# Overview

- AEMR
  - Programmatic AEMR Overview
  - Sites and Metrics
  - Current Protocols (Roegner et al. 2009)SM2
  - 2018 Columbia Estuary Ecosystem Restoration Program Synthesis Memorandum
- Protocol Lessons Learned – Tips, Tricks, and Considerations

Action Effectiveness Monitoring and Research (AEMR) Objective

- Determine the success of restoration actions at site, landscape, and estuary-wide scales in terms of improved ecosystem functionality

Programmatic Plan for Action Effectiveness Monitoring
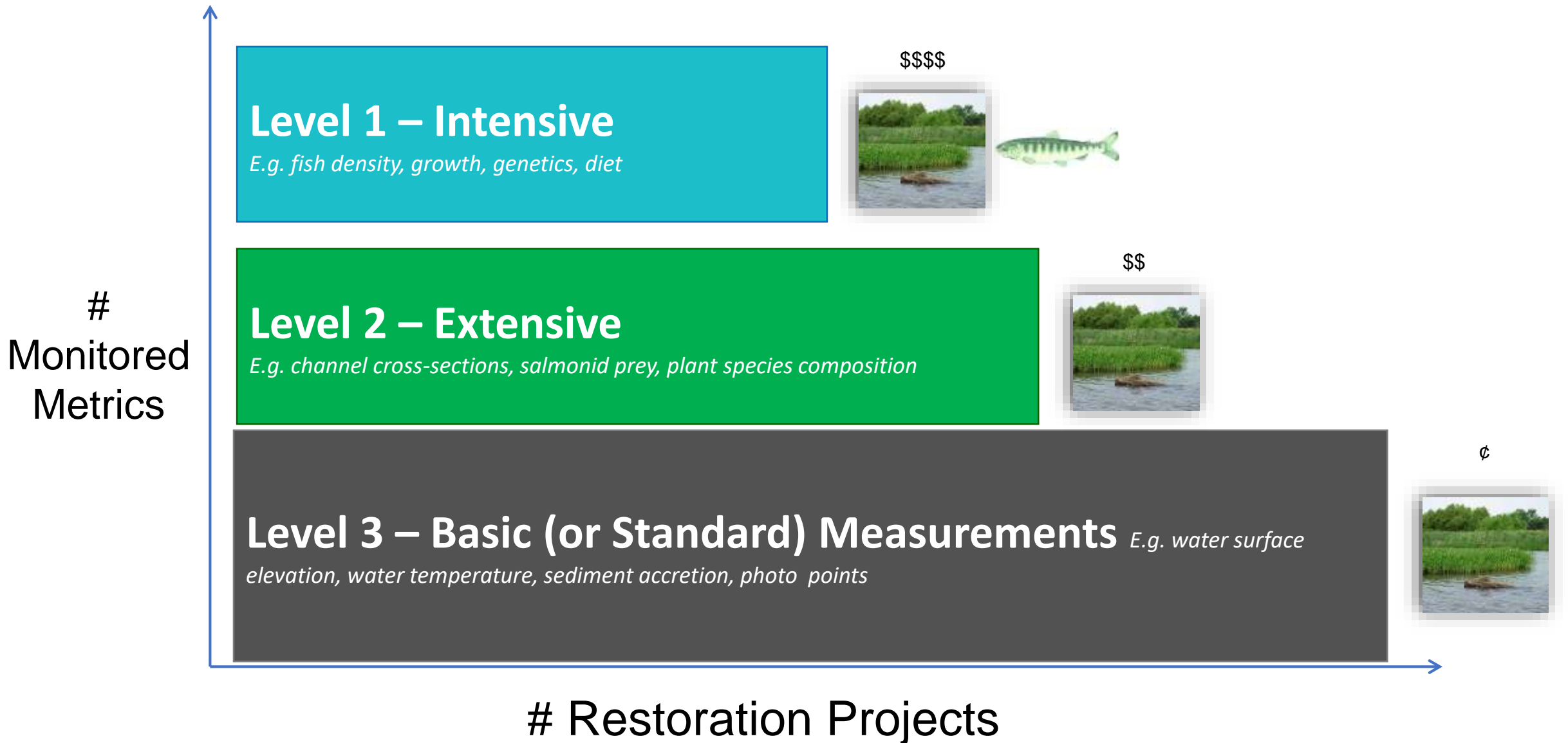
Level 3 Monitoring (Basic)

- Before/After Sampling Design

- Metrics
  - Hydrology and Water Quality
    - Water surface elevation and water temperature (All Sites)
  - Sediment accretion (All Sites)
  - Photo points (All Sites)

- Frequency
  - 1 year pre-restoration
  - 1 through 5 year post restoration

Can you believe it's been …?

NOAA Technical Memorandum NMFS-NWFSC-97

Protocols for Monitoring Habitat Restoration Projects in the Lower Columbia River and Estuary

