Atlantic Canada's Automated Water Quality Monitoring Network

- Update on activities

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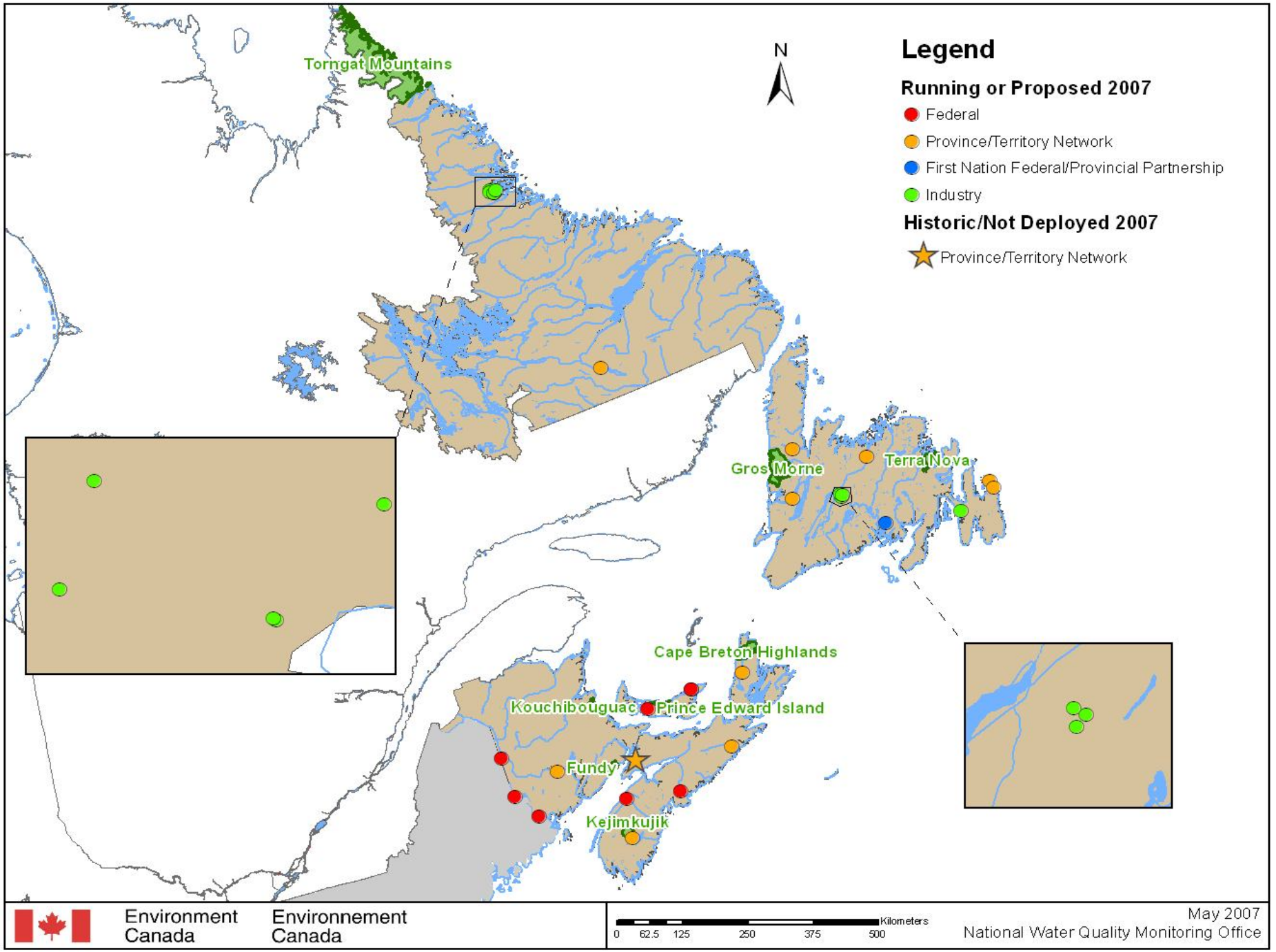
Environment Canada

Automated Water Quality Monitoring Workshop
June 4 and 5, 2007
St. Johns, NL

Outline

- Introduction
- Deployment Methods
- Water Quality Examples
- Quality Assurance and Quality Control
- Future Directions


