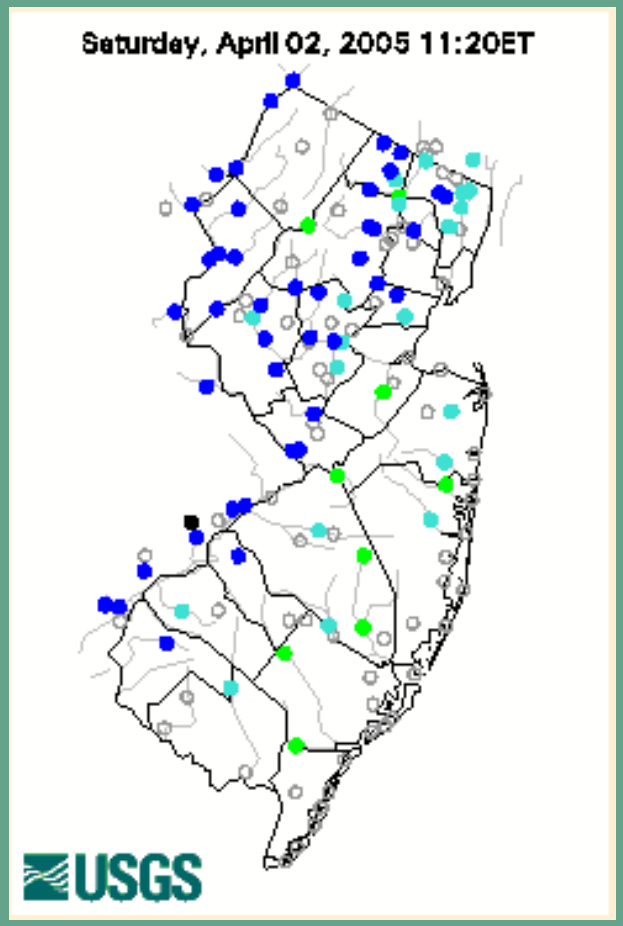
U.S. Geological Survey New Jersey Water Science Center (USGS NJWSC) Streamgaging

- Overview of gaging stream elevation and velocity using mechanical and acoustic methods

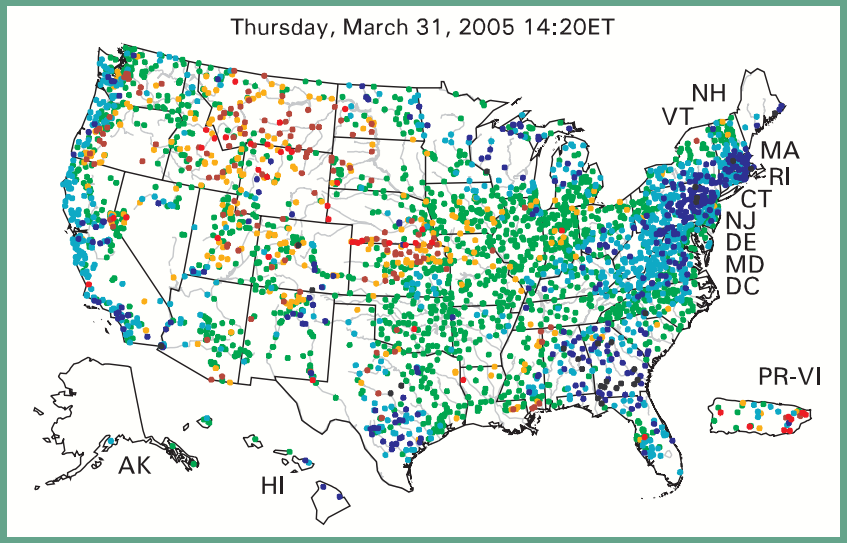
USGS

Real-time Surface Water Data



http://nj.usgs.gov/

USGS



kwws=22z dwhu1xvj v1j ry2z dwhu z dwfk

Explanation

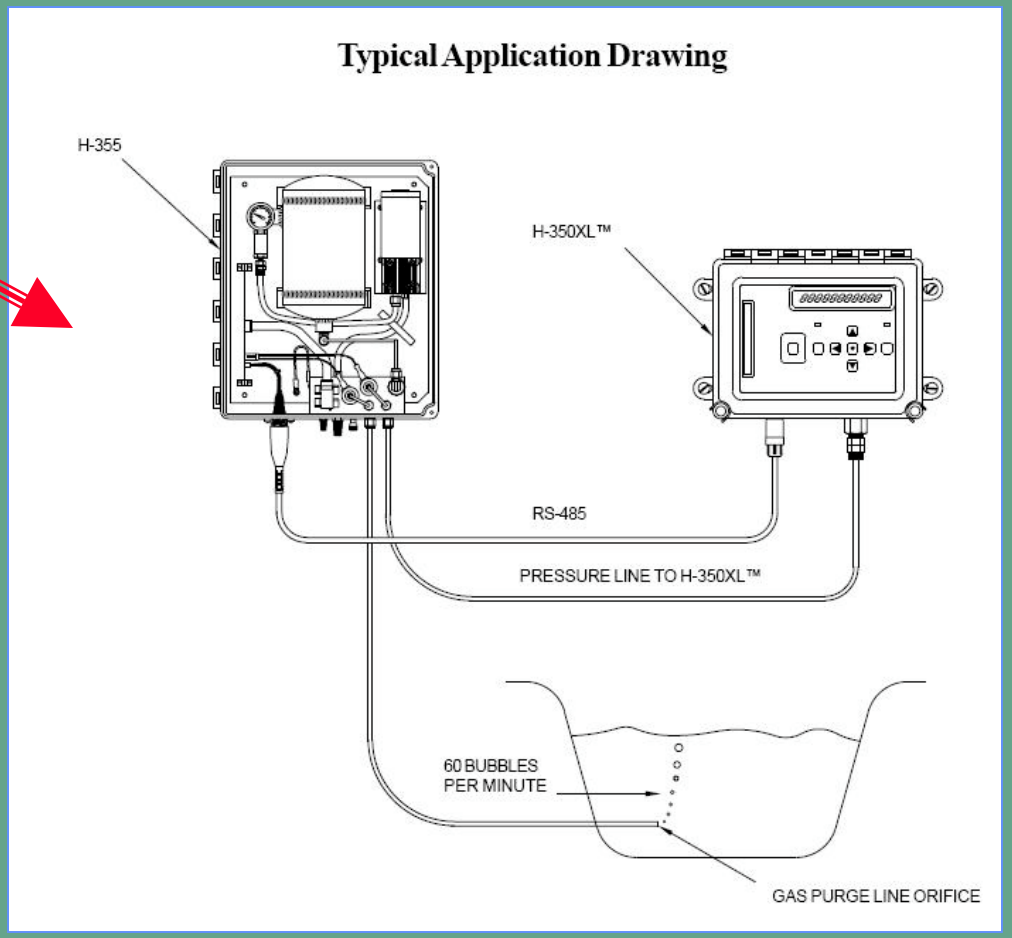
- High
- ≥ 90th percentile
- 75th - 89th percentile
- 25th - 74th percentile
- 10th - 24th percentile
- < 10th percentile
- Low
- Not ranked

The U.S. Geological Survey operates and performs maintenance on many types of gages for continuous stage

- **Gas purge bubbler system gages**
- **Acoustic gages (stage and velocity)**
- **Radar gages**
- **Stilling well gages**

