Real-time Water Quality Monitoring Workshop

St. John's, Newfoundland and Labrador

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Guidelines and Standard Procedures for Continuous Water-Quality Monitors

- Water-quality monitor station operation
- Record computations
- Data reporting

Key Issues

- Data objectives
- Uses, deployment issues, and data analysis
- Quality assurance
- Benefits of real time water quality
- Improved technology

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Continuous WQ Montiors

- pH
- Water Temperature
- Dissolved Oxygen
- Specific Conductance
- Turbidity
- Fluorescence
- ORP
- PAR
- Nitrate, ammonia, etc.
- New gizmos

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USGS Continuous Monitors 2006 Usage

Surface Water Quality	
Continuous record	1658
Periodic record	4816
Ground Water (and Springs) Quality	
Continuous record	250
Periodic record	5470

USGS Continuous Monitors -- 2005 Usage

Type	Non-telemetered	Telemetered
Temperature	253	941
Conductance	171	553
pH	51	242
D.O.	60	294
Turbidity	9	172
Other	3	44

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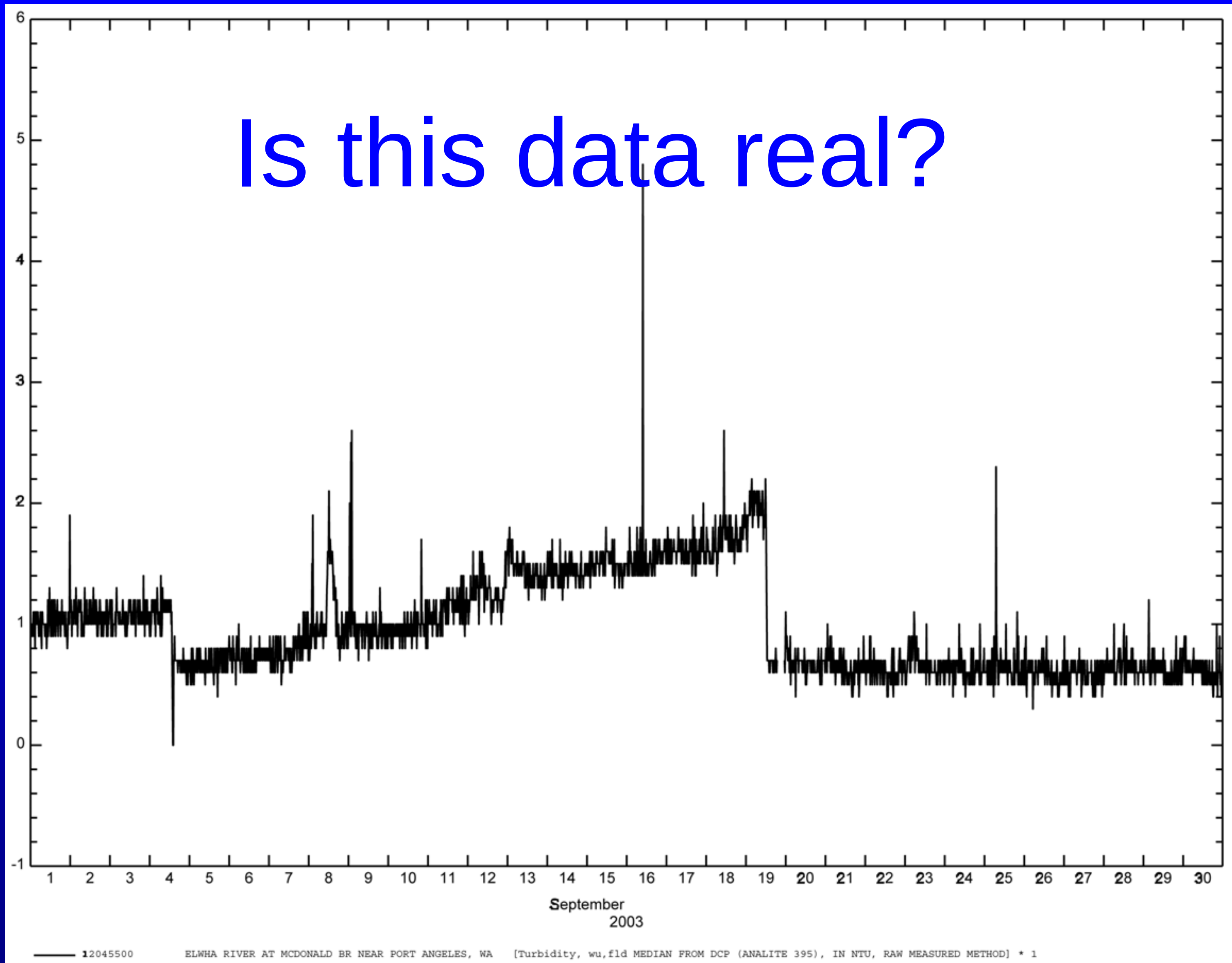
Is this data real?