Torngat Mountains
N
Legend
Running or Proposed 2007
Federal
Province/Territory Network
First Nation Federal/Provincial Partnership
Industry
Historic/Not Deployed 2007
Province/Territory Network
Gros Morne
Terra Nova
Cape Breton Highlands
Kouchibouguac
Prince Edward Island
Fundy
Kejimkujik
Environment Canada
Environnement Canada
0 62.5 125 250 375 500
Kilometers
May 2007
National Water Quality Monitoring Office

Current protocol

- Maintenance/Calibration at 4-5 week intervals
- Usually re-deploy same probe at same location after calibration
- Grab sampling during each site visit
- When possible, take measurement from inside WSC shack

Equipment & Parameters

Water Quality sensors	✓Multiprobes - Hydrolab (Datasonde 4x or 5x) or YSI
Dataloggers – Co-location	✓VEDAS II, Sutron
Communication	✓GOES satellite, landline modem, cell phone
Software	✓Hydras, Aquarius, Access, Excel

Parameters:

- pH
- Specific Conductance
- Turbidity
- Temperature
- Dissolved Oxygen
- Nitrate (some sites)

Deployment Method - Bottom

Advantages

- Very easy and minimal cost
- Easily moveable
- Low visibility

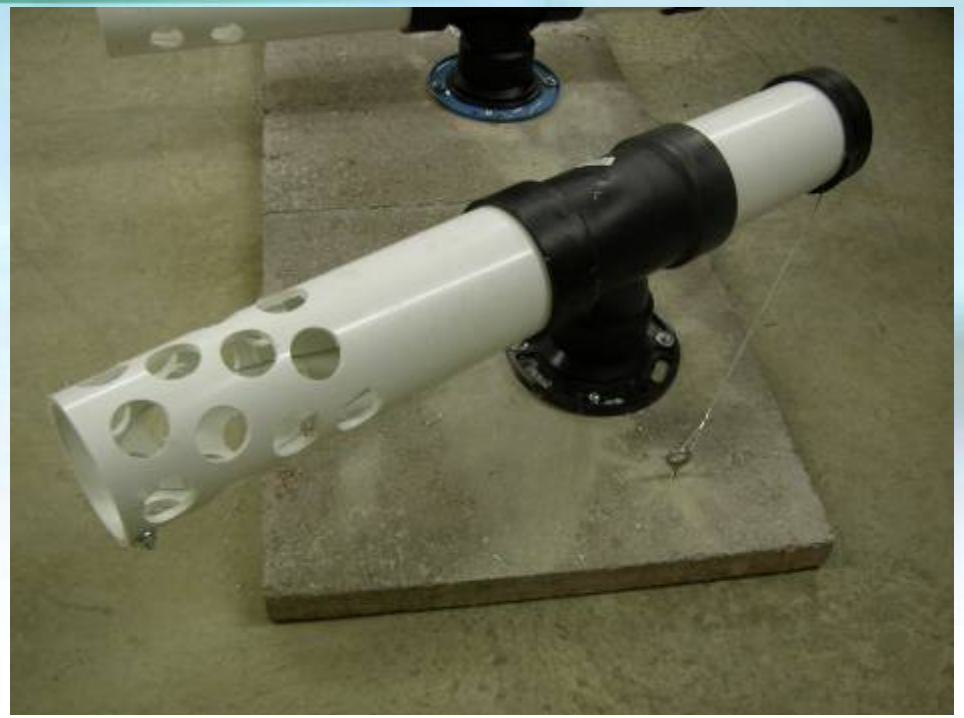
Disadvantages

- Very little protection/security
- Influenced by river bed
- Influenced by current
- Need to wade into river to retrieve
- Limited to low water levels

Deployment Method – Modified Bottom

Advantages

- Easy installation and low cost
- Somewhat moveable
- Probe off the bottom
- Not easily influenced by current
- Limited visibility



Disadvantages

- Some preparation required
- little security
- Distance to river from vehicle
- Need to wade into river to retrieve
- Limited to low water levels

Deployment Method – Vertical

Advantages

- Probe is off the bottom
- Not influenced by current
- No wading required
- Can be used in high/low water
- Some security

Disadvantages

- Set-up time and cost
- Moderate to high visibility
- Cannot easily move the hydrolab
- Need some sort of structure/peer
- Ice in tube