USGS

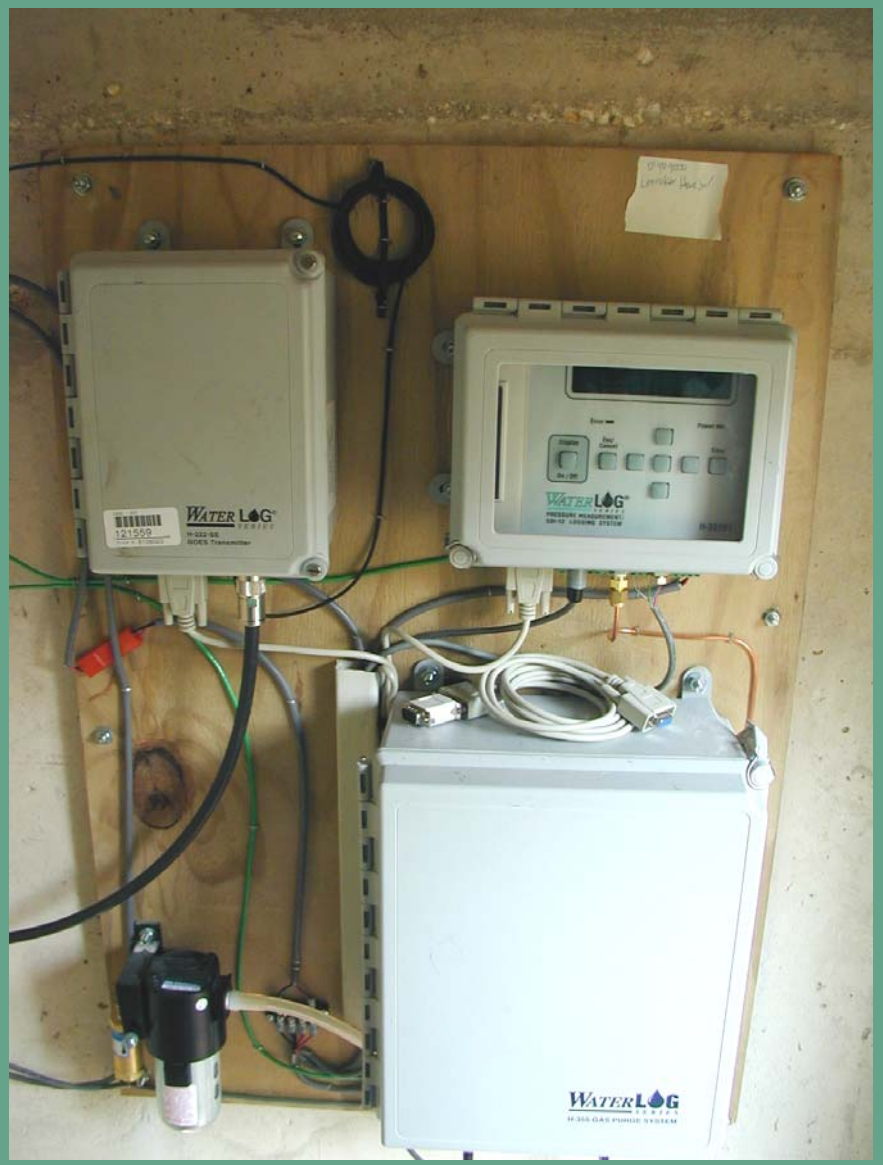
Typical Bubbler Gage Setup



USGS

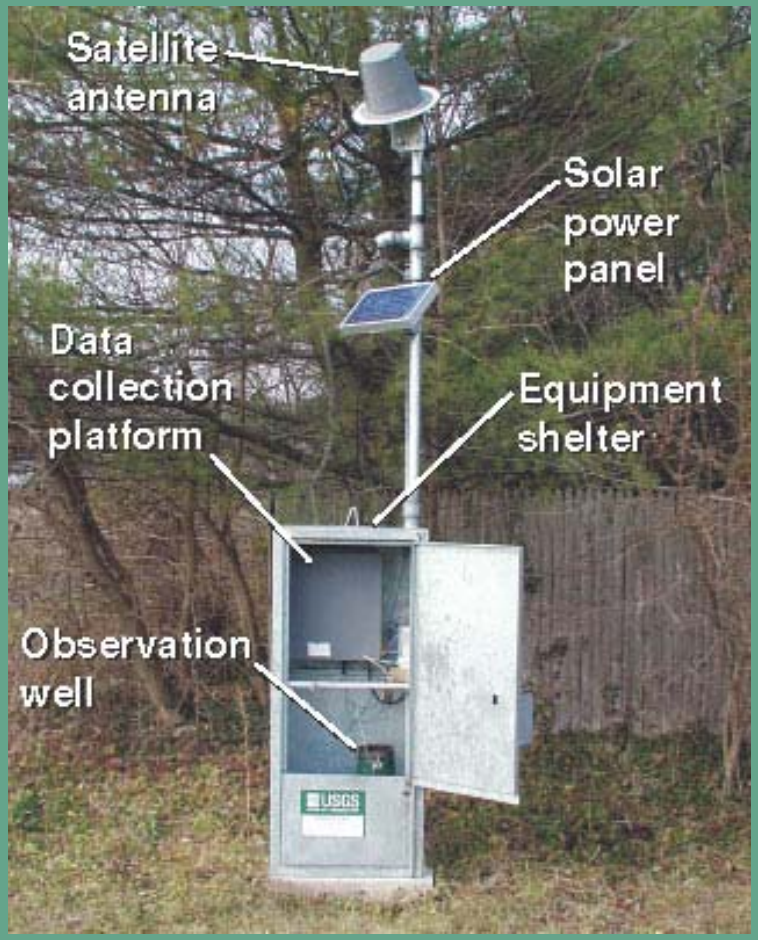
Gas Purge Bubbler System Gage

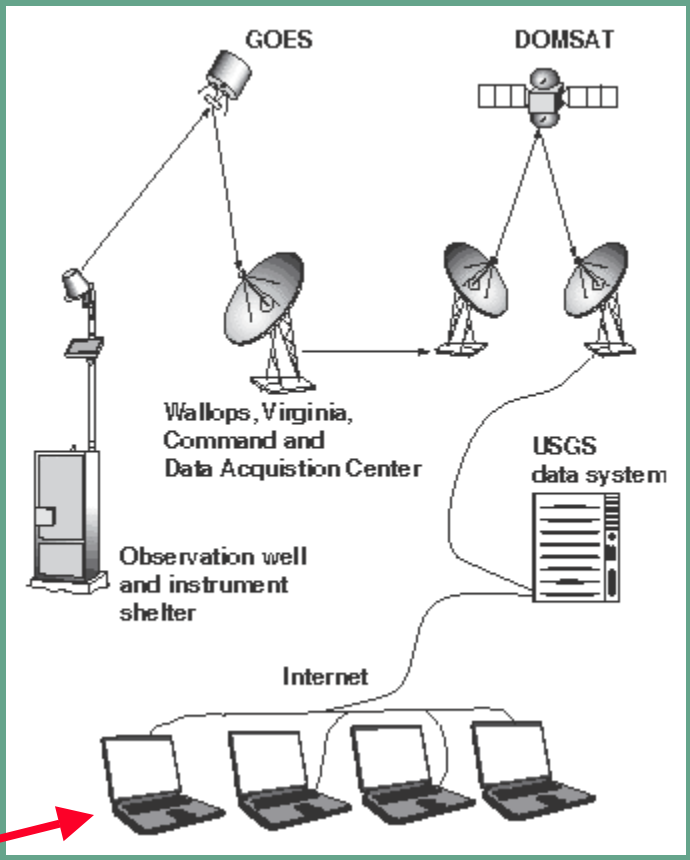
- Air compressor, 15 – 80 psi, constant 60 bubbles/ minute
- Pressure sensor fits in a small shelter
- Powered by 12 volt battery and solar panel
- Measures water levels to 115 ft
- SDI-12 digital communication



USGS

As funds become available, most USGS gages are being updated to include satellite telemetry for near real time stream monitoring for the benefit of government and public concerns and safety. Anyone can visit our website at http://nj.usgs.gov/ to view the status of the rivers in New Jersey and also around the country at http://water.usgs.gov