Data Objectives

- Hydrologic and water quality processes
- Seasonal, diurnal, and event-driven fluctuations
- Early warnings
- Estimates of load
- Optimize sample collection

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Data Objectives –*Approach*

- Consider ***why*** we are monitoring ….
  - Objectives?
  - Criteria?
  - Data reporting?

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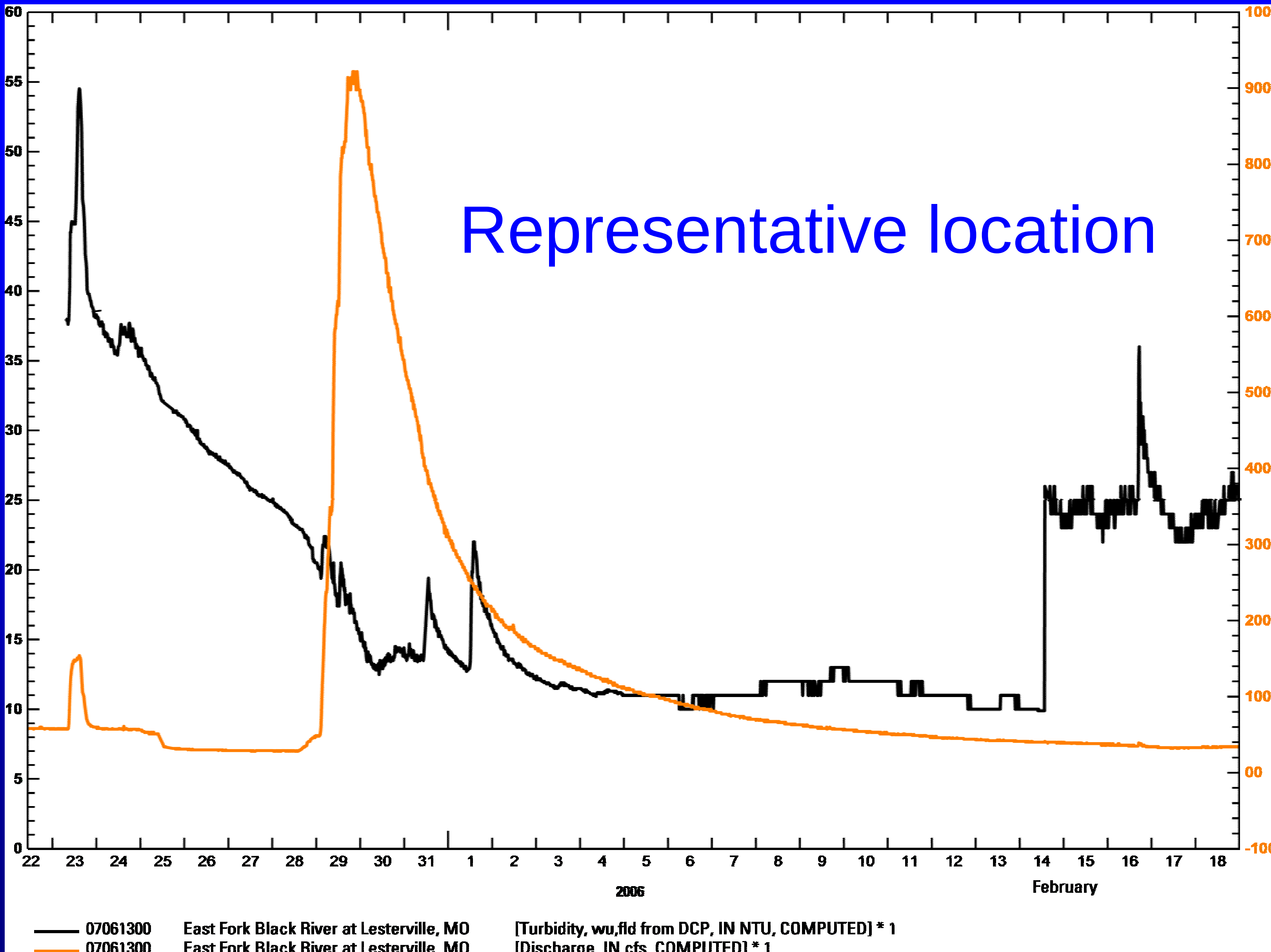
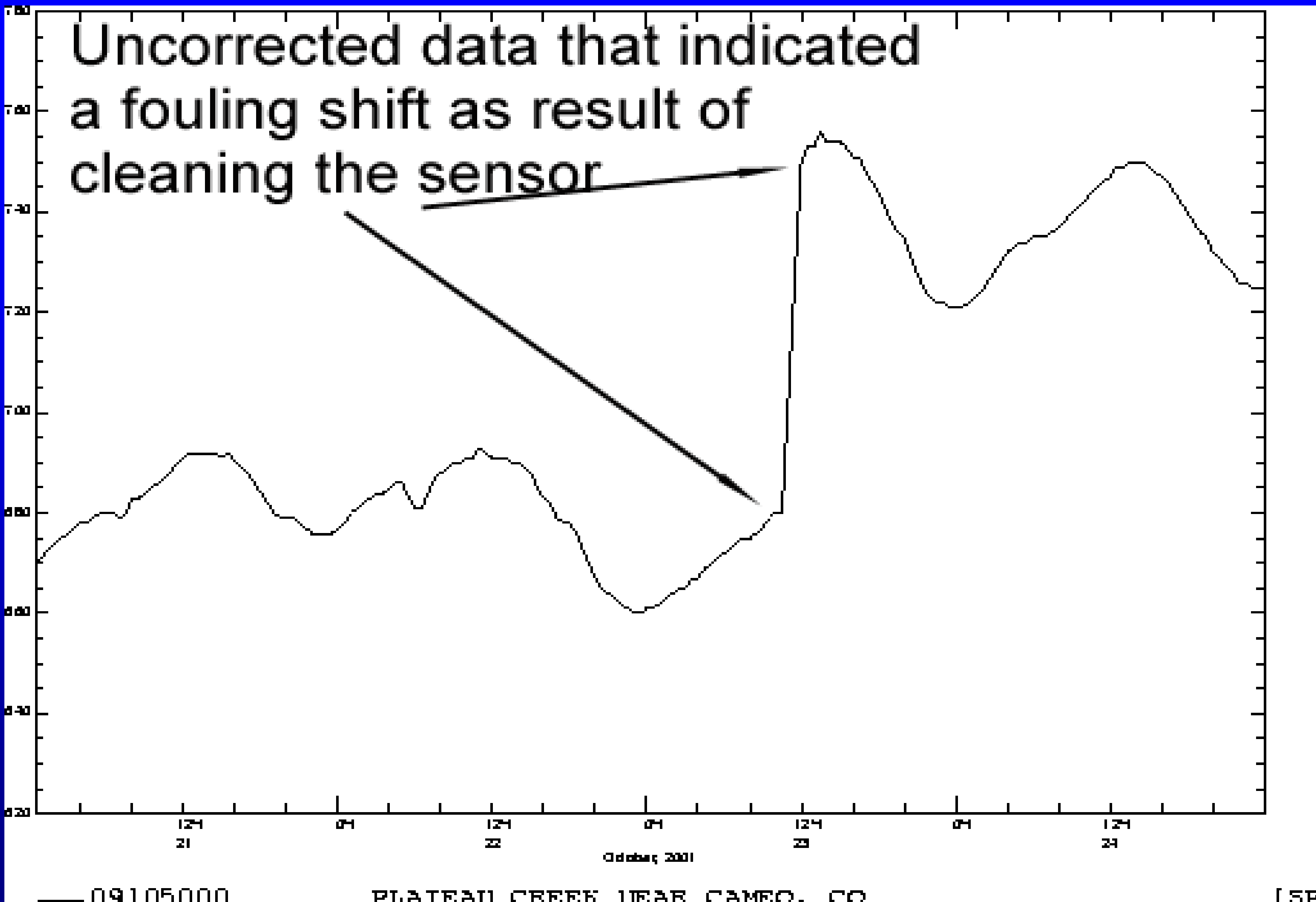
Representative location




Uncorrected data that indicated a fouling shift as result of cleaning the sensor
October, 2001
09105000
PLATEAU CREEK NEAR CAMEO, CO.