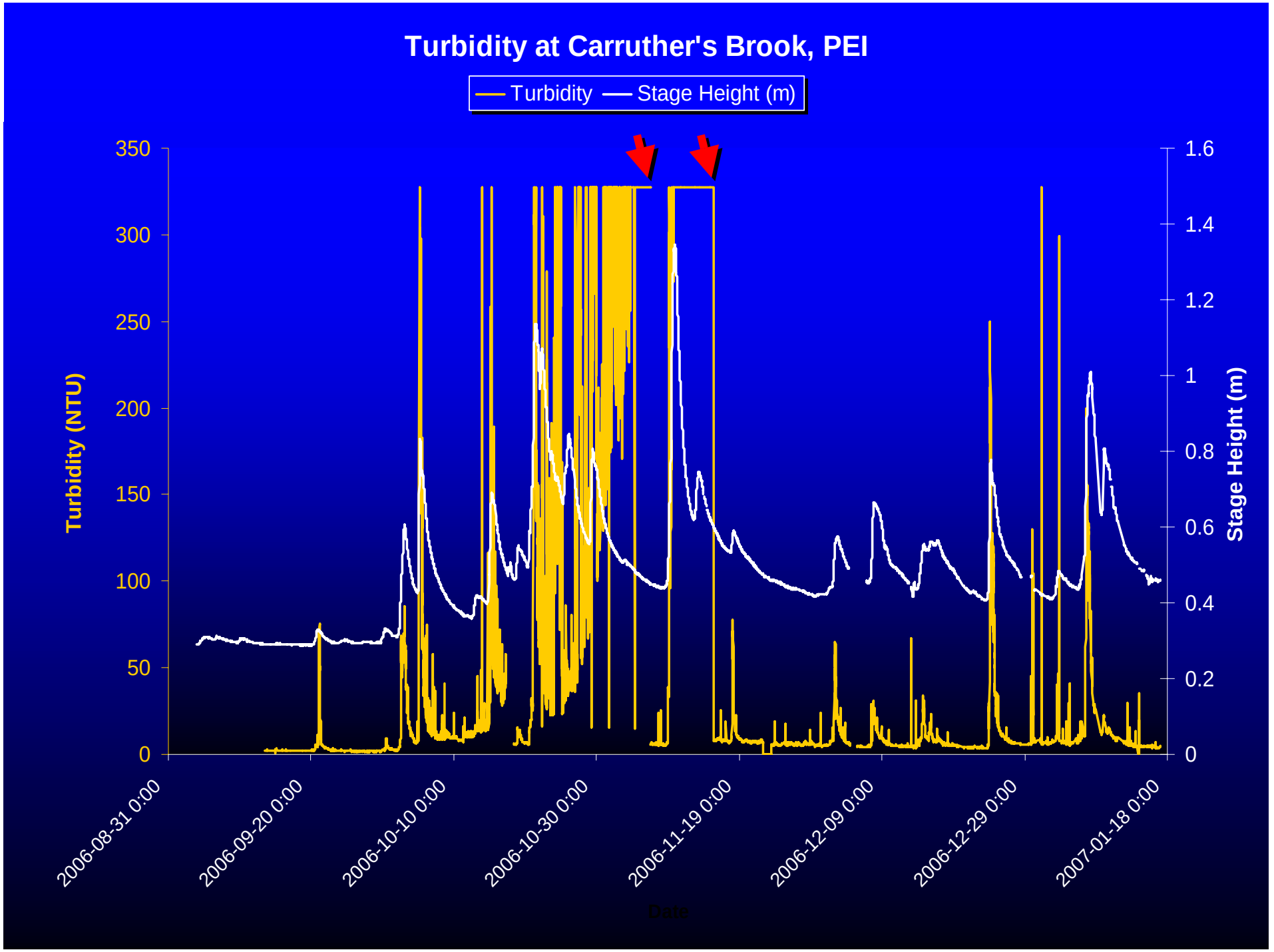
Deployment Method – Bank Installation