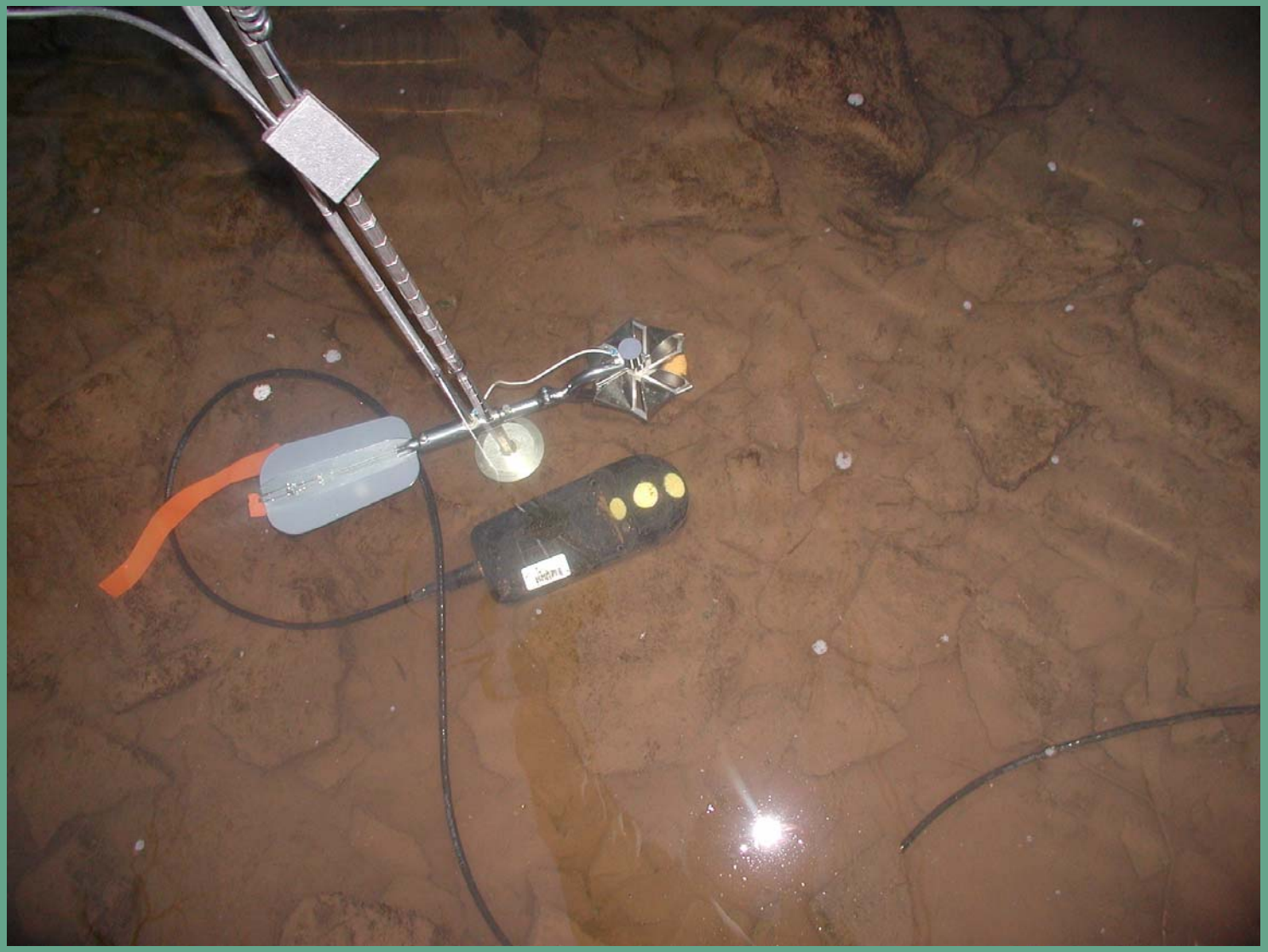




USGS

Your PC at home!!!

Current meter verses acoustic sensor, both are measuring velocity in the stream

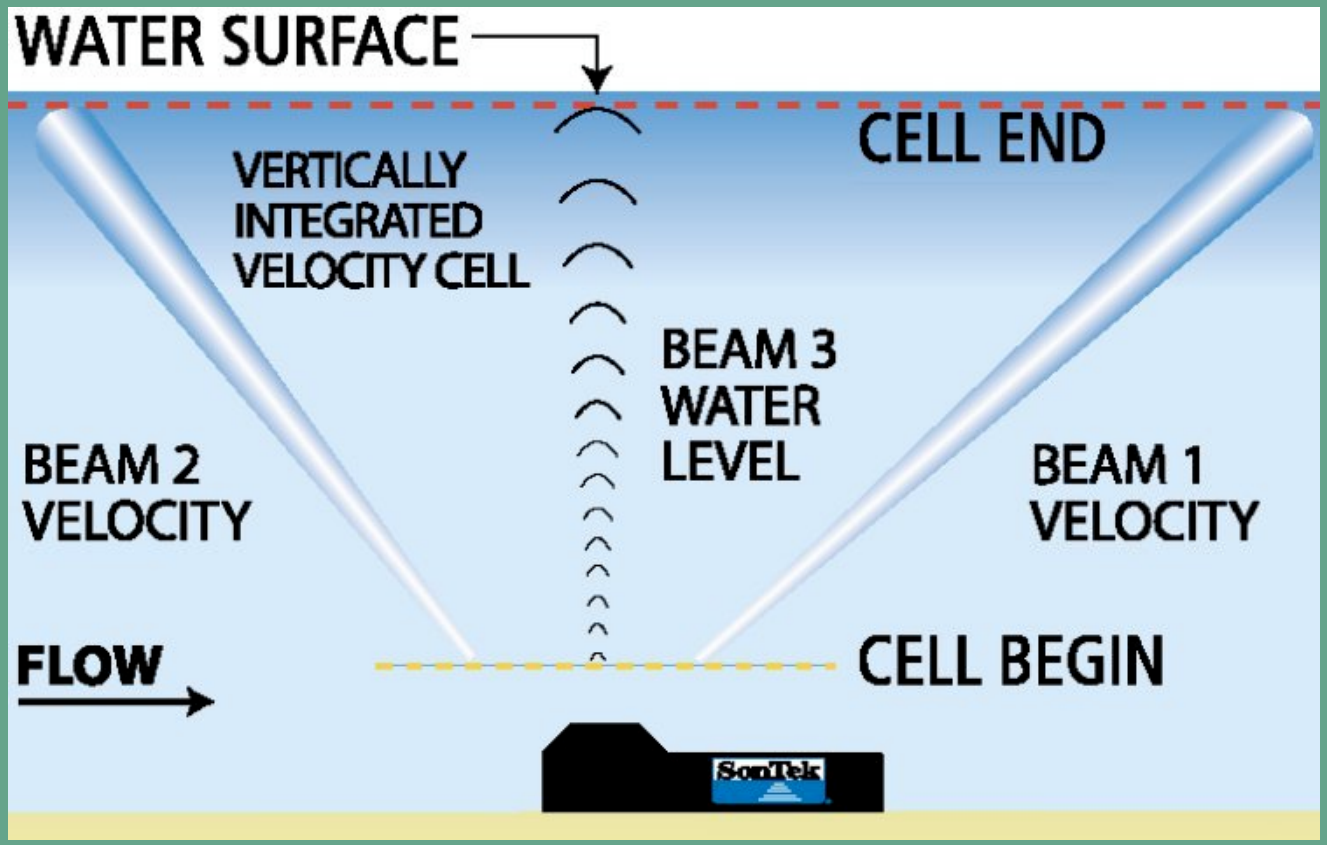


USGS

Sontek Argonaut-SW

- **Depths from 0.5 to 16 feet**

Any use of trade, product, or firm names is for descriptive purposes only and does not imply endorsement by the U.S. Government.



USGS

Sontek Argonaut-SL (Sidelooker)

- Installed at Passaic River at Pine Brook, Sept. 2005
- 2 beams of 1.5 MHz acoustic signals measure velocity (speed of suspended particles)
- Sampling distance 1.6 to 66 ft.
- Velocities up to 20 ft/sec

