PA Water Quality Nontidal Network April 2016 Audit

findings and study plan design

Feb 05, 2018

Overview: Nontidal Water Quality Monitoring

- For *isokinetic sampling* average stream velocity must be greater than 1.5 ft/s when using bottle samplers. Appropriate nozzle sizes are selected based on channel depth to obtain a uniform transit rate.
- Isokinetic depth-integrated samples are collected at equal-width increments across a stream channel and then composited.
- For *non-isokinetic sampling* the stream velocity is outside the limits defined for isokinetic sampling. Weighted sampler bottles are used to obtain representative grab samples along multiple verticals, and then composited.
- *Stream velocity* is a key factor taken into consideration when assessing the need to sample isokinetically. It can be determined from historical stage height/velocity data, directly using discharge measurements, or via indirect means.

PA Water Quality Nontidal Network April 2016 Audit Findings

PA USGS

- Isokinetic samplers were used primarily, but at times weighted samplers were also used. Use of samplers was not driven by hydrologic conditions.
- Transit rates and nozzle sizes were not considered prior to sampling.
- Sample processing techniques were not entirely in accordance with CBP protocols- insufficient sample mixing, inadequate churn splitting, filters not pre-rinsed, sample handling concerns.

SRBC

- Modified isokinetic sampler was used that may not have been appropriate for all sampling conditions.
- Lower than accepted number of **cross-sectional increments** were collected.
- Transit rates and **velocity checks** were not considered prior to sampling.
- Sample processing techniques were not entirely in accordance with CBP protocols- insufficient sample mixing, inadequate churn splitting, sample handling concerns.

Post Audit Procedural Changes

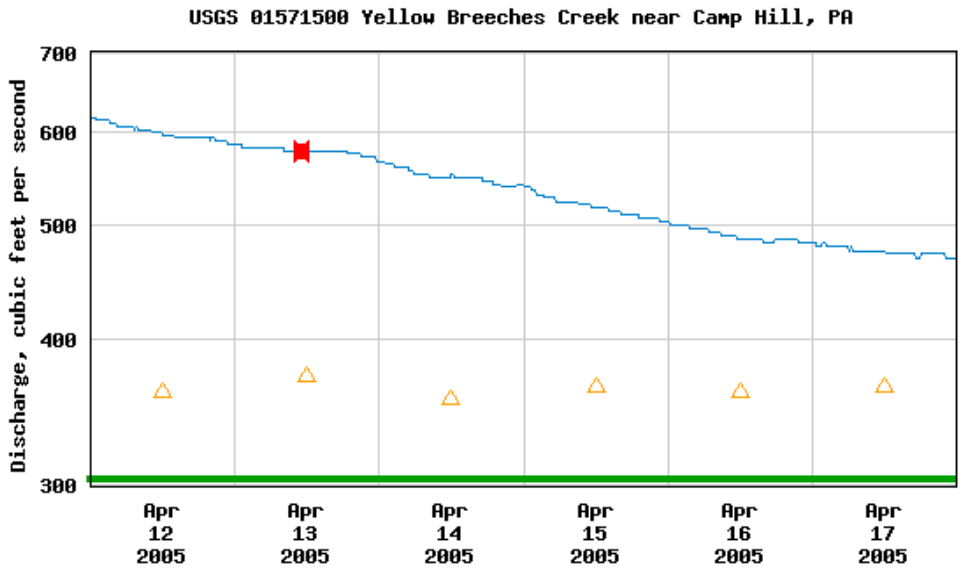
- New samplers are being used in place of the modified DH-48 sampler when isokinetic conditions prevail.
- Stream velocities are being considered prior to sampling.
- Staff have since participated in a refresher training module.
- Check cross sectional variability- Data from individual vertical cross-sections gathered between Sep 2016 through Nov 2017 were in good agreement.
- A follow-up audit was conducted in Nov 2017- formal report is being worked on, but overall the audit was very satisfactory and no major concerns were noted.