February 2009

U.S. DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
National Marine Fisheries Service
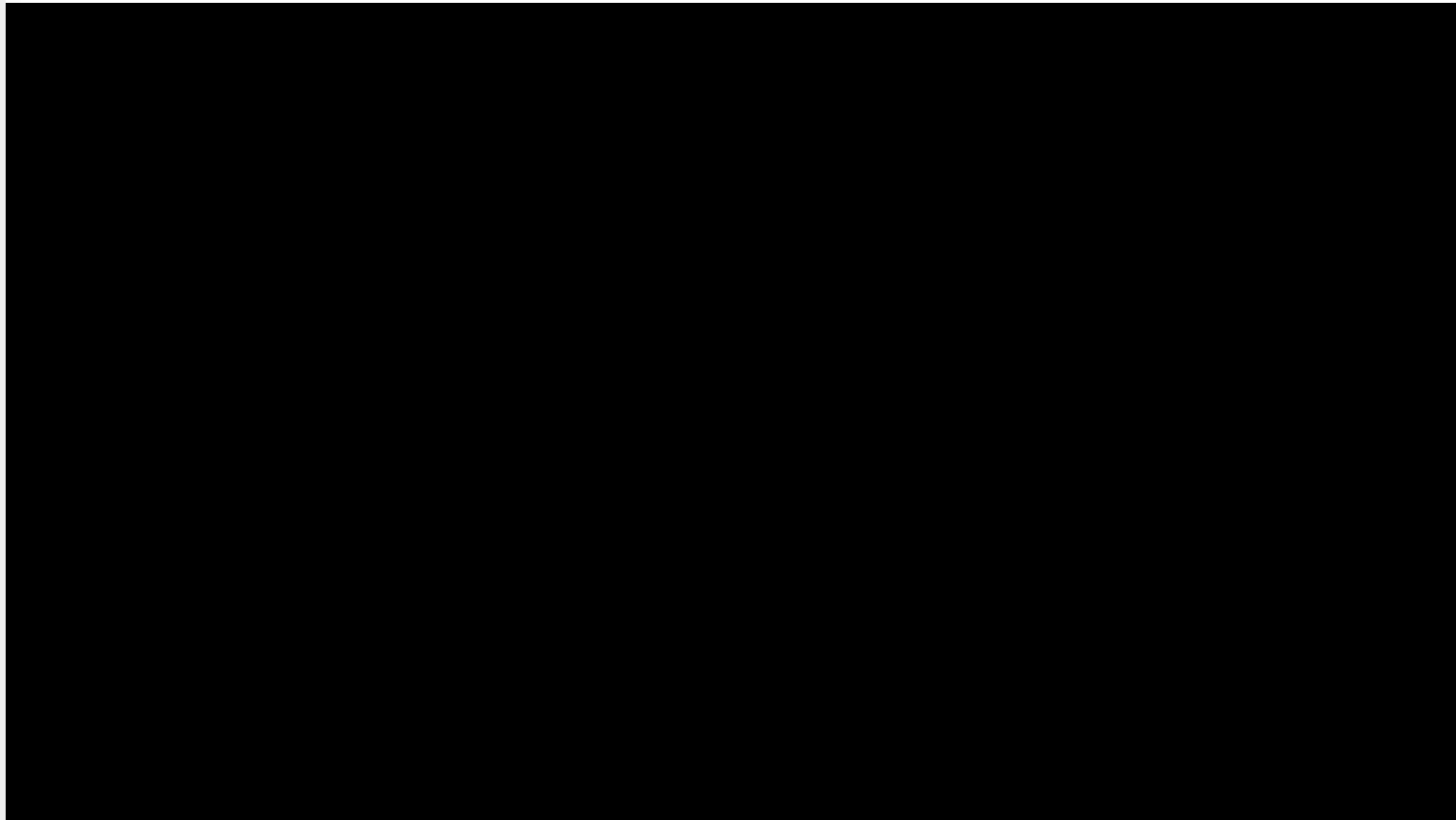
Can you believe it's been almost ten years?

NOAA Technical Memorandum NMFS-NWFSC-97

Protocols for Monitoring
Habitat Restoration Projects
in the Lower Columbia River
and Estuary

February 2009

U.S. DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
National Marine Fisheries Service

- Monitoring, What is this monitoring you speak of?

- Roegner et al 2009
  - Promoted a standard set of monitoring protocols to assess and compare habitat restoration projects in the region

Adaptively Managing Monitoring

- Opportunity to take a hard look at the data and consider common issues that have occurred with data collection over the last 6 years

- Today's conversation builds on the protocols and focuses on the lessons learned and issues that come up with day to day data collection

Columbia Estuary Ecosystem Restoration Program

2018 SYNTHESIS MEMORANDUM

FINAL REPORT

Edited by:
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August 2018

Pacific Northwest
NATIONAL LABORATORY

NOAA

What happened at my restoration project?

- Key to evaluating any project's success is making sure the <u>data quality</u> and <u>quantity</u> are adequate to evaluate the restoration project **Goals** and **Targets** overtime

- Improve data <u>quality</u> and <u>quantity</u> through re-visiting protocols used to collect these data:
    - Sediment Accretion/Erosion
    - Channel Cross Sections
    - Water Surface Elevation and Temperature Data

Lower Columbia
Estuary
Partnership

Key Considerations

- Monitoring of different channel sizes

- Beneficial to have staked beginning and end stakes

- Best to measure at regular intervals along transect tape

Sediment Accretion & Erosion Monitoring

Key Considerations

Strategic Placement
- Sediment accretion & erosion can vary depending on location within the site and elevation of placement (site hydrology)

Number of Benches
- Benches can produce extremely variable results, indicating the need to increase the number of sediment benches used within a site to identify trends

Frequency of Survey
- Benches should be surveyed consistently every 6 to 12 months to identify trends overtime

Other Methods
- Combining the use of sediment benches with feldspar marker horizons and/or SET tables would provide higher resolution data *(Roelof and Day 1993, Cahoon et al. 2000)*

Water Surface Elevation and Temperature

Key Considerations

Strategic Placement

- Capture pre/post hydrology within restored site and at a reference location
- Once established locations should remain the same pre/post restoration