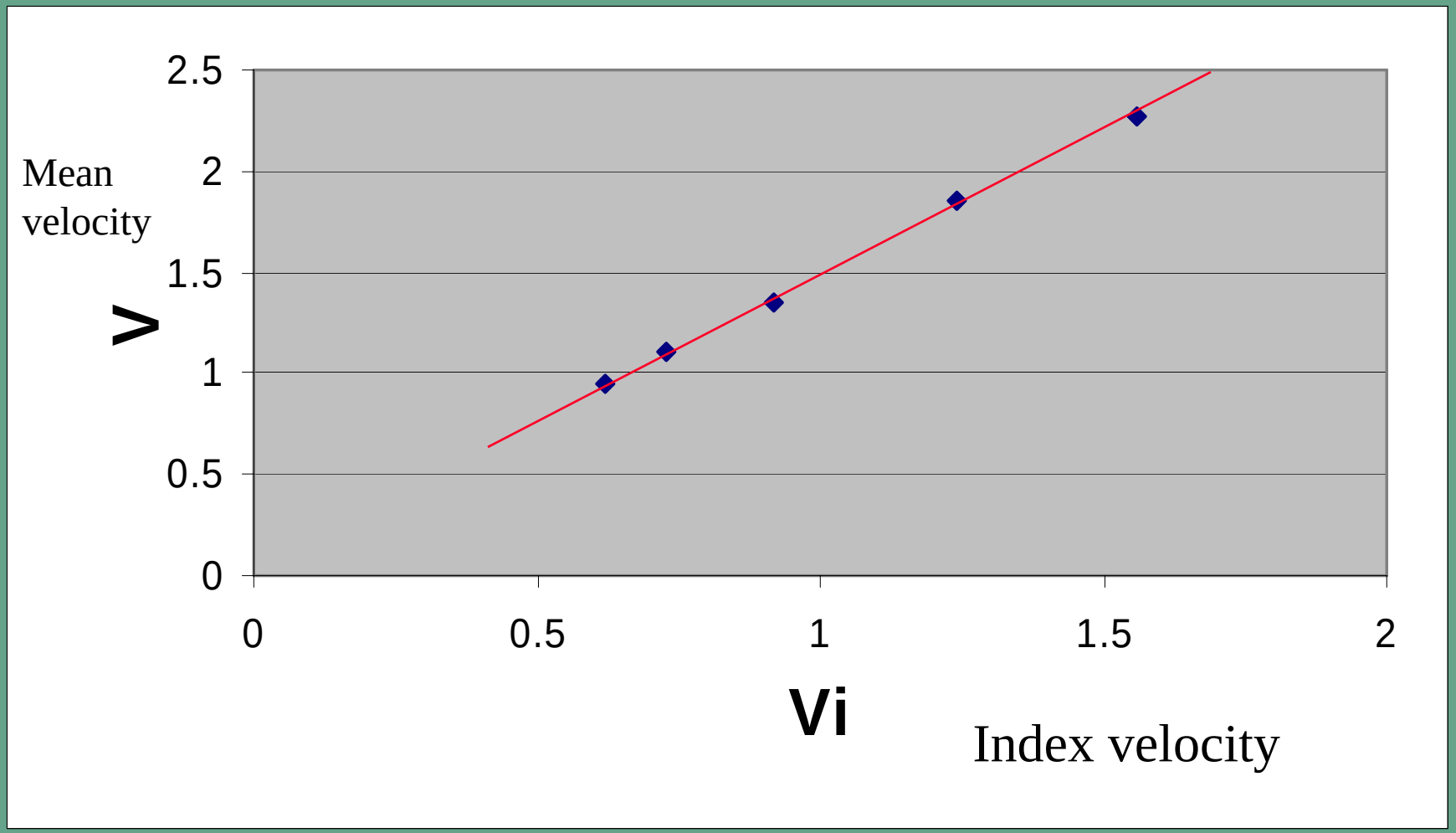
USGS

Measuring discharge of a river with acoustic sensors would involve the following:

- **Relate the index velocity to the mean velocity of stream.**
- **Relate the cross-sectional area of the stream to stage.**
- **Knowing the stage would give area, knowing the index velocity would give mean velocity.**
- **Multiply area by mean velocity to obtain discharge.**

USGS

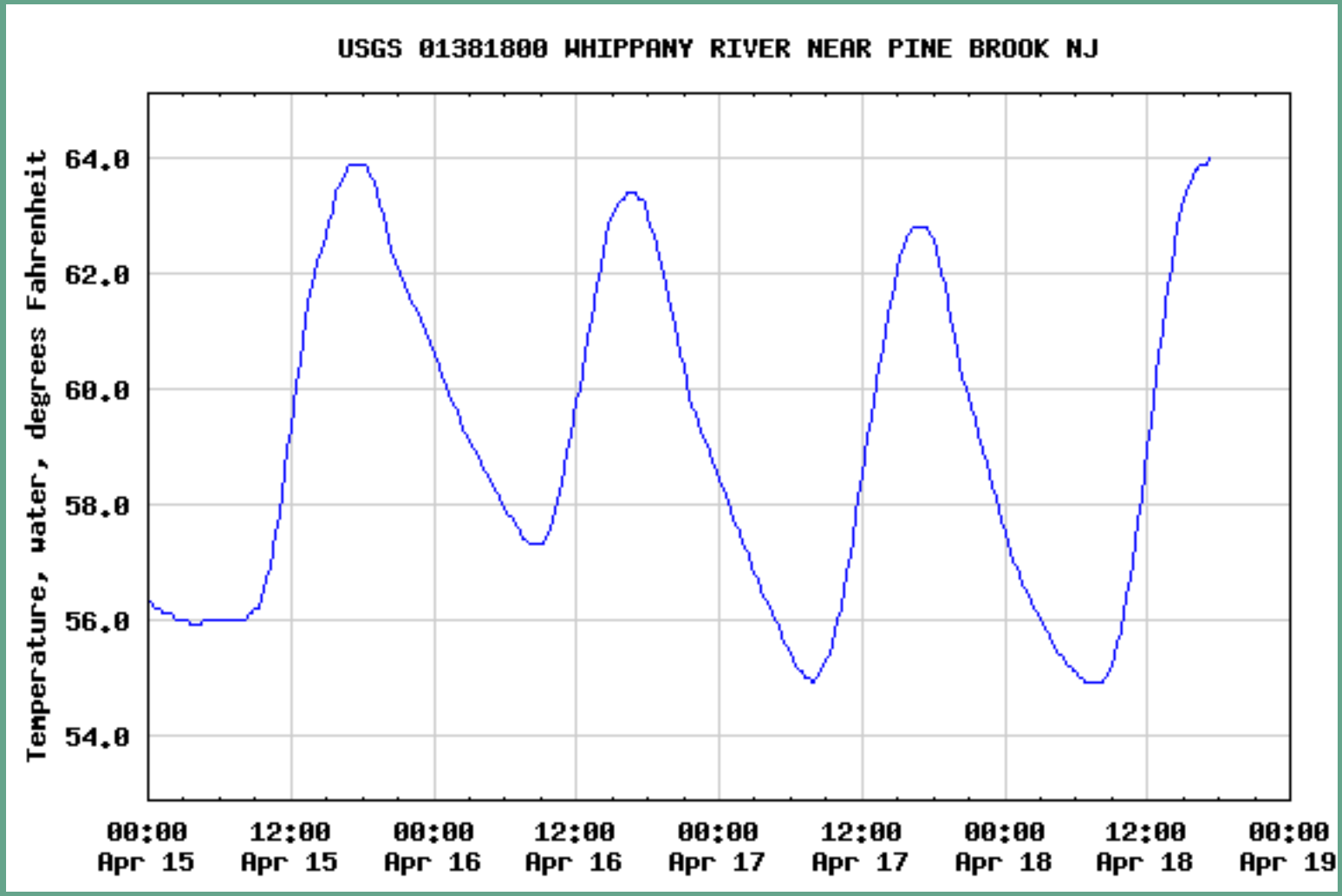
Index velocity from acoustic device verses velocity determined from discharge measurement