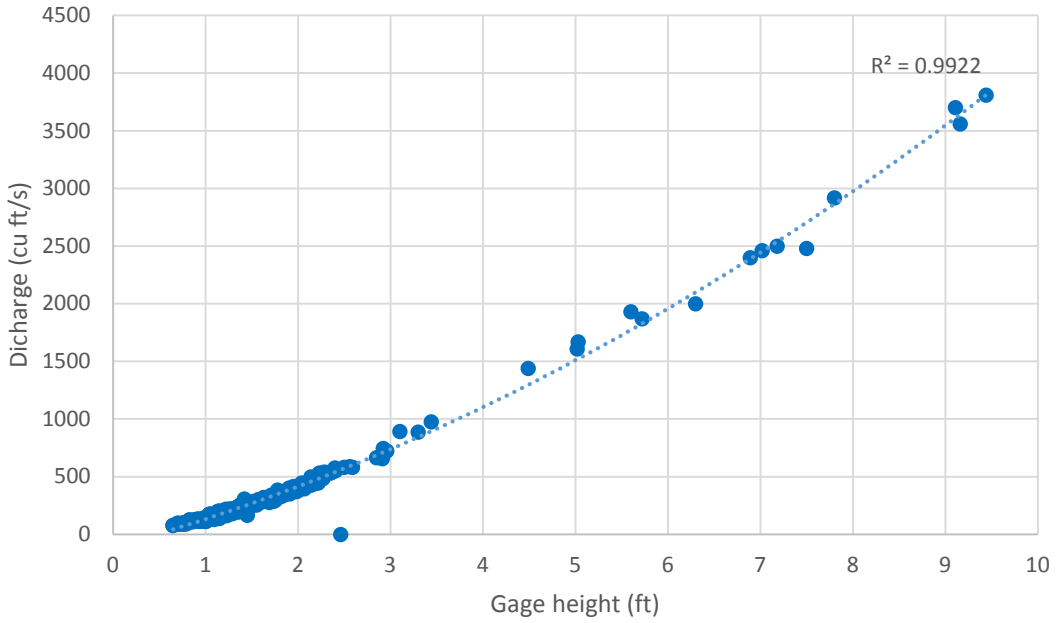
PA Water Quality Nontidal Network: Study Plan Design

- Since stream velocities were not considered while sampling, historic data may be biased.
- Can this bias* be determined if sampling were concomitantly carried out using both old and new methods?
- Are there any instances when data was collected concomitantly using both methods?
  a) 2005 USGS and SRBC @ Yellow Breeches*, Conodoginuet, and Swatara – coincides with the start of NT Network. Marginal variability observed (some of the PADEP lab data had been flagged).
  b) Post audit 2016 old and new methods @ Lewisburg and Marietta – Lewisburg >1.5 ft/s, changes observed between old and new methods*. No significant variability observed when channel velocity was <1.5 ft/s at Marietta between the two methods.

USGS vs SRBC: 2005 Data Comparison @ Yellow Breeches

We have discharge information that can be correlated to gage height, which in turn is used to determine a threshold for channel velocities >1.5 ft/s.