Uses, deployment issues, and data analysis

- Statement of the problem
- Description of the approach
- Product and means of data analysis

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DANGER
KEEP OFF
WATER QUALITY AND
WEATHER MONITORING STATION
WARNING
U.S. GOVERNMENT PROPERTY
NO TRESPASSING
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Quality Assurance

- QA/QC
- QA Plan for Continuous Monitors

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Quality Assurance (QA):

- The systematic management of data-collection systems by using prescribed guidelines and criteria for implementing technically approved methods and policies

Quality Control (QC)

- The operational techniques and activities used to obtain the required quality of data.

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QA Plan for Operation of Continuous WQ Monitors

- Quality Assurance
- Quality Control
- Quality Assessment

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Quality Assessment

- Reviewing:

(1) application of the QA elements, and

(2) analysis of the QC data

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QA Plan for Continuous WQ Monitors

- Standard protocol
- Calibration criteria
- Allowable limits for corrections
- Maximum allowable limits
- Rating of accuracy

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Standard Protocol

(1) Initial reading of sensors to determine drift and fouling

(2) Second reading after cleaning: fouling

(3) Calibration check: drift

(4) Final environmental reading

Rating Continuous Water-Quality Data

- Assessment of accuracy
- Amount of data recorded and assessment of instrument performance
  - ✓ Excellent
  - ✓ Good
  - ✓ Fair
  - ✓ Poor

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Techniques and Methods

- **Book 1, Section D3**
- **http://pubs.usgs.gov/tm/2006/tm1D3/**

National Field Manual

http://water.usgs.gov/owq/FieldManual/

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Benefits of Real Time Water Quality

- Early notification
- Criteria thresholds
- Monitoring optimization
- Sample collection optimization

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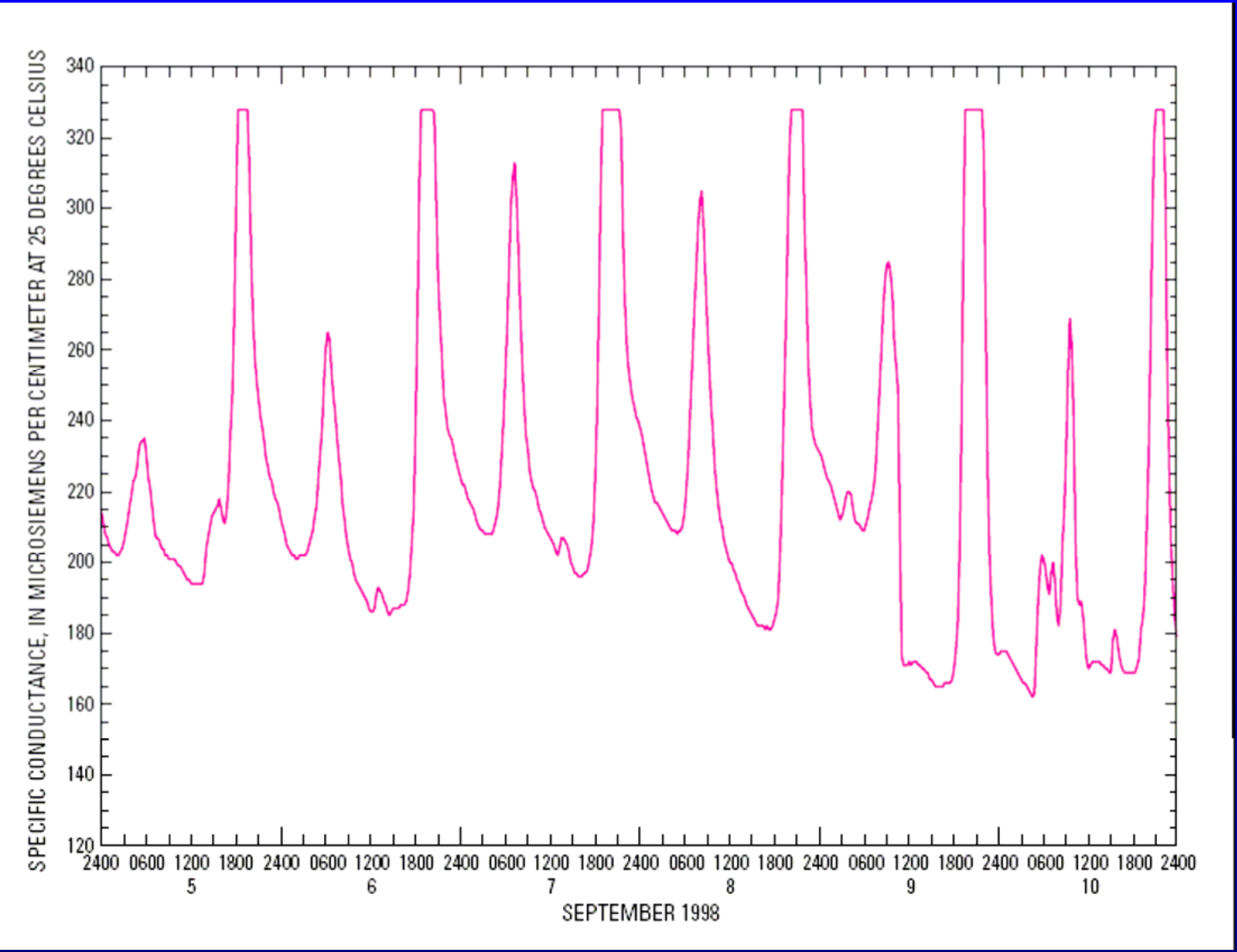
Review of Raw Data