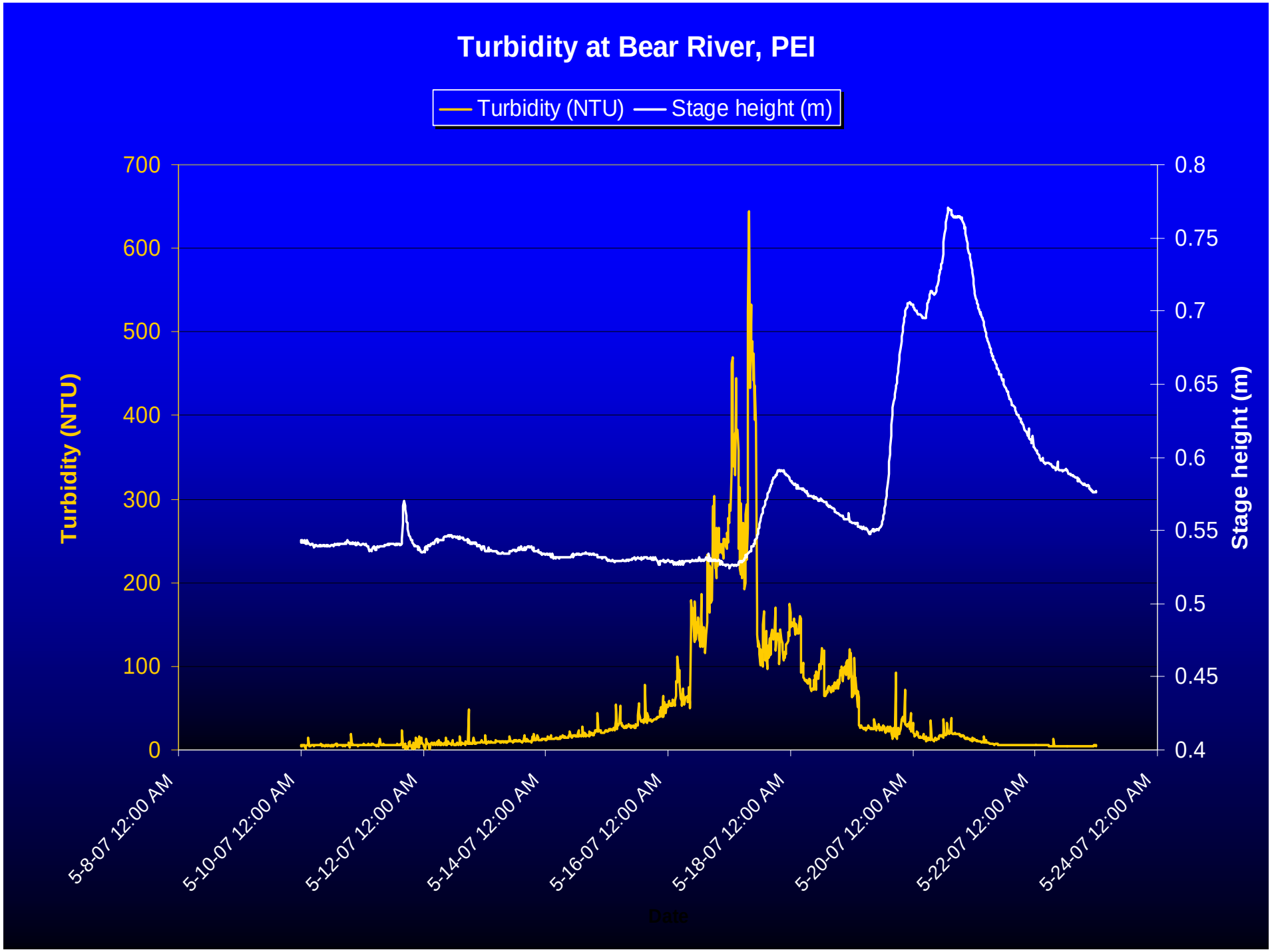
Advantages

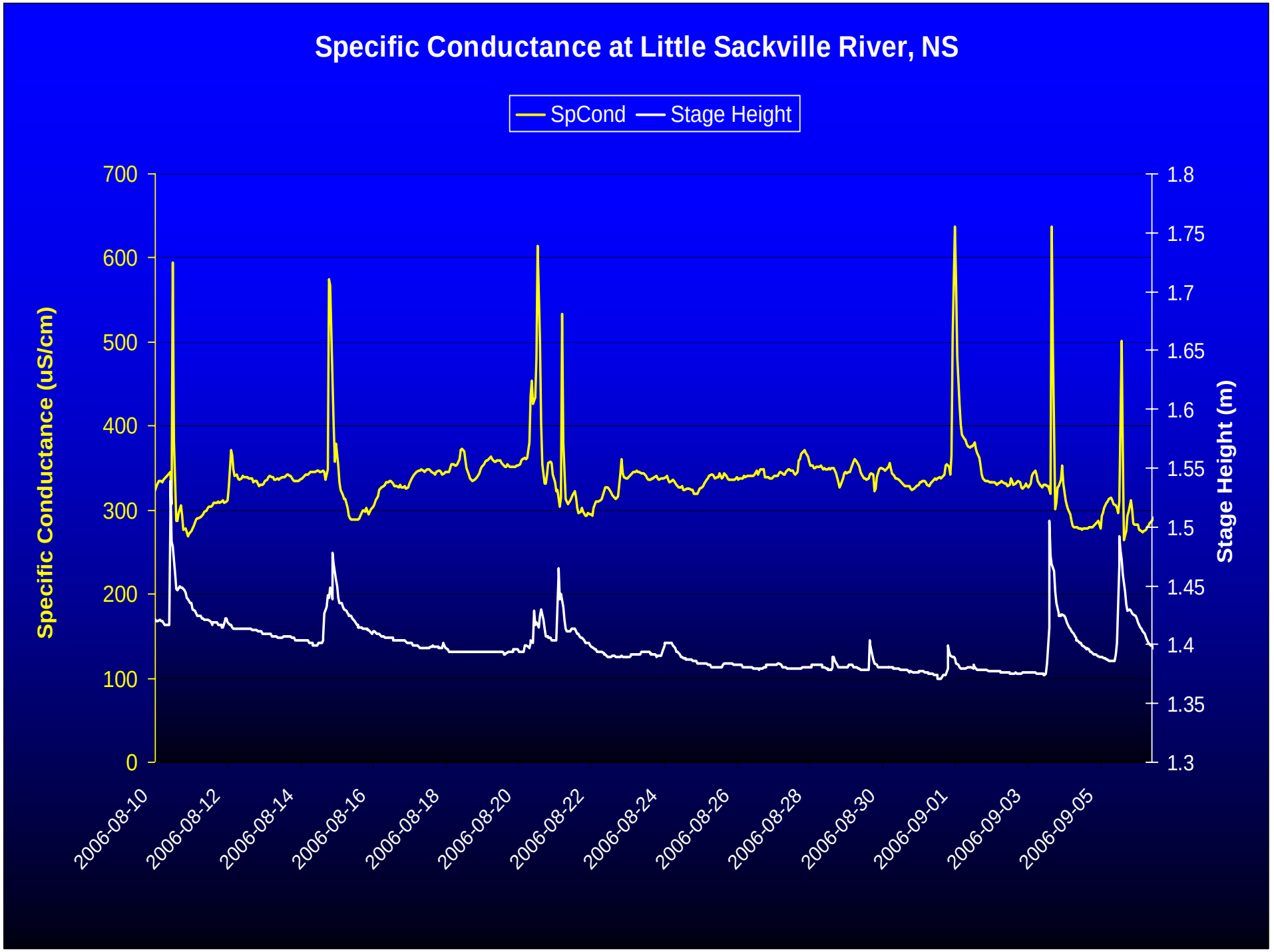
- Probe is off the bottom
- Not influenced by current
- No wading required
- Can be used in high/low water
- Some security