Number of Loggers

- Determined by dynamics of the site and the need for redundancy

Frequency of Data Retrieval

- At least every 6 months, before/after winter season

Post-Processing

- Technical Issues

Water Surface Elevation and Temperature

Lower Columbia Estuary Partnership

Technical Issues
Onset HOBO Data Loggers

U20L series

U20 series

HOBOware Pro

❑ Data Loss Prevention

❑ Trouble Shooting Data Issues

❑ Data Quality
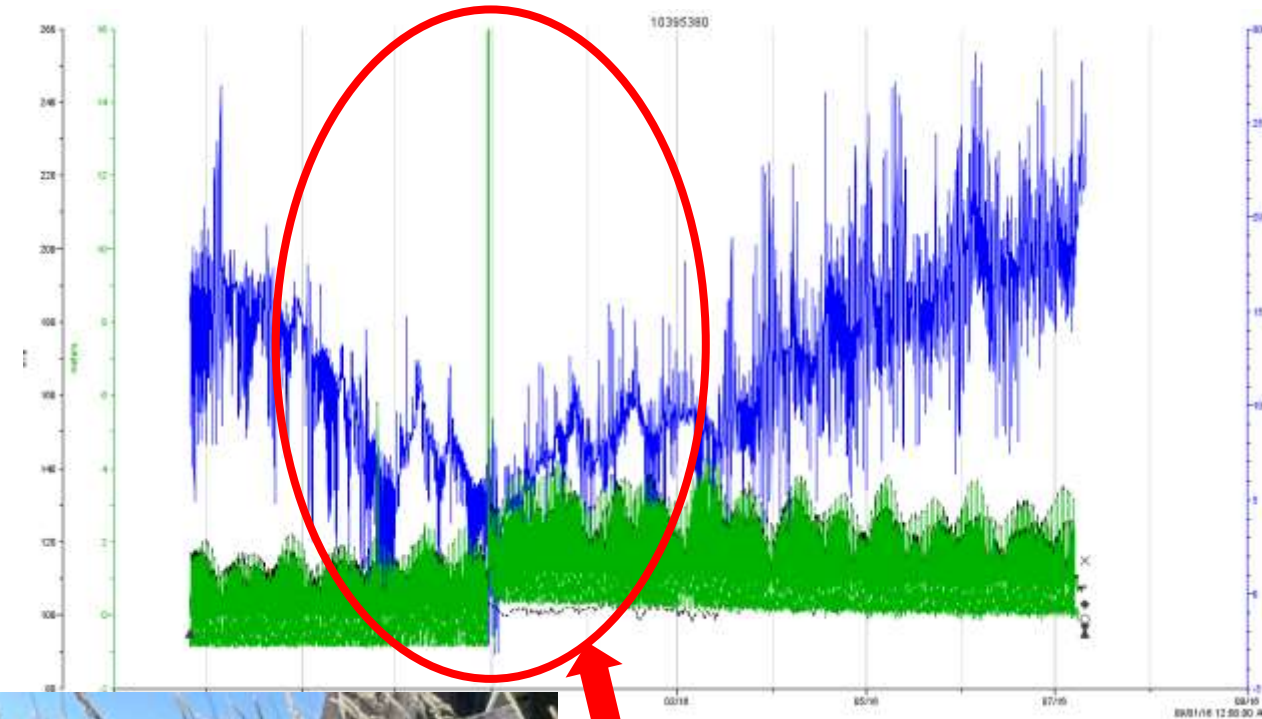
❑ Data Sharing – Metadata
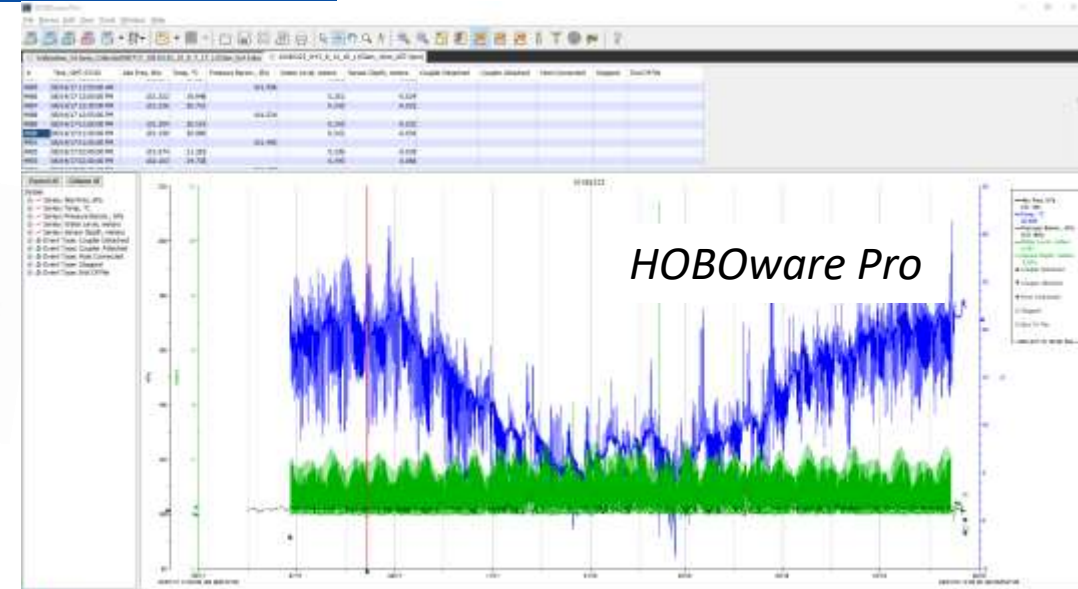
Technical Issues

❑ **Data Loss Prevention**

1. **Physical Loss of Data Logger and/or Housing**
   - Security – Low visibility location (if public)
   - Stability - Location and depth of rebar etc.

2. **Data Logger Malfunction**
   - Extreme cold temperatures ≤1°C
   - Dropping loggers/physical stress

Oh no!

Water Surface Elevation and Temperature

Technical Issues (continued)

- ☐ Trouble Shooting Data Issues
- ☐ Data Quality
- ☐ Data Sharing - Metadata

Creating a helpful guide outlining how to address some of these technical issues:

Best Practices - Quick Guide: Water Surface Elevation & Temperature Data Collection

Prepared by Sarah Kidd, Matthew Schwartz, and Grace Brennan
Lower Columbia Estuary Partnership

1. Purpose

To aid in the collection of accurate water surface elevation and temperature data for restoration and reference site monitoring.

Lower Columbia Estuary Partnership

Quick Guide Highlights

- Are these data any good?
  - ❑ *Tracking Data Logger Accuracy*
- What field data to collect and when?
  - ❑ *Making Reference Measurements Count*
  - ❑ *What is a Reference Measurement?*
- Installation Set-ups
  - ❑ *Making Logger Retrieval and Elevation Surveying EASY*

Diagram from Natural Resource Report NPS/NCBN/NRR—2017/1370

Are these data any good?