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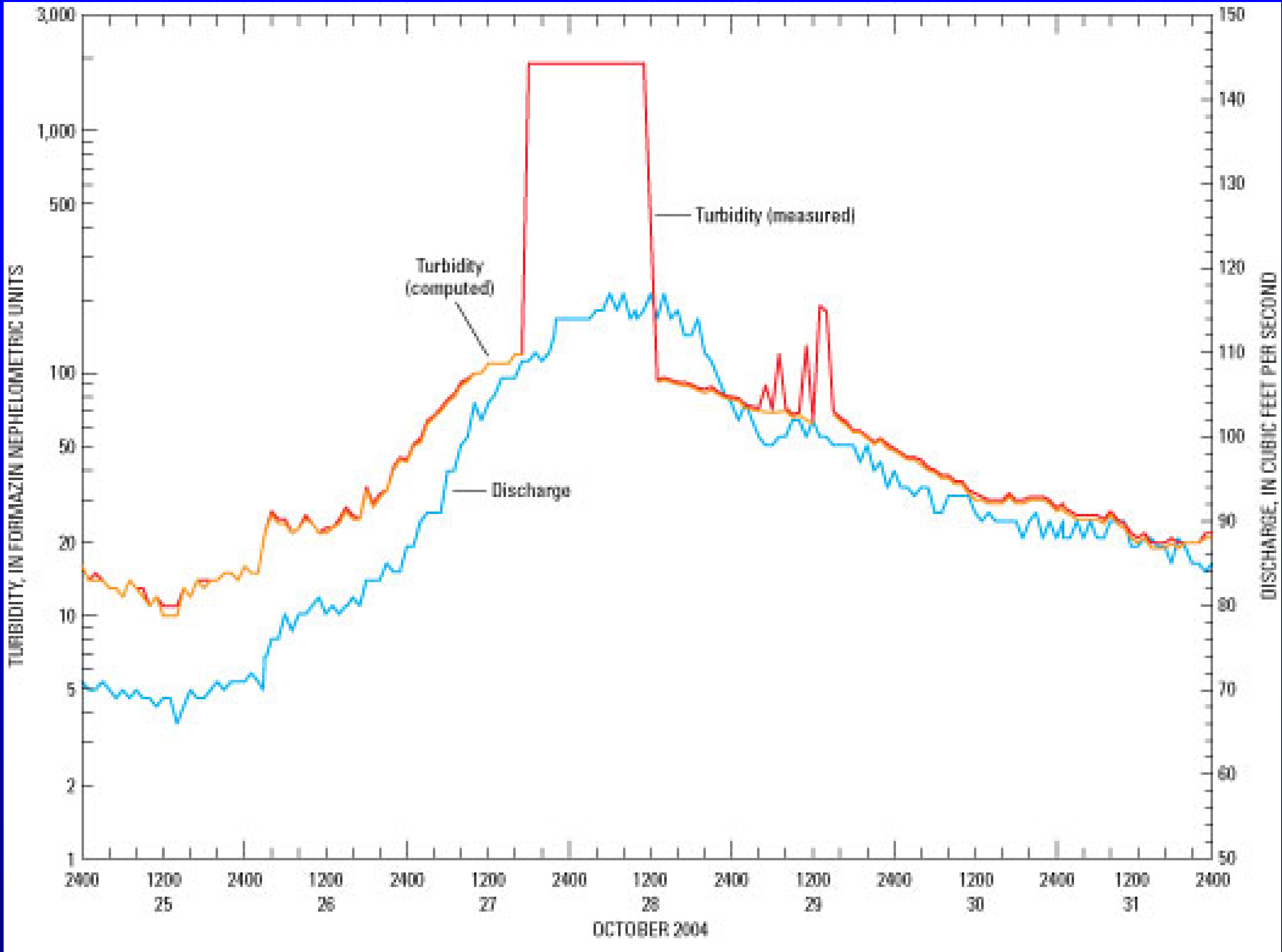