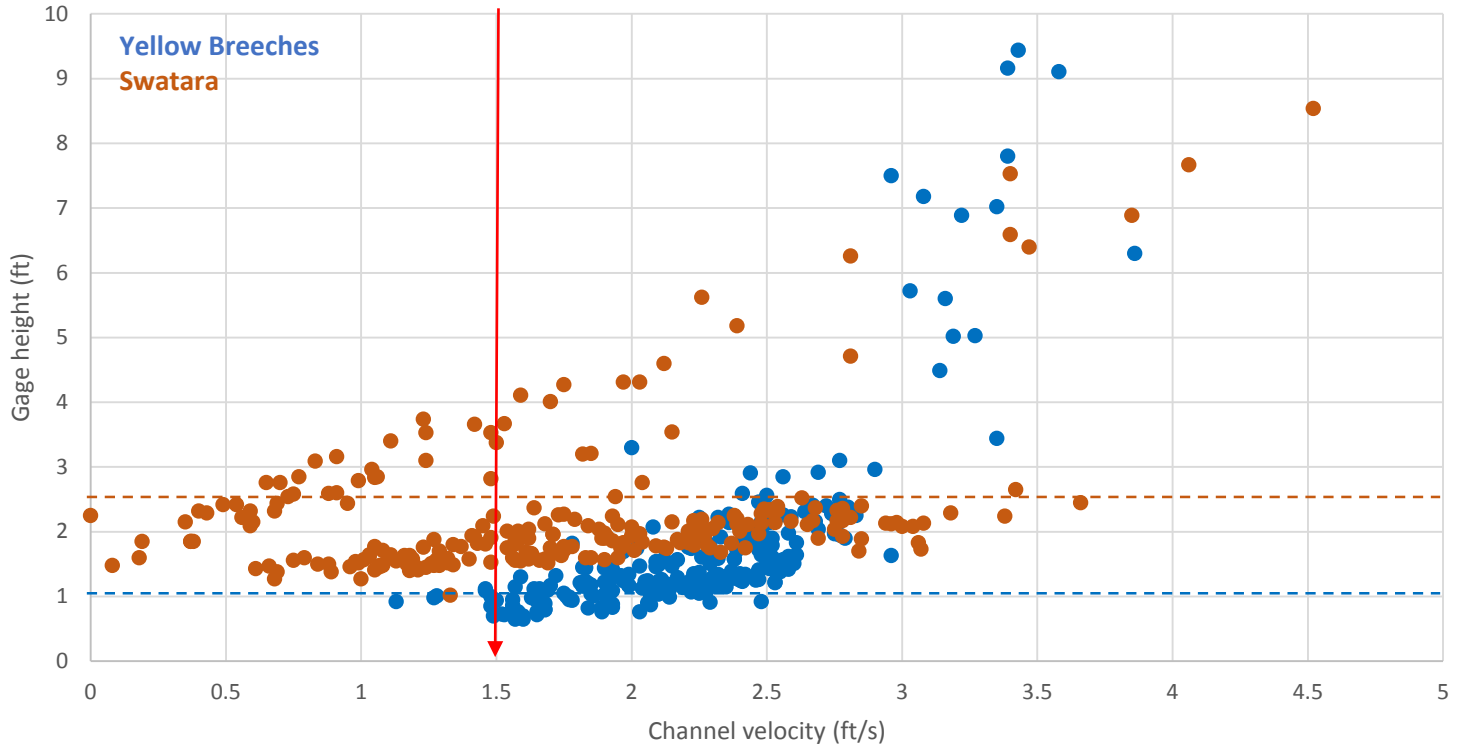




USGS vs SRBC: April 14 2005 Data Comparison @ all two of the three sites

Site	Yellow Breeches	Swatara
Discharge (cu ft/s)	550	950
Gage height (ft)	2.2	2.1
Threshold for isokinetic (ft)	1	2.5
Sampling day conditions	Isokinetic	Non-isokinetic

Within reasonable constraints, any detected bias may be applied to historical data at each of the sites.



SRBC 2016 Data Comparison of Old and New Methods

Site	Lewisburg	Marietta
Sampling date	10/22/2016	10/25/2016
Discharge (cu ft/s)	34,800	43,000
Gage height (ft)	8.5	35
Threshold for isokinetic (ft)	2.2	37
Sampling day conditions	Isokinetic	Non-isokinetic
≥20% variability	Total ammonia (20%), DOP (25%), DP (75%)	Total ammonia (56%)

- At Lewisburg isokinetic conditions were prevalent on the day of sampling.

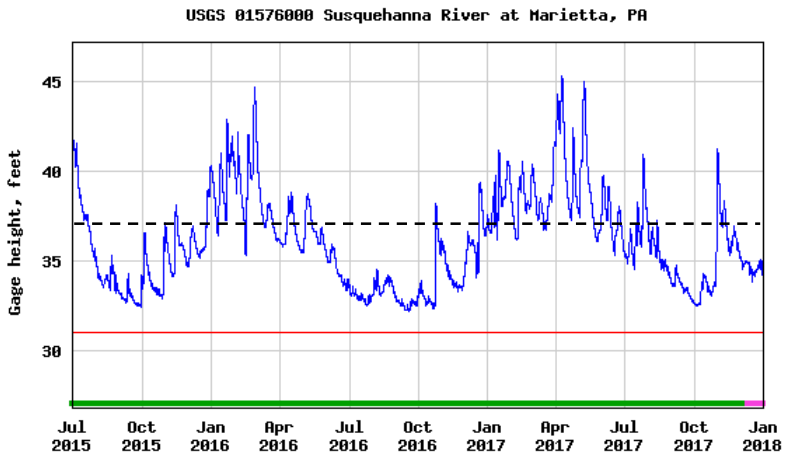
  More variability?