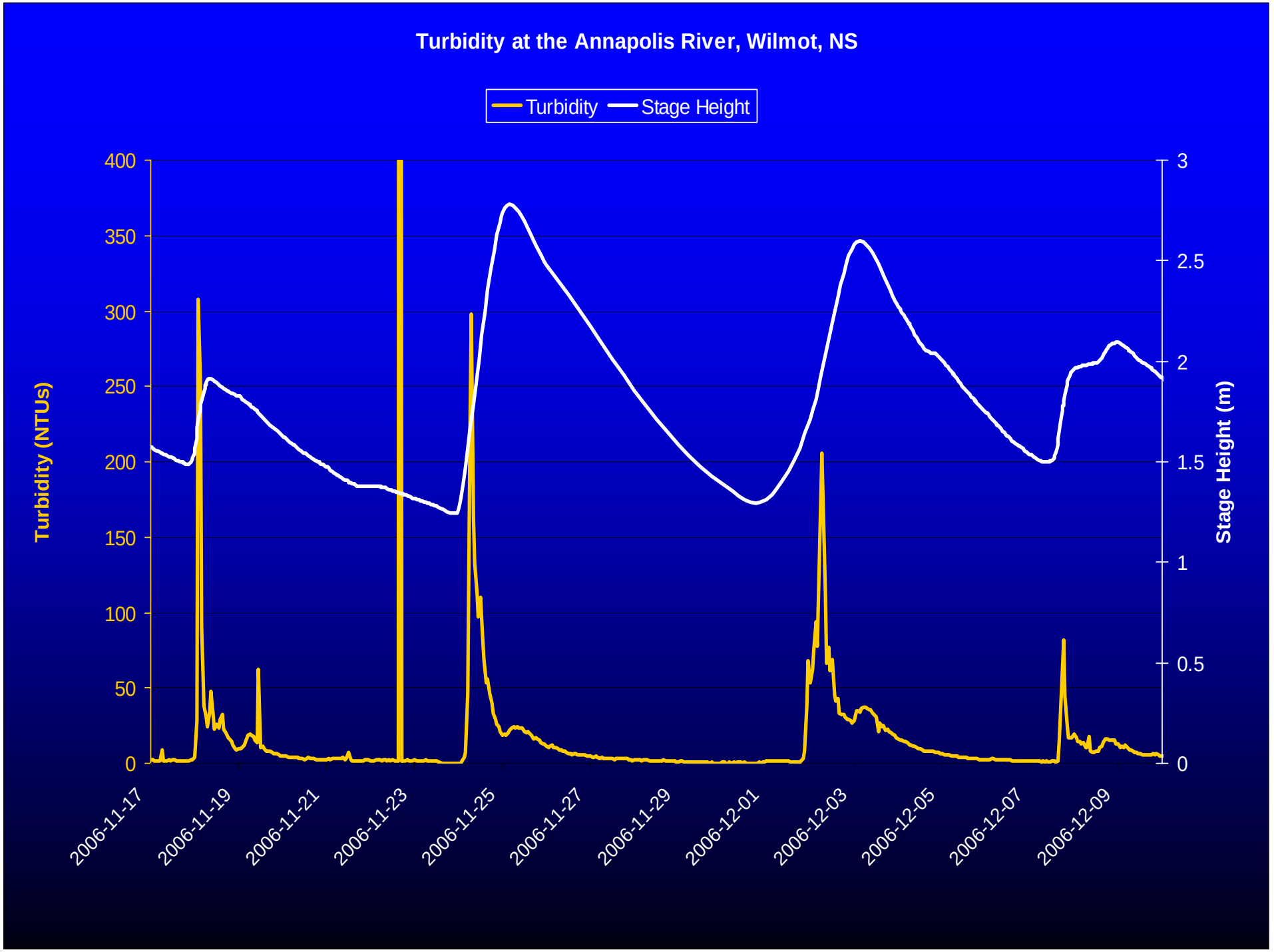
Disadvantages

- Set-up time and cost
- Moderate to high visibility
- Cannot easily move the hydrolab
- ice in tube


Turbidity at Carruther's Brook, PEI
Turbidity
Stage Height (m)
Turbidity (NTU)
Stage Height (m)
350
300
250
200
150
100
50
0
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
0
2006-08-31 0:00
2006-09-20 0:00
2006-10-10 0:00
2006-10-30 0:00
2006-11-19 0:00
2006-12-09 0:00
2006-12-29 0:00
2007-01-18 0:00
Date


Turbidity at Bear River, PEI
Turbidity (NTU)
Stage height (m)
Turbidity (NTU)
Stage height (m)
700
600
500
400
300
200
100
0
0.8
0.75
0.7
0.65
0.6
0.55
0.5
0.45
0.4
5-8-07 12:00 AM
5-10-07 12:00 AM
5-12-07 12:00 AM
5-14-07 12:00 AM
5-16-07 12:00 AM
5-18-07 12:00 AM
5-20-07 12:00 AM
5-22-07 12:00 AM
5-24-07 12:00 AM
Date


Specific Conductance at Little Sackville River, NS
SpCond
Stage Height
Specific Conductance (uS/cm)
Stage Height (m)
700
600
500
400
300
200
100
0
1.8
1.75
1.7
1.65
1.6
1.55
1.5
1.45
1.4
1.35
1.3
2006-08-10
2006-08-12
2006-08-14
2006-08-16
2006-08-18
2006-08-20
2006-08-22
2006-08-24
2006-08-26
2006-08-28
2006-08-30
2006-09-01
2006-09-03
2006-09-05