Figure 7. Turbidity values at the North Fork Ninnescah River above Cheney Reservoir, Kansas, October 2004.

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Improved Technology

- More robust sensors
- Luminescent DO sensors
- Fluorescence, PAR, ORP
- In-stream analyzers (nitrate, silicate, phosphorus, chloride,…

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Lab Experiments

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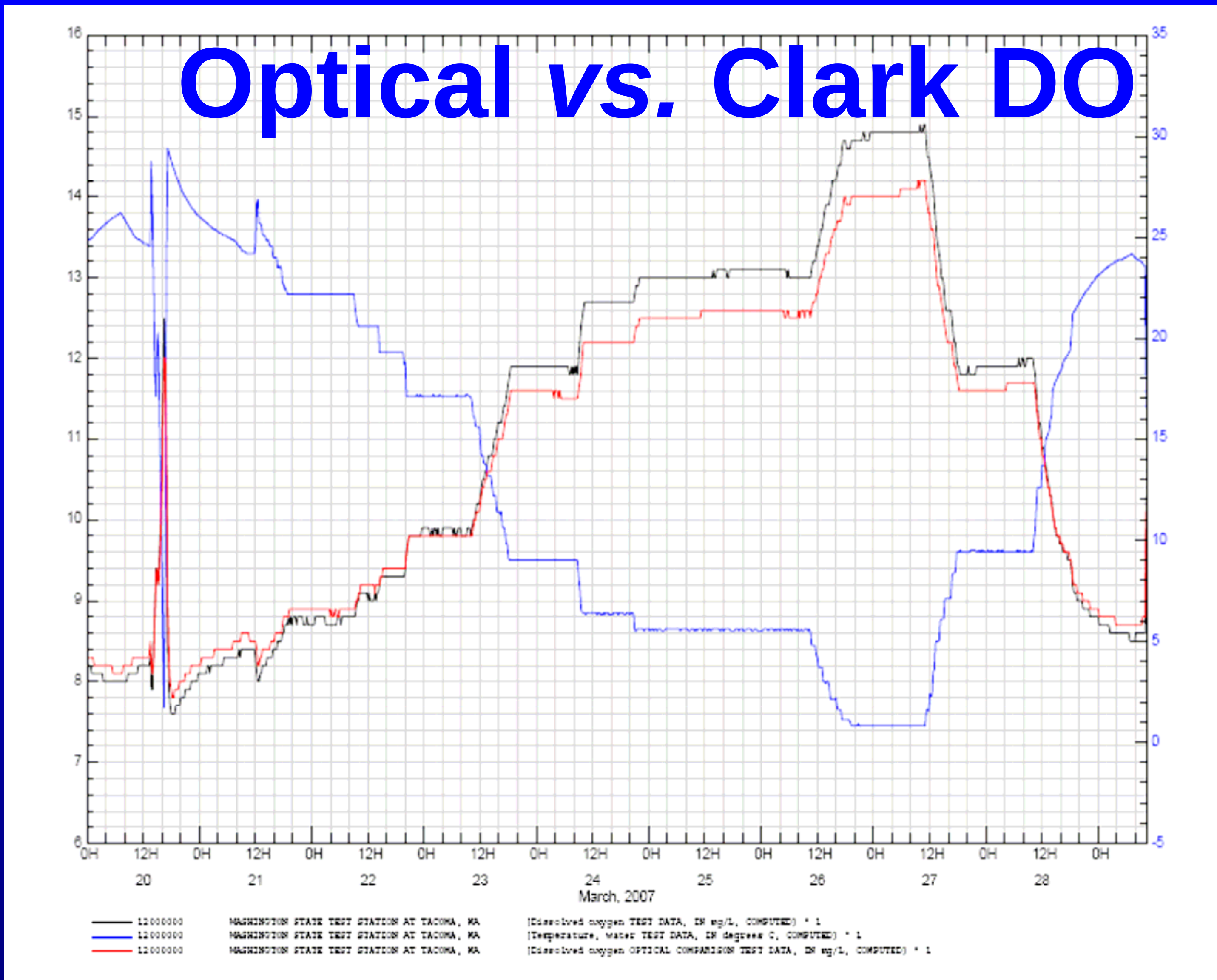
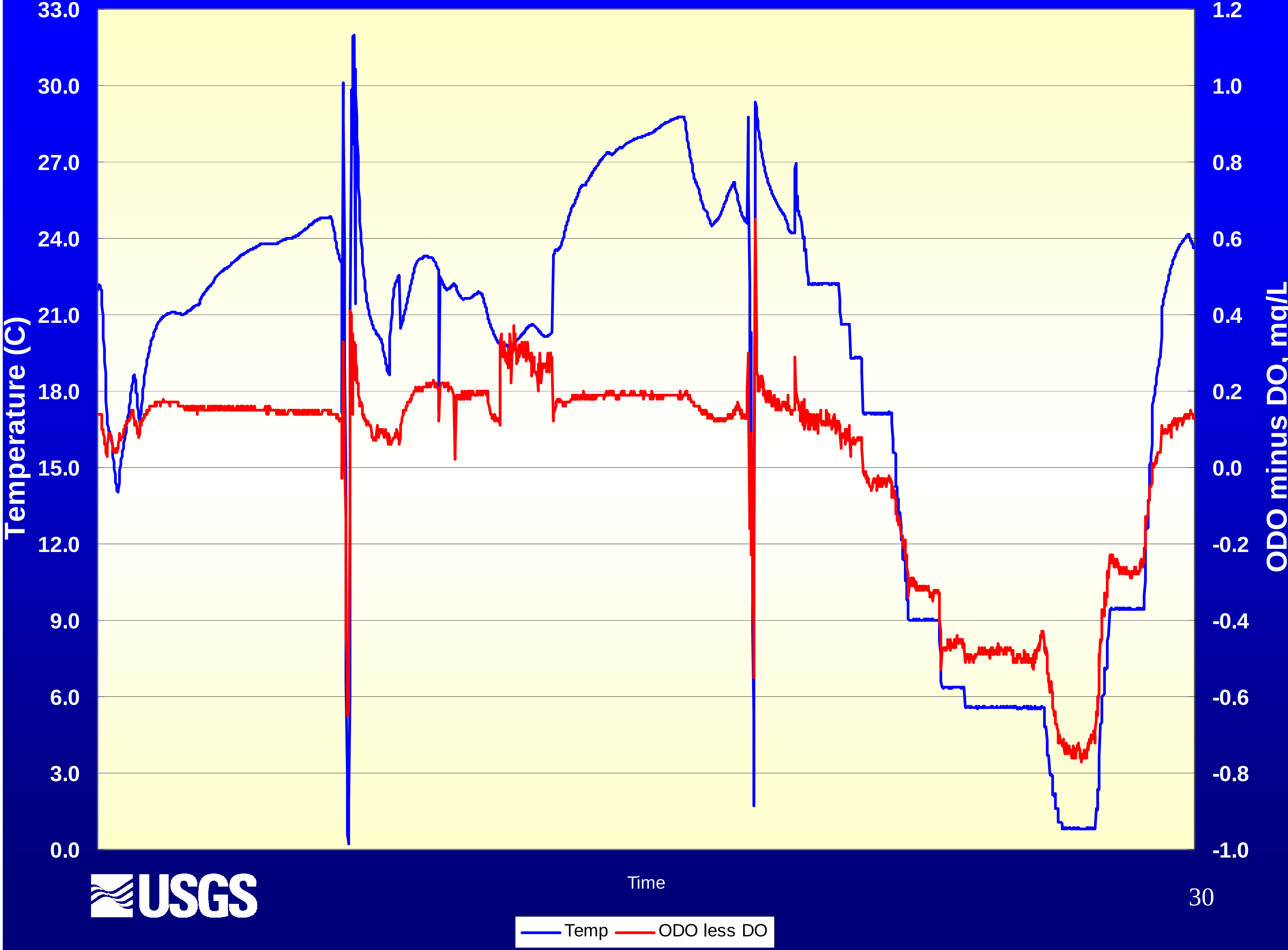
science for a changing world