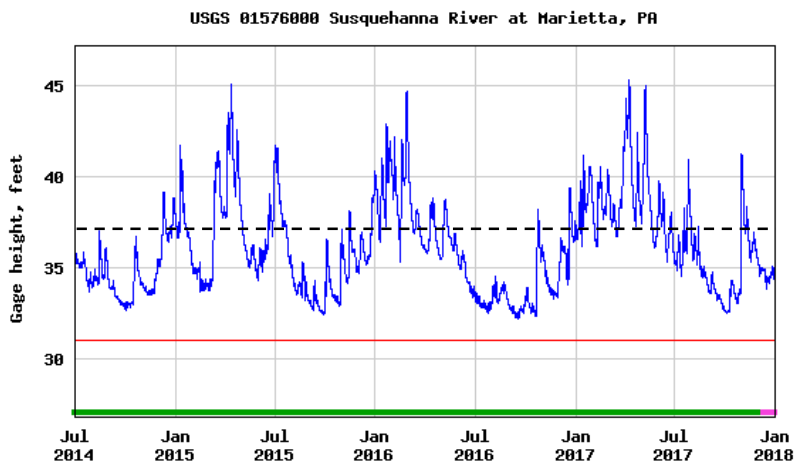
  Significant?

Study Plan Design: some thoughts

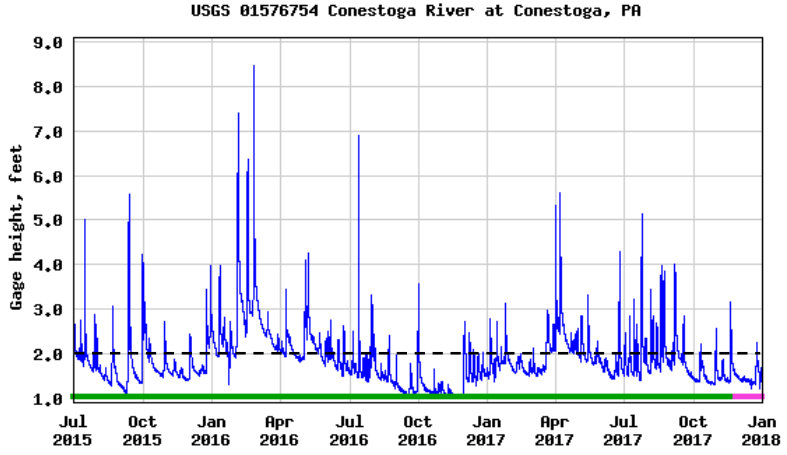
- Problem - Since stream velocities were not considered while sampling, historic data may be biased.
- Hypothesis - Can this bias be determined if sampling were concomitantly carried out using both old and new methods?
- Plan - Historic data was collected over a range of different velocities, can this be simulated during a storm event by collecting samples every 60 min over the rising and falling limbs of a hydrograph along a single vertical? Any observed bias can then be applied to the historic data.
- Query 1 - Are samples along a single vertical truly representative of a composite sample (traditionally used), and can any bias thus determined be applied to the historic data?
- Query 2 - Original study plan is designed for Marietta and Conestoga, will additional sites have to be included to get a definitive answer?

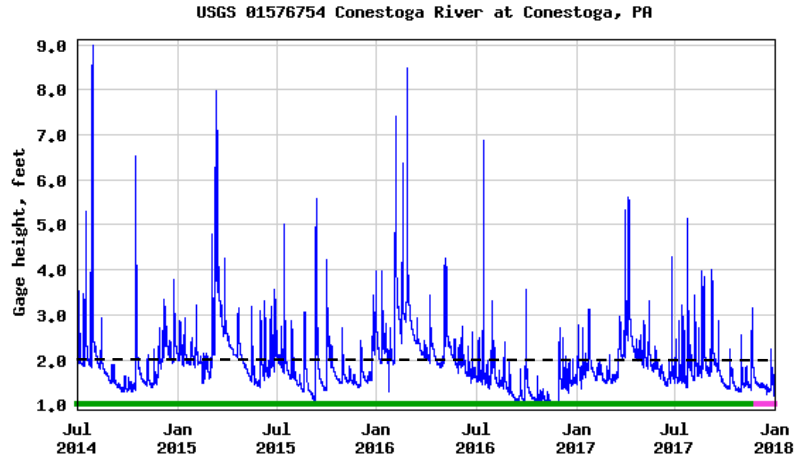
Site Hydrographs- Potential Time Frame





Marietta (Threshold = 37 ft):
Jan-June velocities >1.5 ft/s





Conestoga (Threshold = 2 ft):
Jan-June velocities >1.5 ft/s

Moving On....

- Only addressing velocity as a major factor in this study.
- Change focus of study from single vertical to composite sampling.
- If MD USGS is in charge of the design, get Joel to weigh in on the changes.
- Get input from Elgin about sample size (replicates/triplicates?). Earlier study report from Elgin defines n = 40 as a permissible number to work within detection limits for the various parameters (at least for tidal).
- Get ball rolling for April start date?