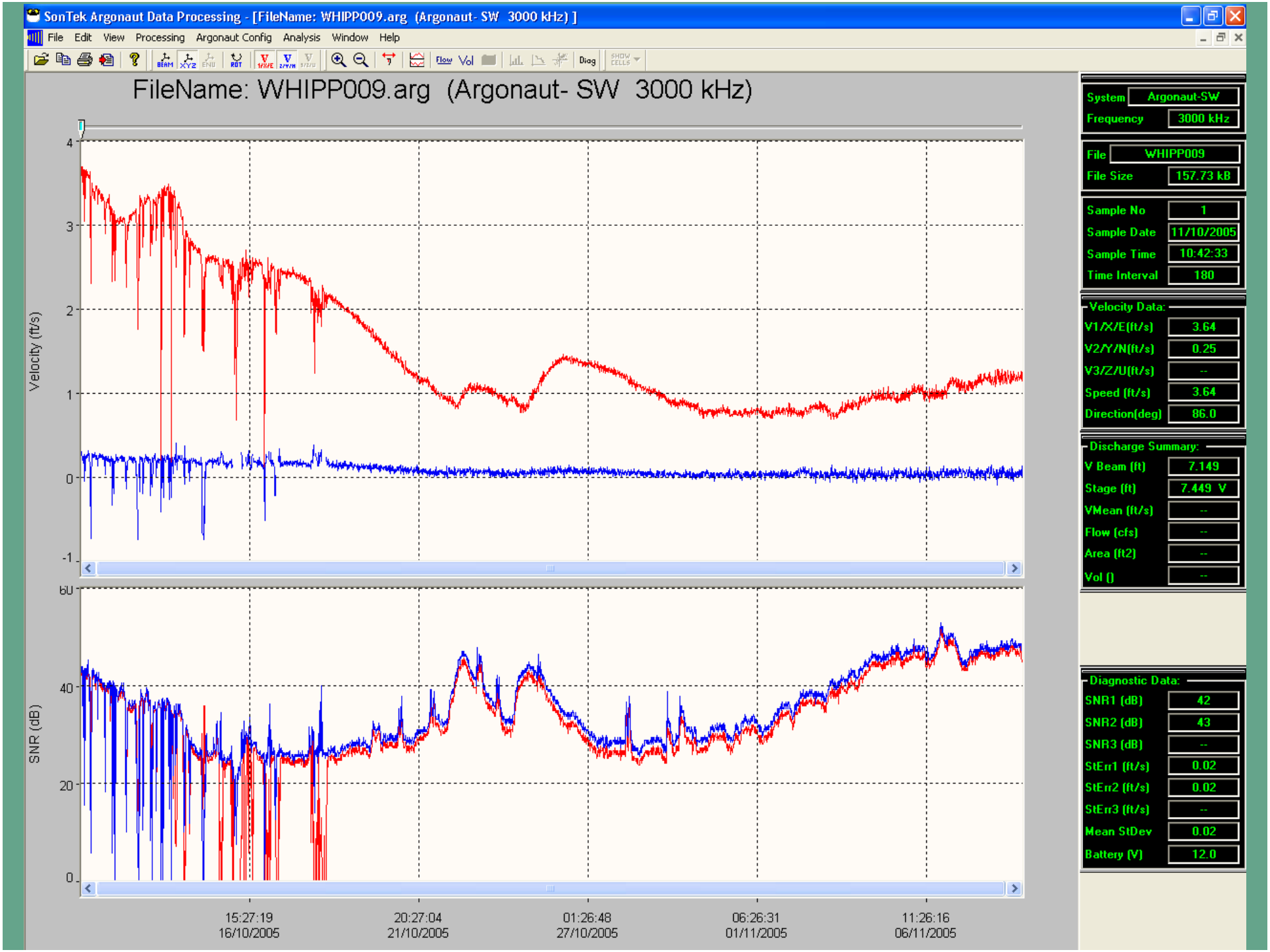
USGS

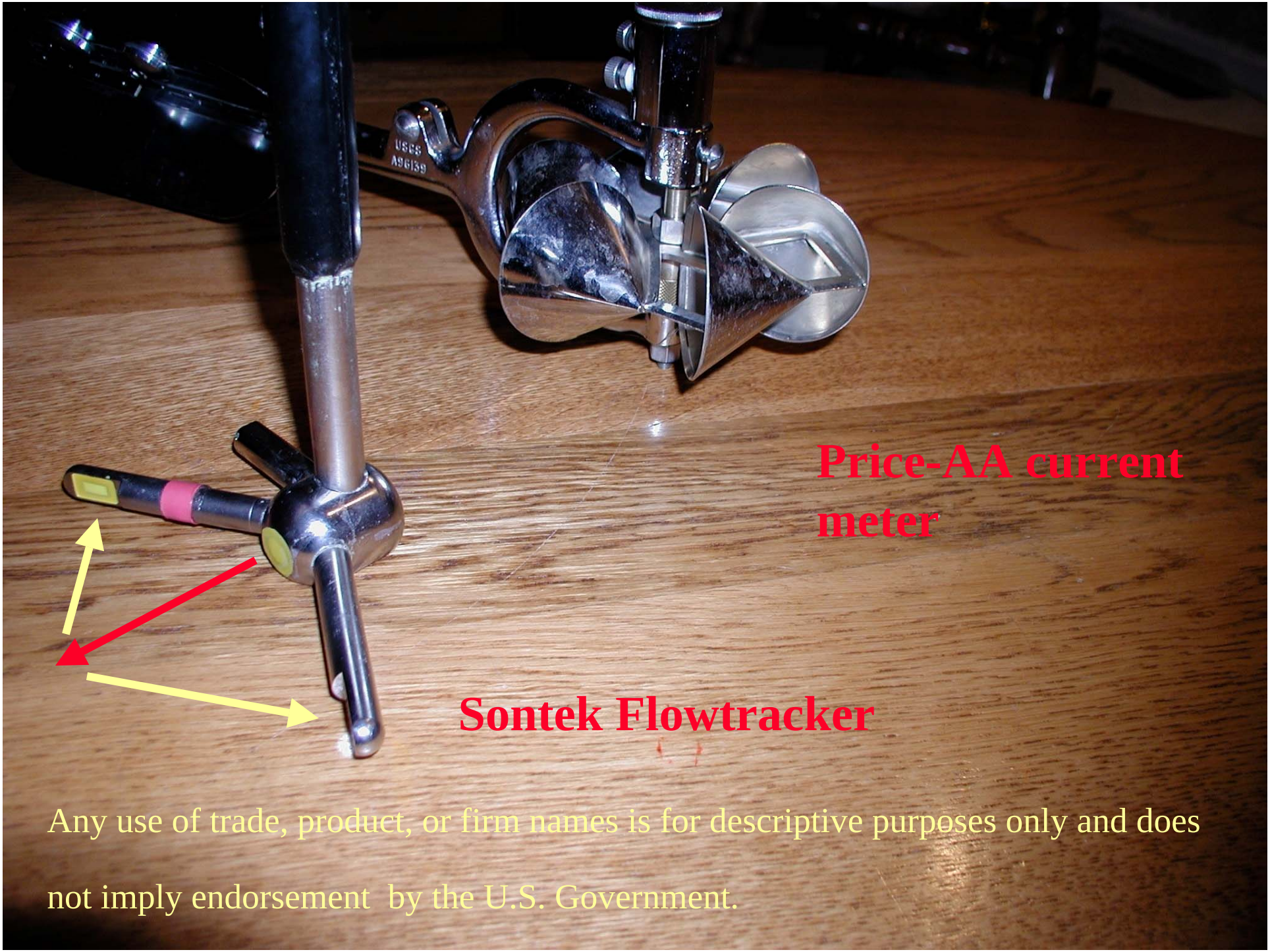
Water temperature is one of the parameters that is logged and can be accessed when using acoustic equipment. Water temperature is needed to compute the speed of sound in water.

http://nj.usgs.gov



USGS

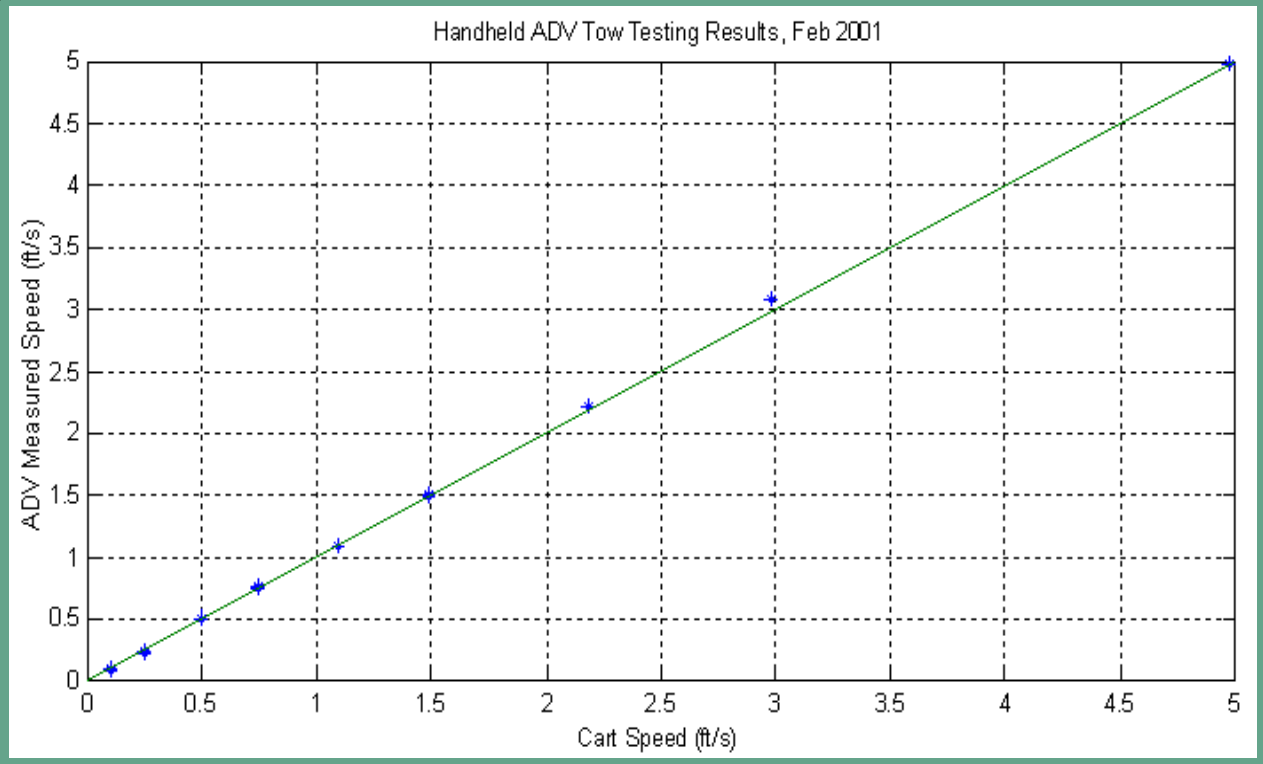

SonTek Argonaut Data Processing - [FileName: WHIPP009.arg (Argonaut- SW 3000 kHz)]
File Edit View Processing Argonaut Config Analysis Window Help
FileName: WHIPP009.arg (Argonaut- SW 3000 kHz)
Velocity (ft/s)
4
3
2
1
0
-1
SNR (dB)
60
40
20
0
15:27:19
16/10/2005
20:27:04
21/10/2005
01:26:48
27/10/2005
06:26:31
01/11/2005
11:26:16
06/11/2005
System Argonaut-SW
Frequency 3000 kHz
File WHIPP009
File Size 157.73 kB
Sample No 1
Sample Date 11/10/2005
Sample Time 10:42:33
Time Interval 180
Velocity Data:
V1/X/E(ft/s) 3.64
V2/Y/N(ft/s) 0.25
V3/Z/U(ft/s) --
Speed (ft/s) 3.64
Direction(deg) 86.0
Discharge Summary:
V Beam (ft) 7.149
Stage (ft) 7.449 V
VMean (ft/s) --
Flow (cfs) --
Area (ft2) --
Vol () --
Diagnostic Data:
SNR1 (dB) 42
SNR2 (dB) 43
SNR3 (dB) --
StErr1 (ft/s) 0.02
StErr2 (ft/s) 0.02
StErr3 (ft/s) --
Mean StDev 0.02
Battery (V) 12.0