Optical *vs.* Clark DO





33.0
30.0
27.0
24.0
21.0
18.0
15.0
12.0
9.0
6.0
3.0
0.0
Temperature (C)
1.2
1.0
0.8
0.6
0.4
0.2
0.0
-0.2
-0.4
-0.6
-0.8
-1.0
ODO minus DO, mg/L
Time
Temp
ODO less DO

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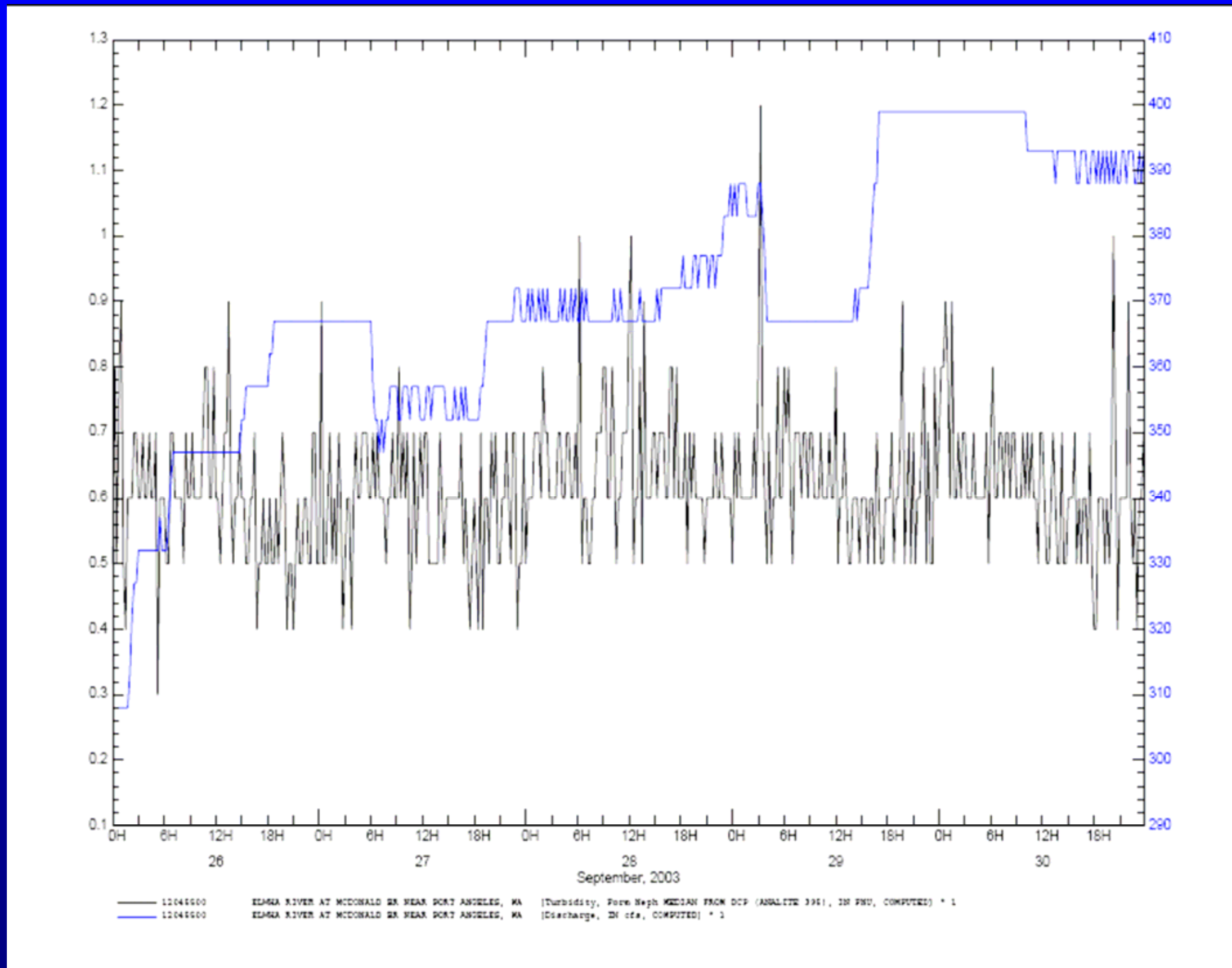
Low-level Turbidity



Turbidity Method Detection Limit		
Ave.	0.6175	
S.D.	0.1048	(x 3) = 0.3144