Lower Columbia Estuary Partnership
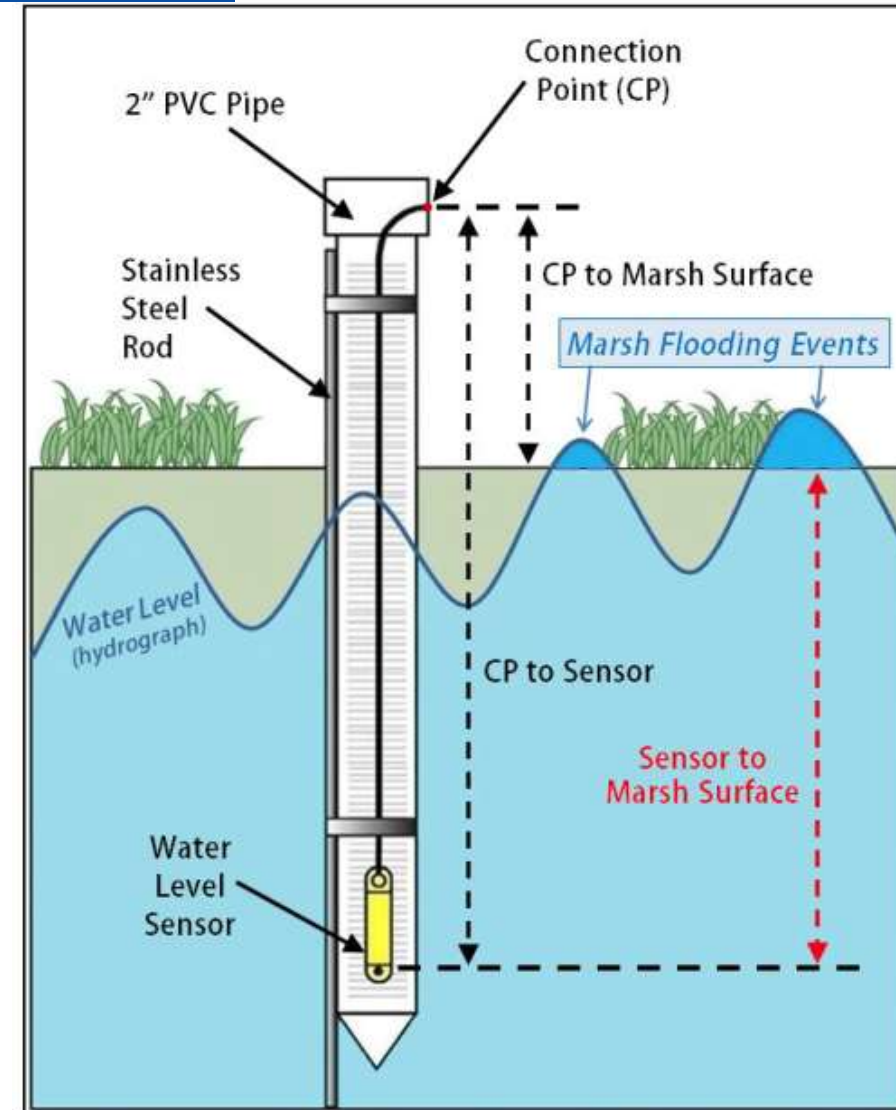
Quick Guide Highlights

- Are these data any good?
  - ❑ *Tracking Data Logger Accuracy*

Conducting Pre/Post Deployment Calibration Checks for Water Level and Temp

- Gives you a measure of the quality of your data
- Provides information on if the logger has started malfunctioning during deployment
- These QA/QC data can then be shared with the logger deployment data
  - *Required for State Water Quality Databases*

YSI Probe for Temp

Are these data any good?

Checking and tracking the accuracy of your data loggers

Use colander for best results

Ensure NIST is as close to loggers as possible

Loggers laid flat

Sink temp loggers

0º C Bath:
- ❑ Make sure bath is well mixed
- ❑ Monitor closely
- ❑ Run for at least 90 mins

10º C Bath
- ❑ Thoroughly mix
- ❑ Lay WSE sensors down flat, measure sensor depth
- ❑ Run for at least 90 mins

20º C Bath
- ❑ Thoroughly mix
- ❑ Run for 60-90 minutes **to get 10 consecutive minutes of the same temperature – this is true for each bath**

Are these data any good?

Checking and tracking the accuracy of your data loggers

Use co
for bes

Calibration Check Accuracy Expectations:

- **Sensor Temperature should be ± 0.2°C of the YSI/NIST thermometer***
- **Sensor Depth should be within ± 5 cm of measured depth**

Oregon DEQ Requires ± 0.5°C, Washington Department of Ecology Requires ± 0.2 °C

0° C

- M
mixed
- Monitor closely
- Run for at least 90 mins

- Thoroughly mix
- Lay WSE sensors down flat, measure sensor depth
- Run for at least 90 mins

- Thoroughly mix
- Run for 60-90 minutes to get 10 consecutive minutes of the same temperature

Technical Issues

❑ ***Tips and Tricks:***

✓ For long deployments always swap out data loggers instead of using a shuttle to pull data and relaunch existing loggers
  - o *If the logger is bad you won't have to go back to replace it, reduces data loss!*

✓ Make sure you collect reference water depth and temperature measurements at deployment & retrieval
  - o *Pro Tip: Put loggers in a bucket of water in the office (pre and post deployment) and make a water depth measurement, this provides a back up reference measurement to use incase of logger malfunction*

✓ If no local ATM logger is available, local NOAA weather station data can be used to correct for sensor depth/water level
  - o *Using a local ATM logger can make data correction easier and more accurate*

Discussion — We want to hear from you!
What are your best field tips and tricks?

EXTRA SLIDES

Quick Guide Highlights

- Are these data any good?

  ❑ *Tracking Data Logger Accuracy*

- What field data to collect and when?