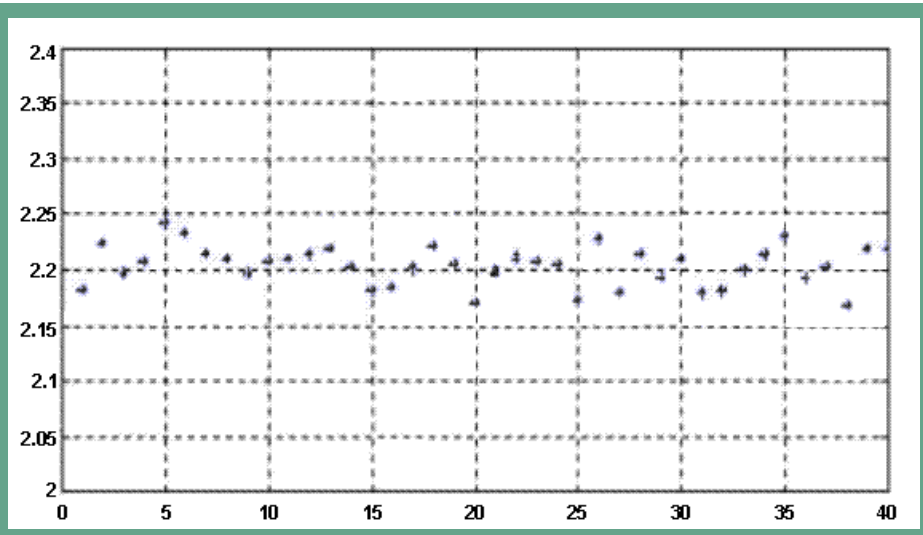


Any use of trade, product, or firm names is for descriptive purposes only and does not imply endorsement by the U.S. Government.

Rigorous Testing of Flowtracker

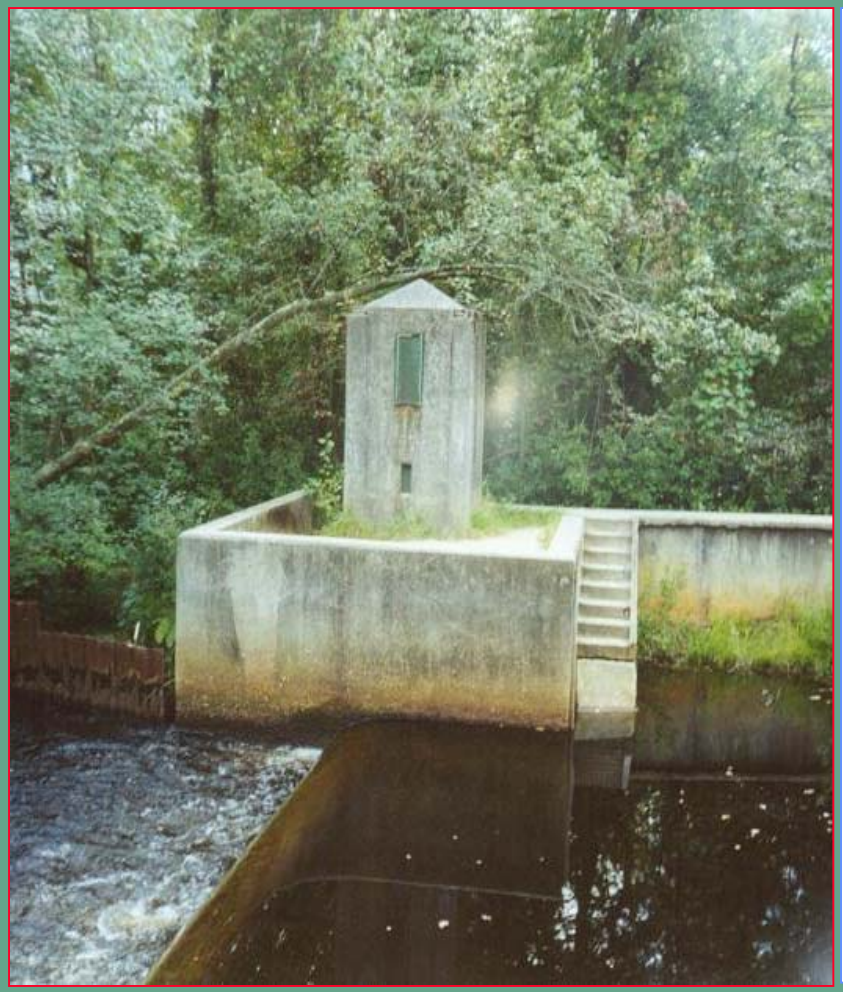
- HIF Tow Tank results - ± 1%
- Field Testing – Flowtracker vs standard current meters
  - Tested across the country with satisfactory results

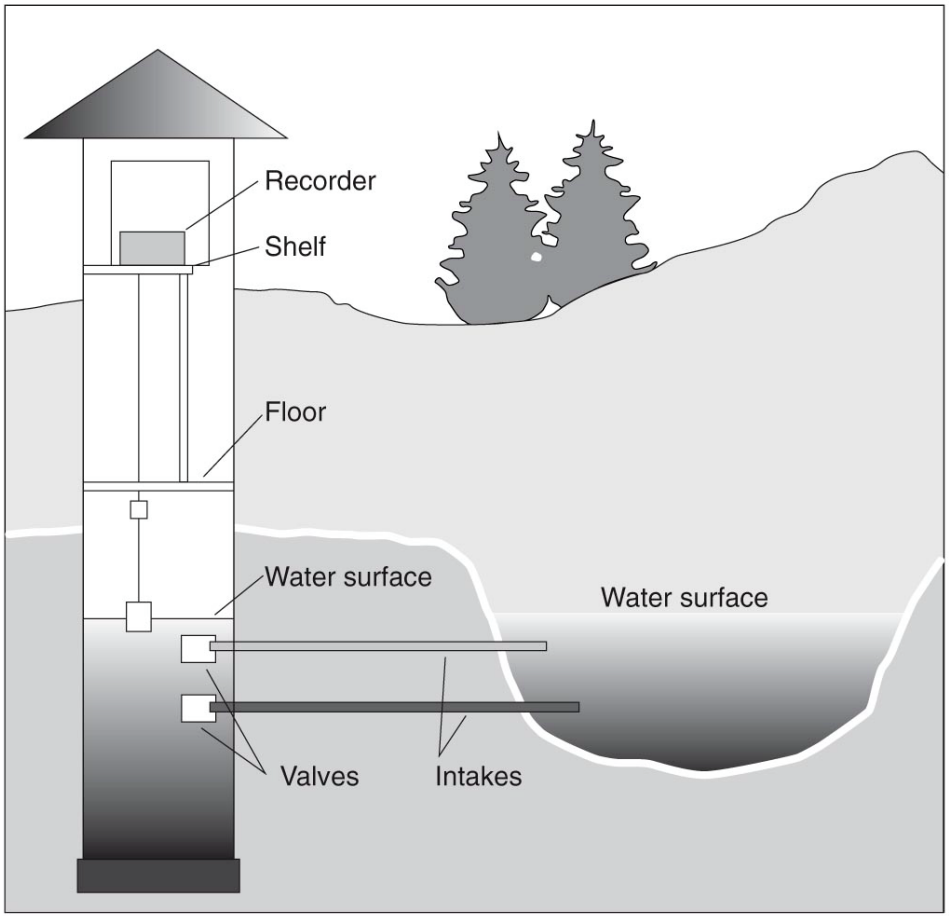




USGS

USGS gage house design utilizing a stilling well. Many were built during the WPA era. Confined space is an issue though. New technology allows for different systems to be design and installed (depending on stream attributes)





(From Wahl and others, 1995)

