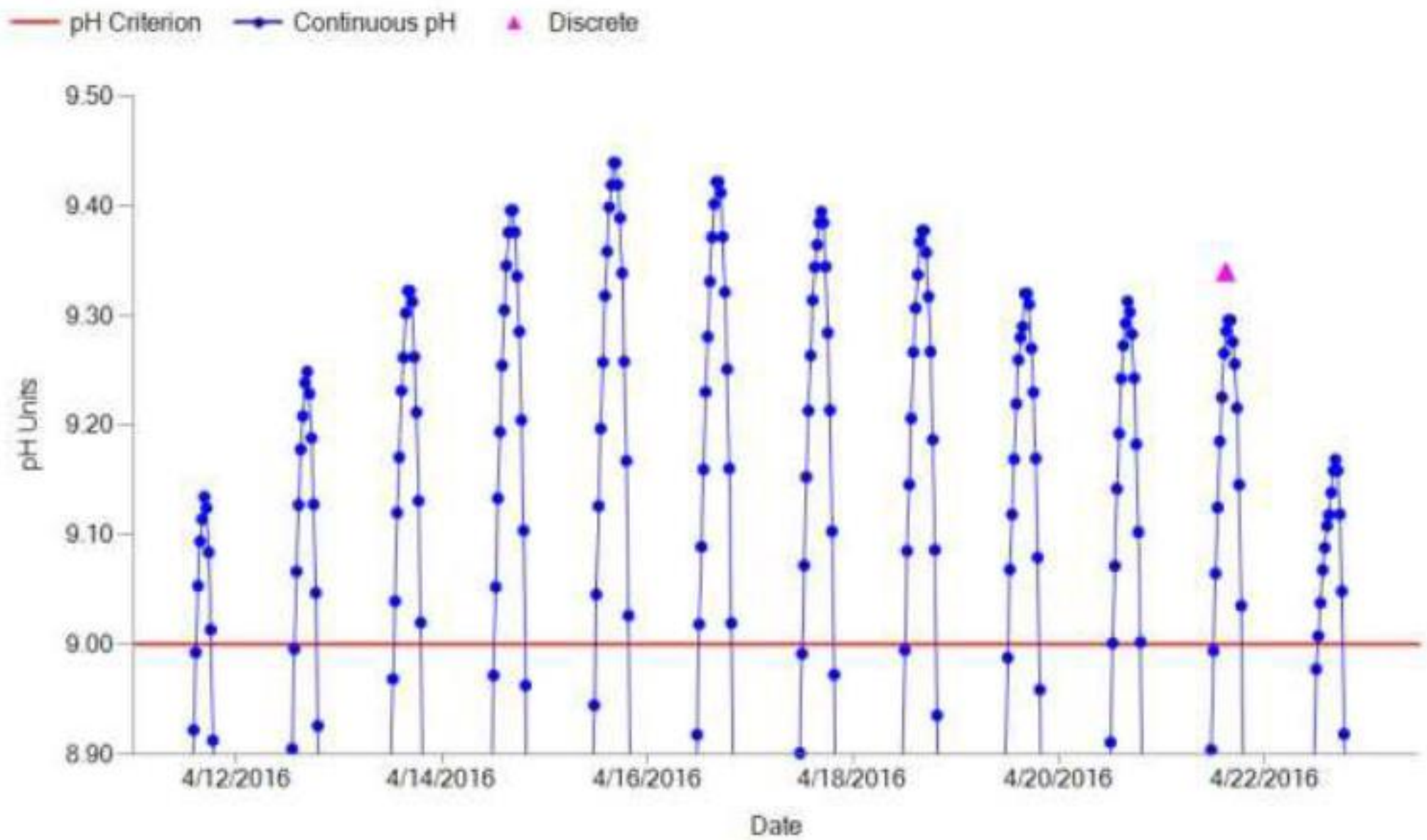
# Challenges Associated with Continuous Monitoring Data

*Assessment challenges*:

- Evaluation of data:
  - Criteria: are magnitude, frequency and duration appropriate when considering large continuous data sets?
  - 10% rule?
  - Incorporate discrete data with continuous data
- Lack of state assessment methods & EPA guidance (reg requirements still apply)
- Time intensive (data collection and analysis)