  ❑ *Making Reference Measurements Count*

  ❑ *What is a Reference Measurement?*

- Installation Set-ups

  ❑ *Making Logger Retrieval and Elevation Surveying EASY*

Diagram from Natural Resource Report NPS/NCBN/NRR—2017/1370
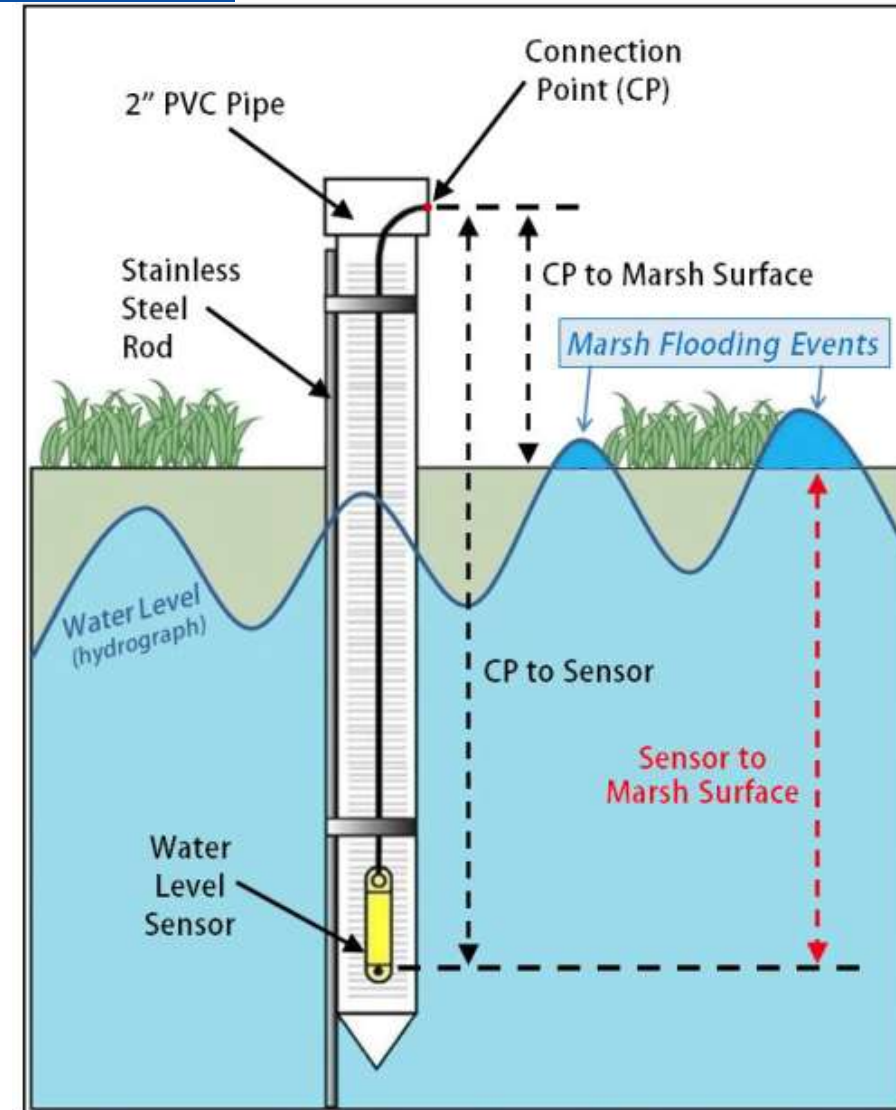
Quick Guide Highlights

- What field data to collect and when?