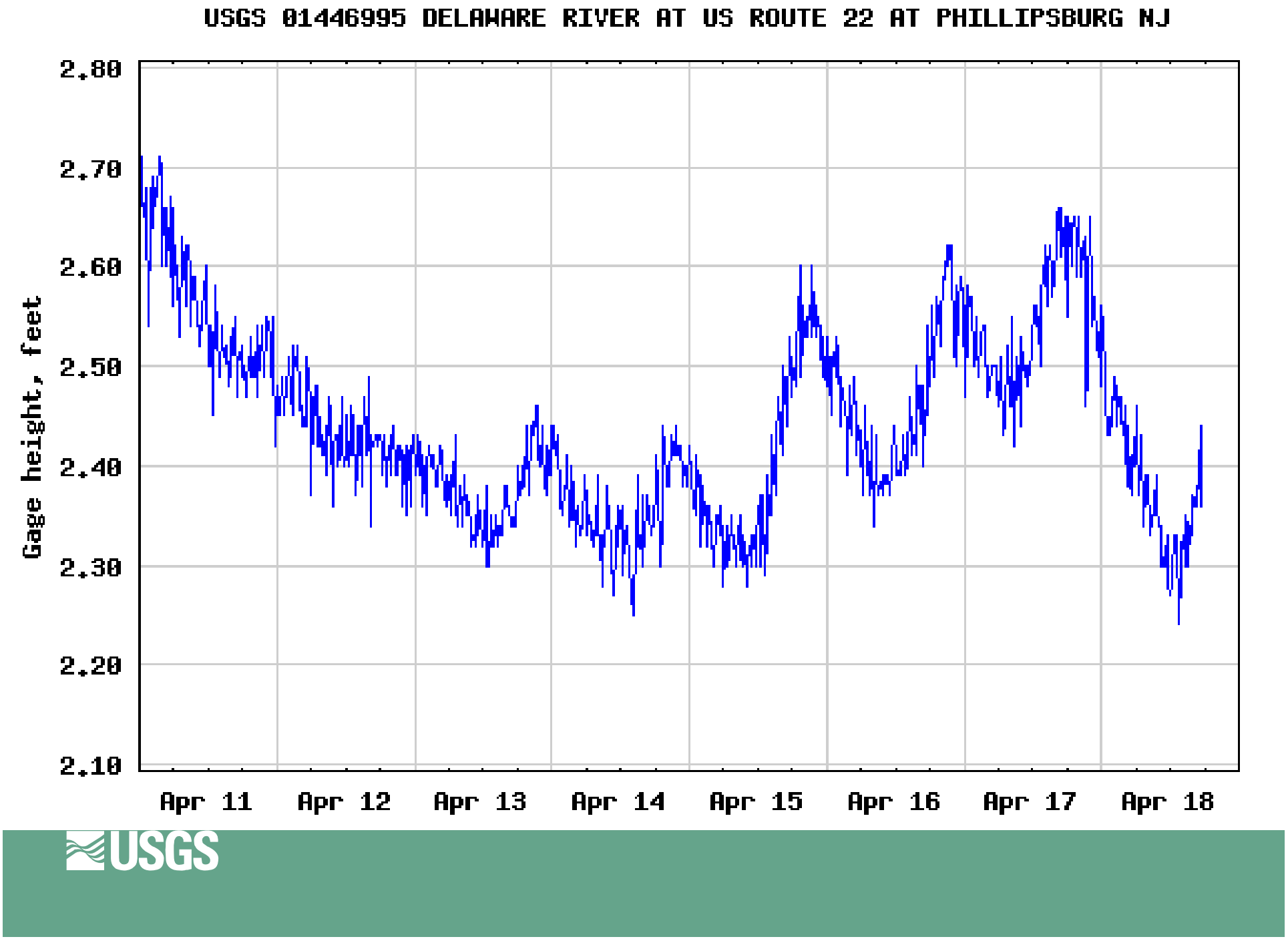
USGS

Radar non-contact stage sensor

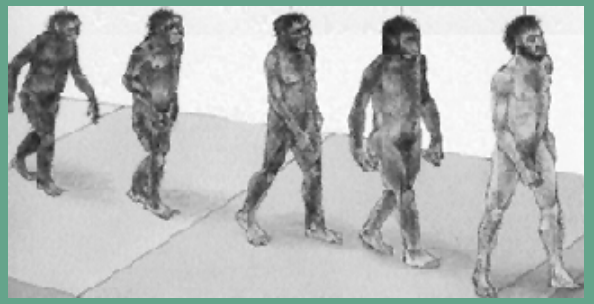
- Waterlog H-360 installed Oct. 5, 2005 Delaware River at Phillipsburg
- A microwave transmittor and sensor aimed at water surface from bridge (2” to 115’)
- Echo is received and evaluated to determine distance to water surface
- Sensor output is compatible with our DCPs
- Distance, elevation, and signal strength stored
- Accuracy ± 0.025 ft

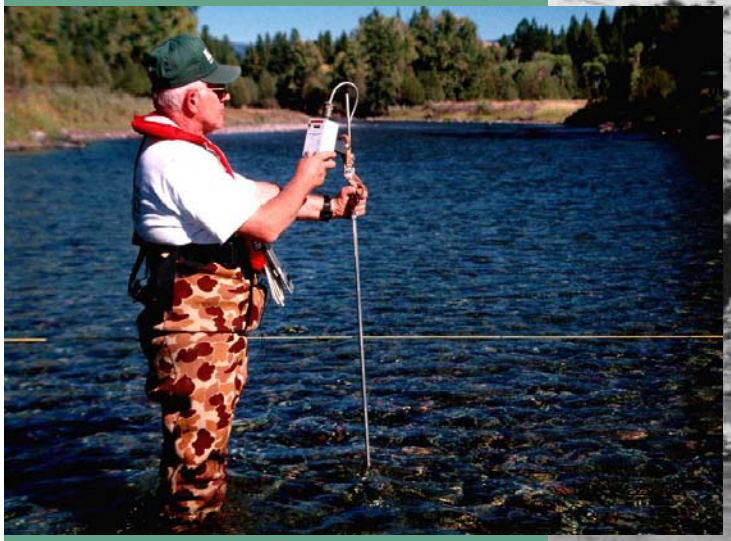
USGS

01446995 Delaware River at US Route 22 at Phillipsburg, NJ


USGS 01446995 DELAWARE RIVER AT US ROUTE 22 AT PHILLIPSBURG NJ
Gage height, feet
2.80
2.70
2.60
2.50
2.40
2.30
2.20
2.10
Apr 11
Apr 12
Apr 13
Apr 14
Apr 15
Apr 16
Apr 17
Apr 18
USGS