# Benefits of Continuous Monitoring Data

- Allows instream data to be collected without field visit
- Diel water quality changes due to photosynthesis/respiration can be captured
- Wet-weather impacts can be evaluated
- Derived assessments using continuous data (based on conductivity or turbidity)
- Data very useful for use attainment decisions and stressor ID


pH Criterion
Continuous pH
Discrete
9.50
9.40
9.30
9.20
9.10
9.00
8.90
pH Units
4/12/2016
4/14/2016
4/16/2016
4/18/2016
4/20/2016
4/22/2016
Date

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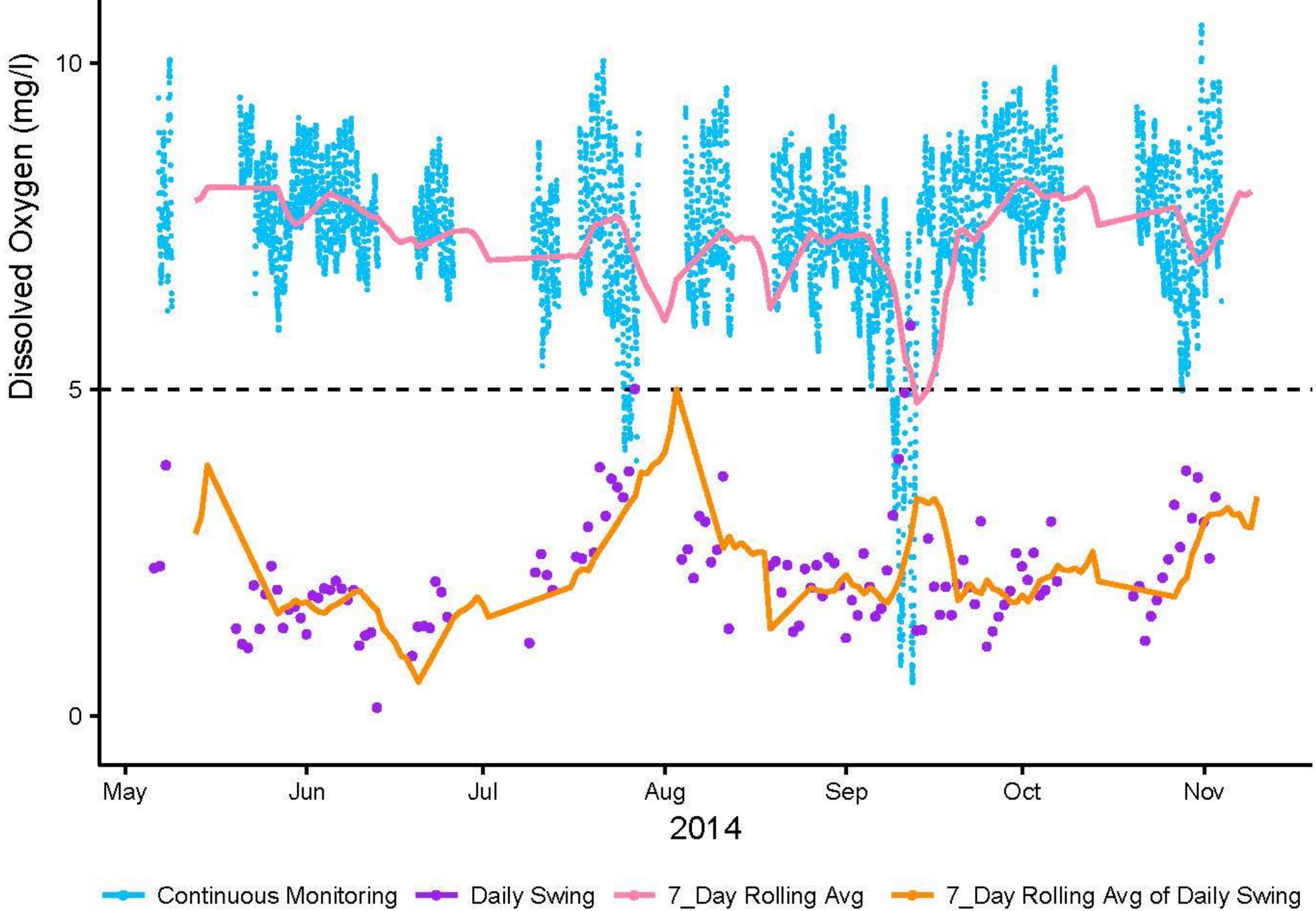
Dissolved Oxygen (mg/l)
10
5
0
May
Jun
Jul
Aug
Sep
Oct
Nov
2014
Continuous Monitoring
Daily Swing
7_Day Rolling Avg
7_Day Rolling Avg of Daily Swing

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# NEXT: Data Storage/Management