  ❑ *Making Reference Measurements Count*

  ❑ *What is a Reference Measurement?*

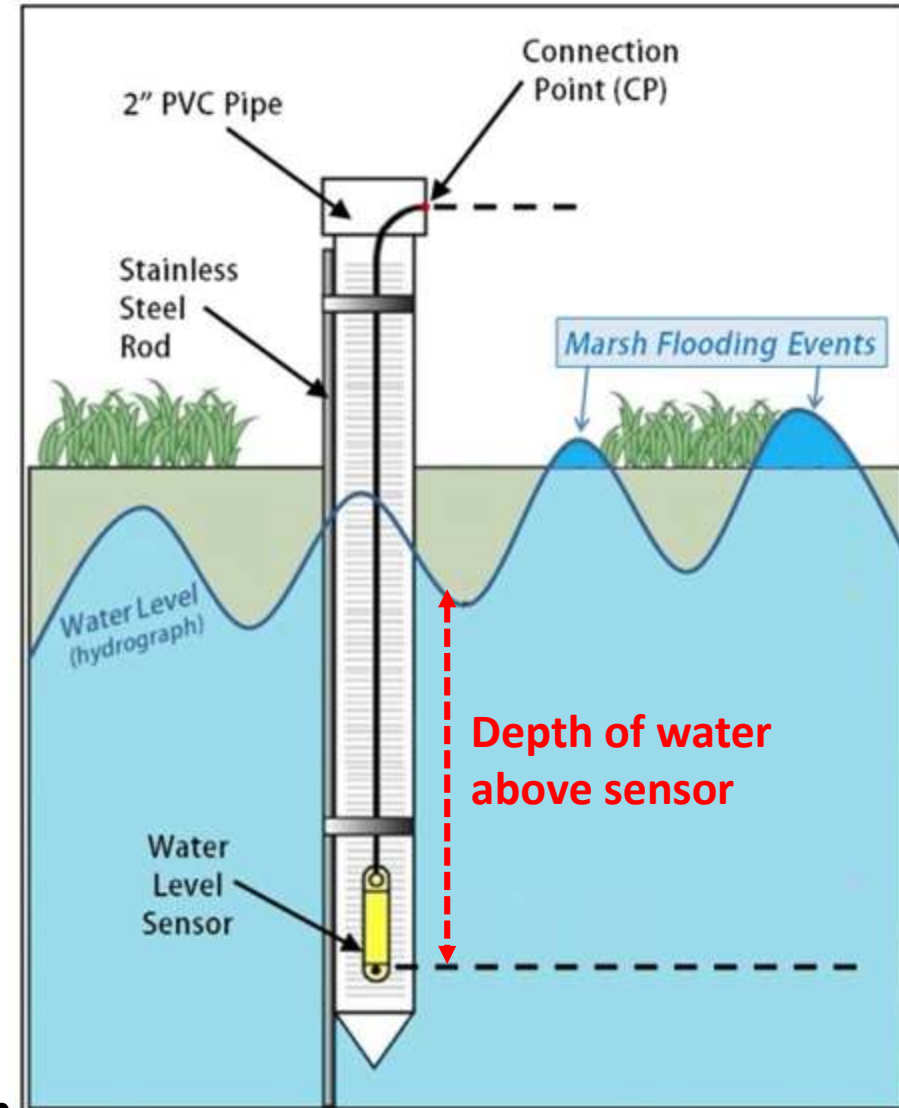**Field data collect when deploying and retrieving data loggers should include:**
- ❑ **Depth of water above sensor**
- ❑ **Temperature of water**
- ✓ **CRITICAL** these measurements need to be taken near a data collection interval, esp. important for very tidal sites
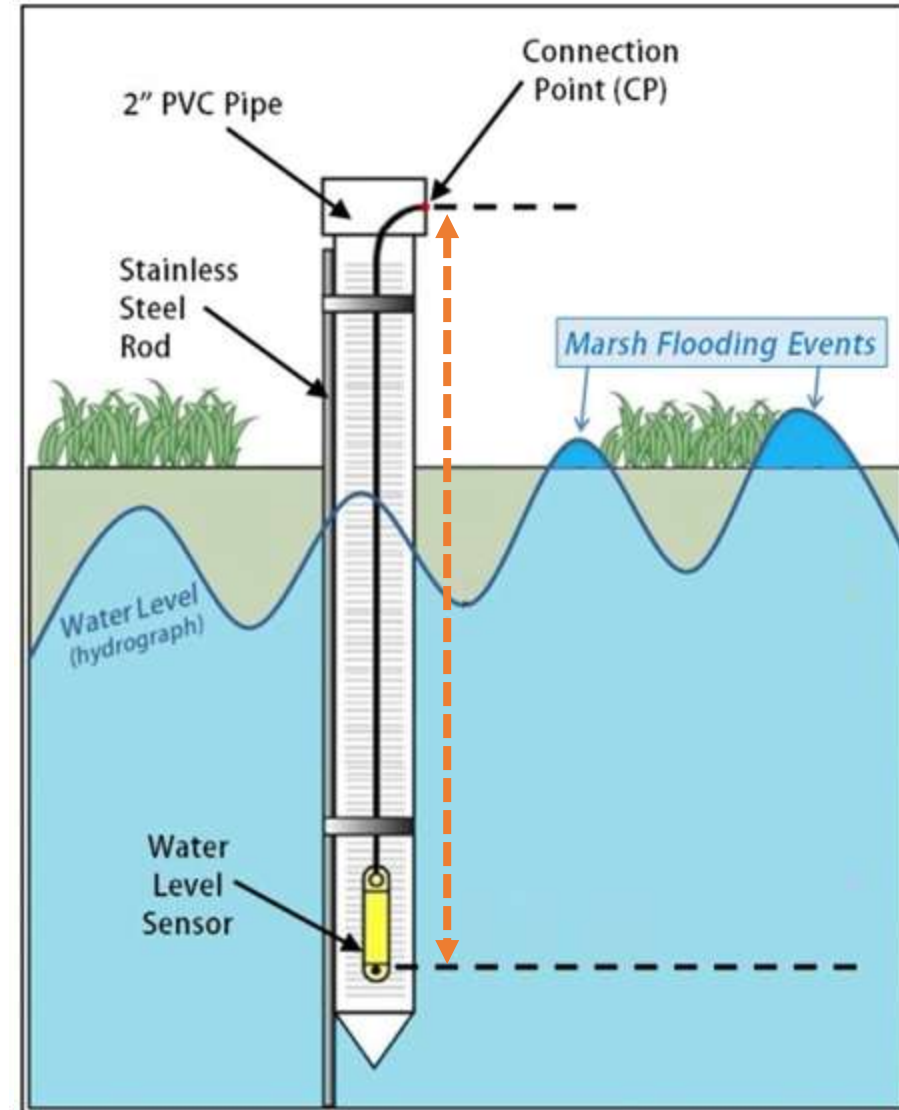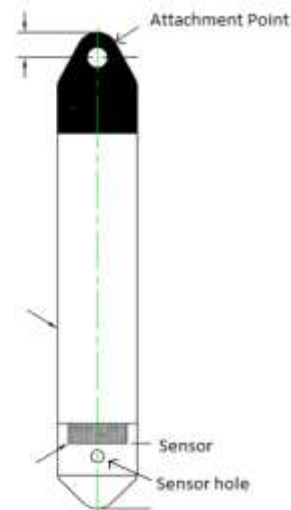
YSI Probe for Temp

Ruler for Water Depth

Connection Point (CP)

2" PVC Pipe

Stainless Steel Rod

Marsh Flooding Events

Water Level (hydrograph)

Depth of water above sensor

Water Level Sensor

What if I can't measure sensor depth directly?

- **Measure from the logger housing top of cap (aka connection point) to the sensor**

Attachment Point

Sensor

Sensor hole

Sensor located near hole at the bottom of the data logger

2" PVC Pipe

Connection Point (CP)

Stainless Steel Rod

Marsh Flooding Events

Water Level (hydrograph)

Water Level Sensor

What if I can't measure sensor depth directly?