Evolution of Equipment



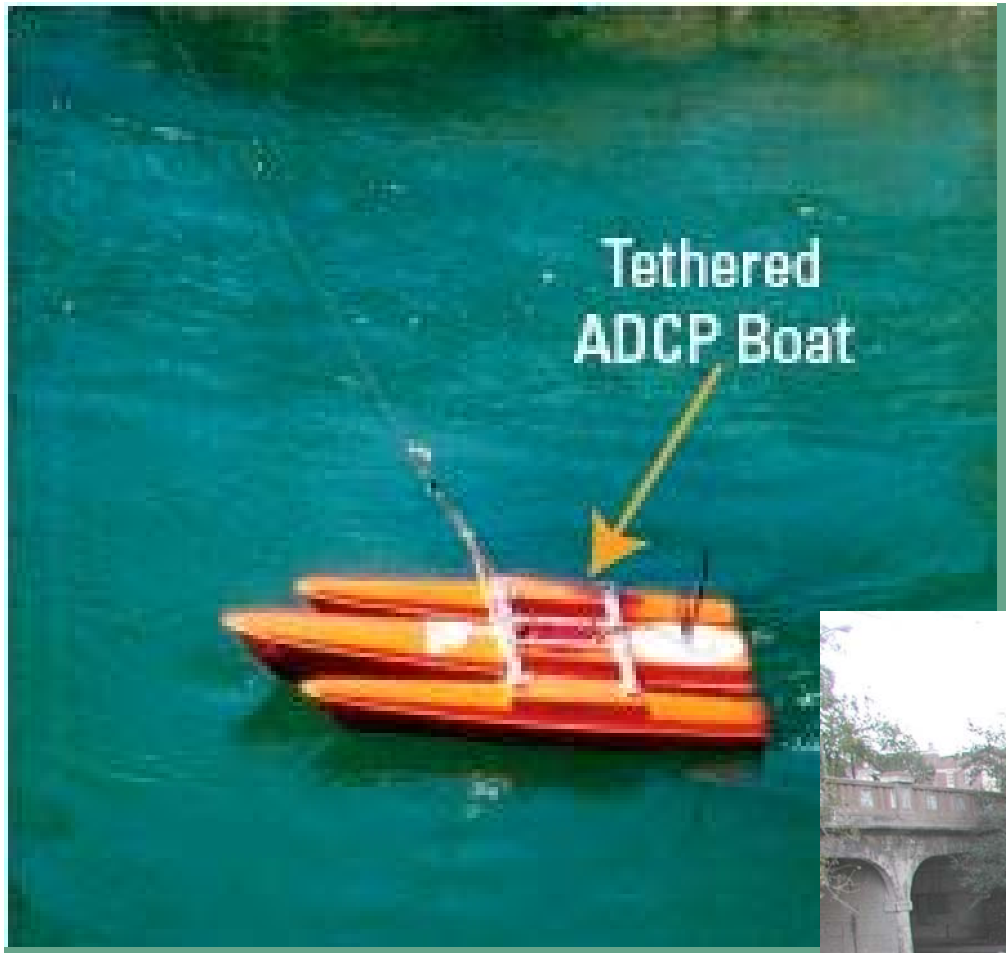


USGS

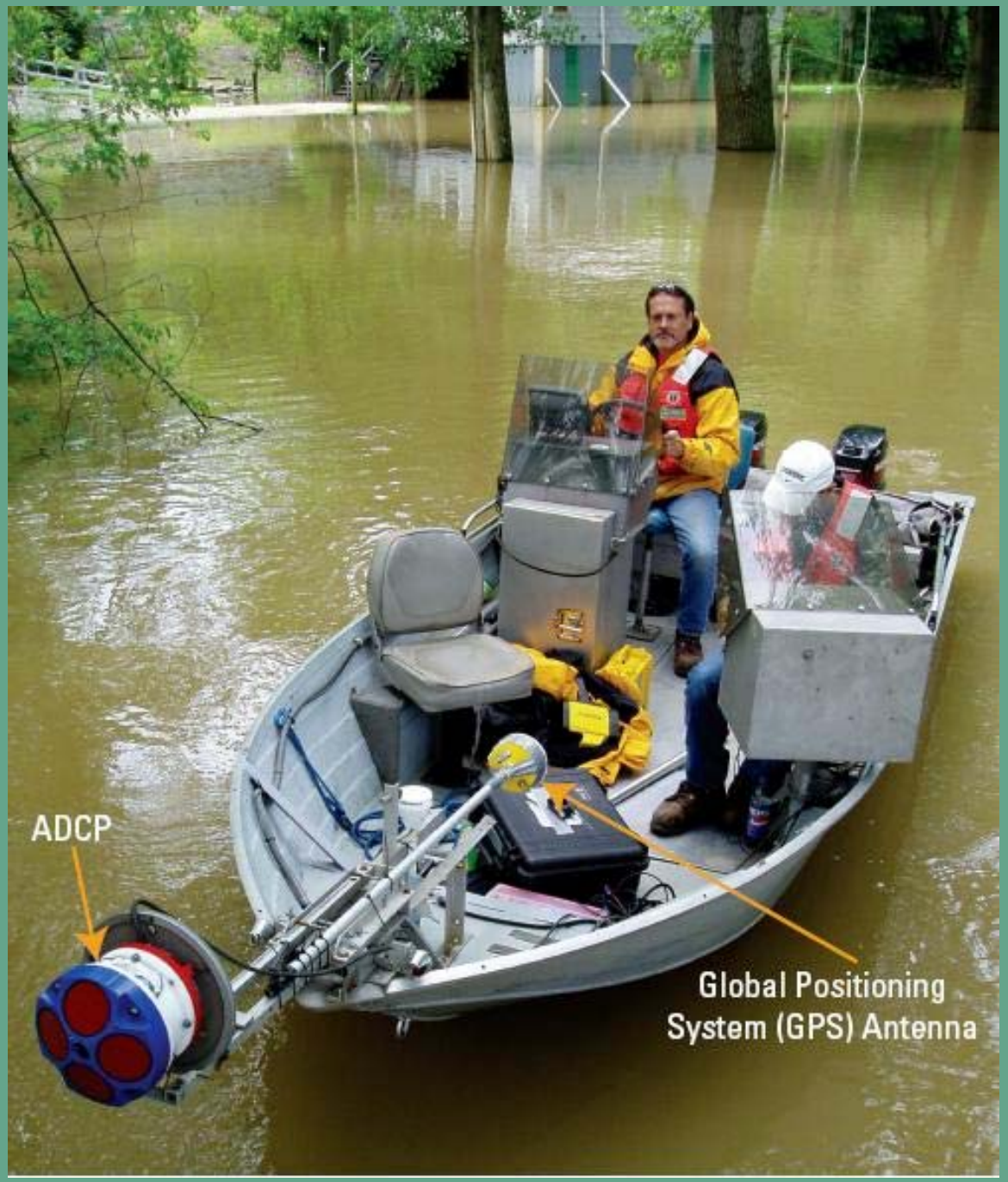
USGS

Radar for measuring velocity


Radar for measuring velocity



USGS

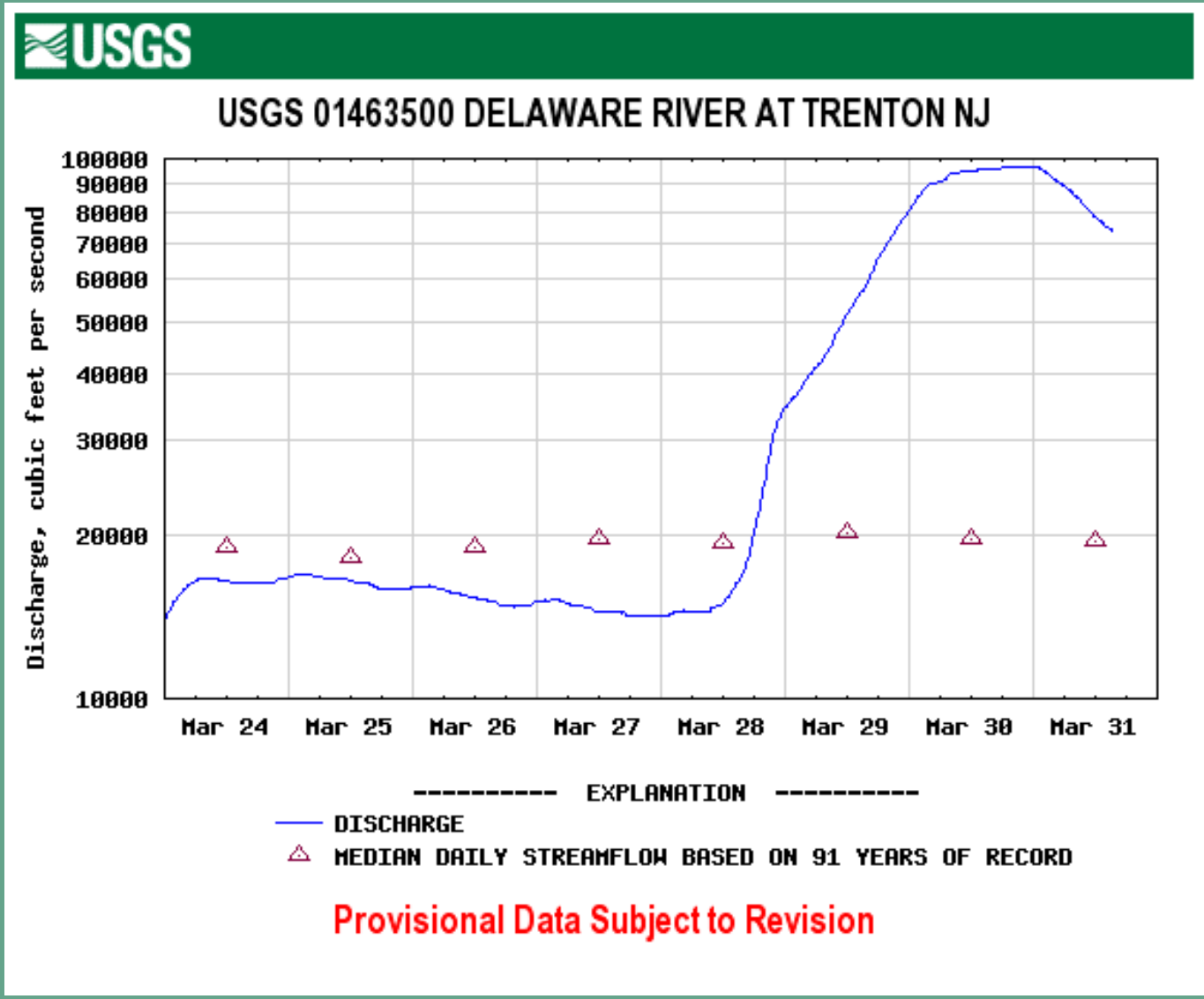


USGS

OceanScience SeaSpider

USGS

http://nj.usgs.gov The April 2005 flood was monitored from as far away as Texas by a mother whose daughter lives along the Delaware River



USGS

USGS

USGS