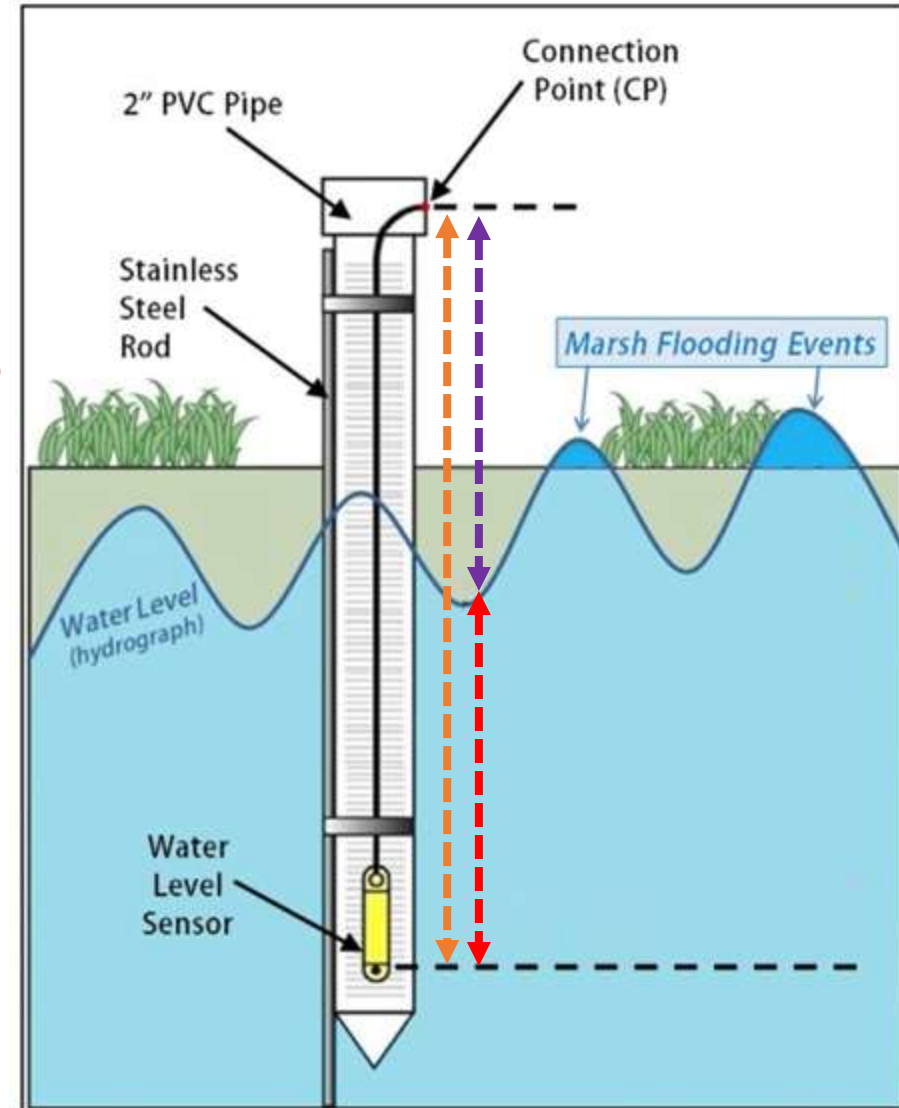- **Measure from the logger housing top of cap (aka connection point) to the sensor**
- **Measure from connection point to the water surface**

Attachment Point

Sensor

Sensor hole

Sensor located near hole at the bottom of the data logger

2" PVC Pipe

Connection Point (CP)

Stainless Steel Rod

Marsh Flooding Events

Water Level (hydrograph)

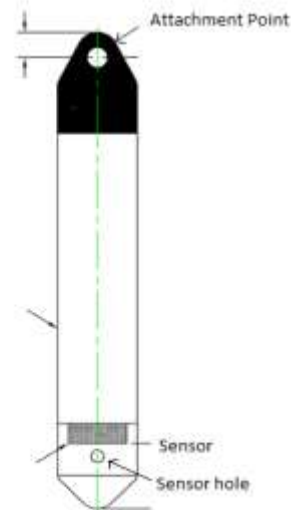Water Level Sensor

What if I can't measure sensor depth directly?

- **Measure from the logger housing top of cap (aka connection point) to the sensor**
- **Measure from connection point to the water surface**
- Subtract these numbers = **Depth of water above sensor**

Attachment Point

Sensor

Sensor hole

Sensor located near hole at the bottom of the data logger

Connection Point (CP)

2" PVC Pipe

Stainless Steel Rod

Marsh Flooding Events

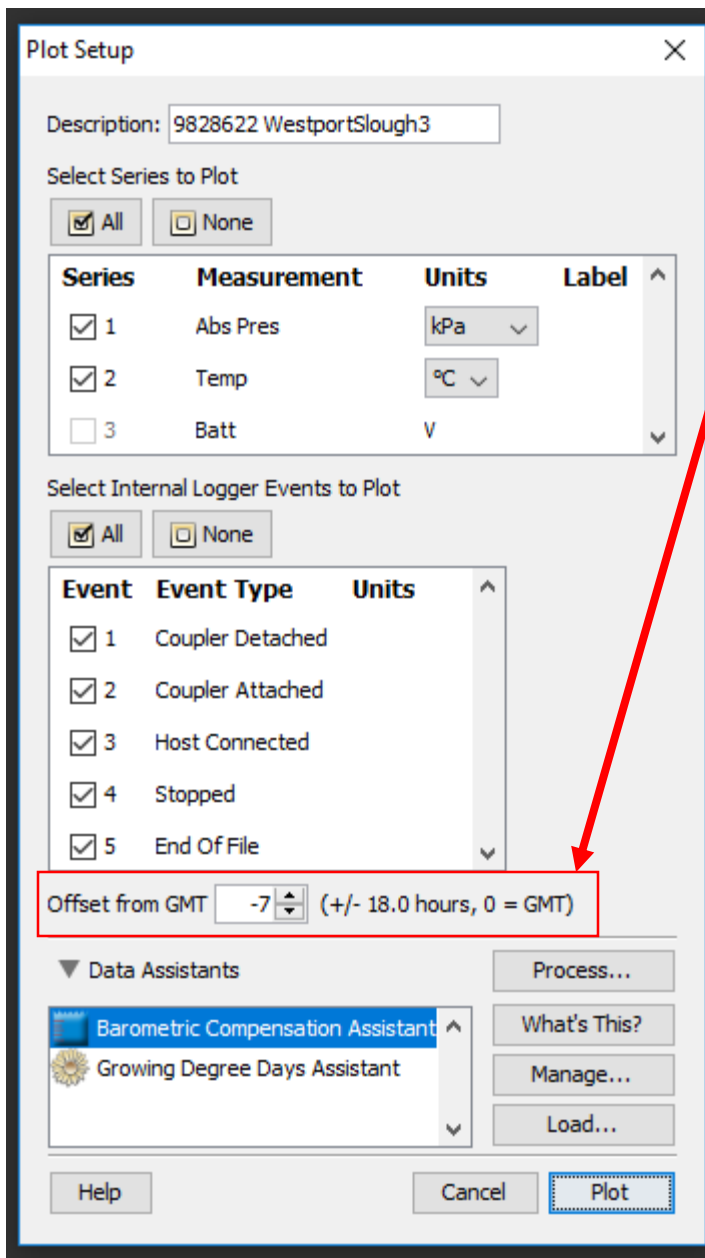Water Level (hydrograph)

Water Level Sensor

Quick Guide Highlights

Other measurements to collect:
- ❑ **Elevation of sensor**
- ❑ **Measurements to identify if the sensor housing has shifted during deployment**
    - ❑ **Such as from sediment to housing cap to identify if the unit has sunk**
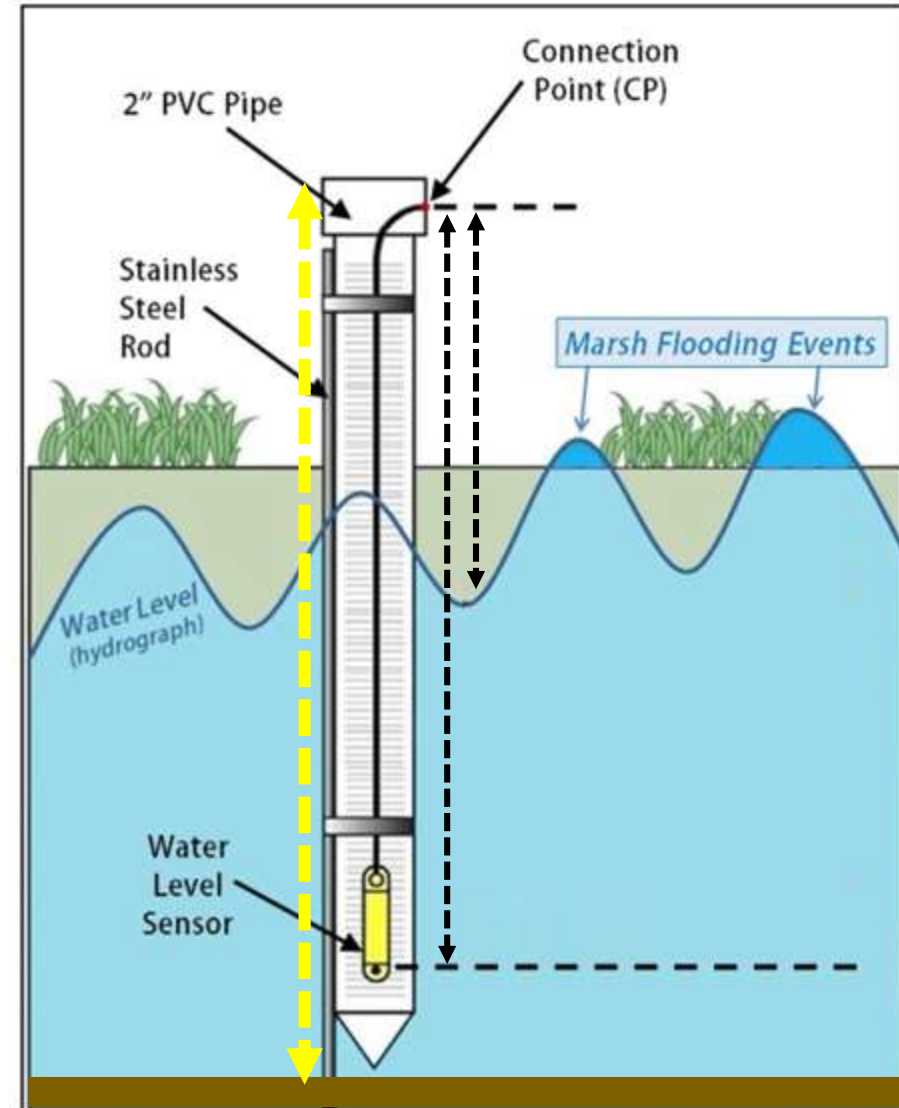
GMT: Setting the time zone

This is where you can set the time zone for the data.
- GMT – 0 Greenwich Mean Time (GMT)
- GMT -8 Pacific Standard Time (PST)
- GMT -7   Pacific Daylight Time (PDT)

To correct data for day light savings you must determine when the day light savings events occur in your data and correct for them with
- GMT -7 during the Summer (day light savings)
- GMT -8 during the Winter (no day light savings)
- This correction can be done in post-processing, but you must know what time zone your data was collected in before the correction can be made

Why does this matter? Your data and reference measurements will be off by an hour after crossing a time boundary – because Hoboware doesn't correct this for you.

Technical Guide - Helpful Resources

Continuous Water Level Data Collection and Management Using Onset HOBO® Data Loggers
Natural Resource Report NPS/NCBN/NRR—2017/1370
https://irma.nps.gov/DataStore/DownloadFile/563851

Oregon Plan for Salmon and Watersheds, Water Quality Monitoring Guidebook, Temperature Protocols Chapter 6:
http://docs.streamnetlibrary.org/Protocols/021.pdf

Washington Department of Ecology Quality Assurance Monitoring Plan: Continuous Monitoring for Oxygen, Temperature, pH, and Conductivity in Statewide Rivers and Streams
https://fortress.wa.gov/ecy/publications/summarypages/0903122.html

HOBOware User's Guide:
http://www.onsetcomp.com/support/manuals/12730-MANBHW-UG

HOBOware Pro Barometric Compensation Assistant User's Guide:
http://www.onsetcomp.com/files/manual_pdfs/Barometric-Compensation-AssistantUsers-Guide-10572.pdf

HOBO® U20 Water Level Logger Manual:
http://www.onsetcomp.com/files/manual_pdfs/12315-F-MAN-U20.pdf

Specifications for HOBO® U20 Water Level Loggers:
http://www.onsetcomp.com/files/datasheet/Onset%20HOBO%20U20%20Water%20Level%20Data%20Loggers.pdf

Specifications for HOBO® U20L Water Level Loggers:
http://www.onsetcomp.com/files/datasheet/Onset-HOBO-U20L-Water-Level-DataLogger-Series.pdf

US Geological Survey. 2012. Water level continuous standard operating procedures. Unpublished protocols. USGS, Western Ecological Research Center, San Francisco Bay Estuary Field Station, Vallejo, CA.
http://www.tidalmarshmonitoring.org/monitoring-methods-hydrology.php