Turbidity at the Annapolis River, Wilmot, NS
Turbidity
Stage Height
Turbidity (NTUs)
Stage Height (m)
400
350
300
250
200
150
100
50
0
3
2.5
2
1.5
1
0.5
0
2006-11-17
2006-11-19
2006-11-21
2006-11-23
2006-11-25
2006-11-27
2006-11-29
2006-12-01
2006-12-03
2006-12-05
2006-12-07
2006-12-09

Quality Assurance/Quality Control (QA/QC)

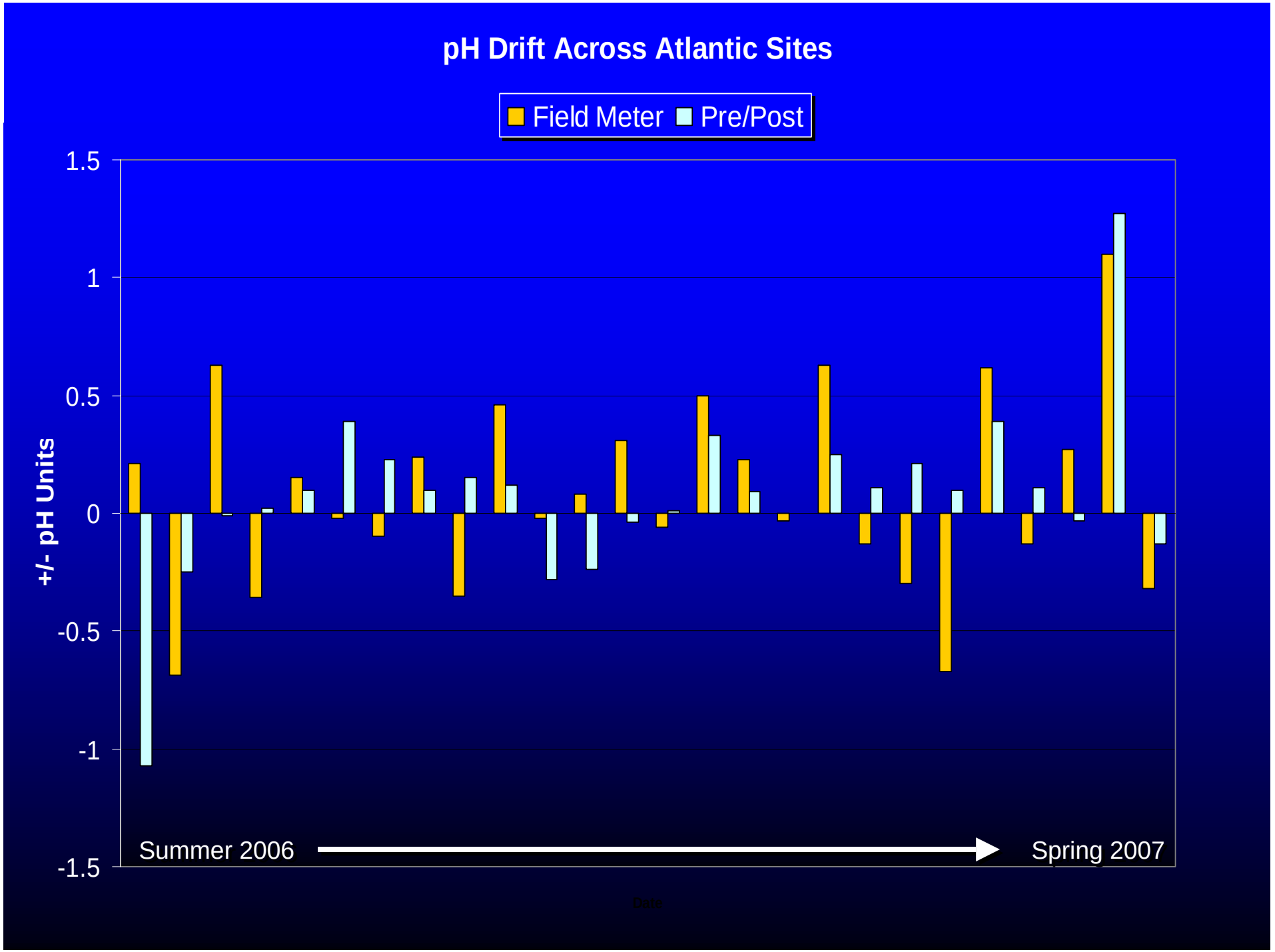
Field QA/QC

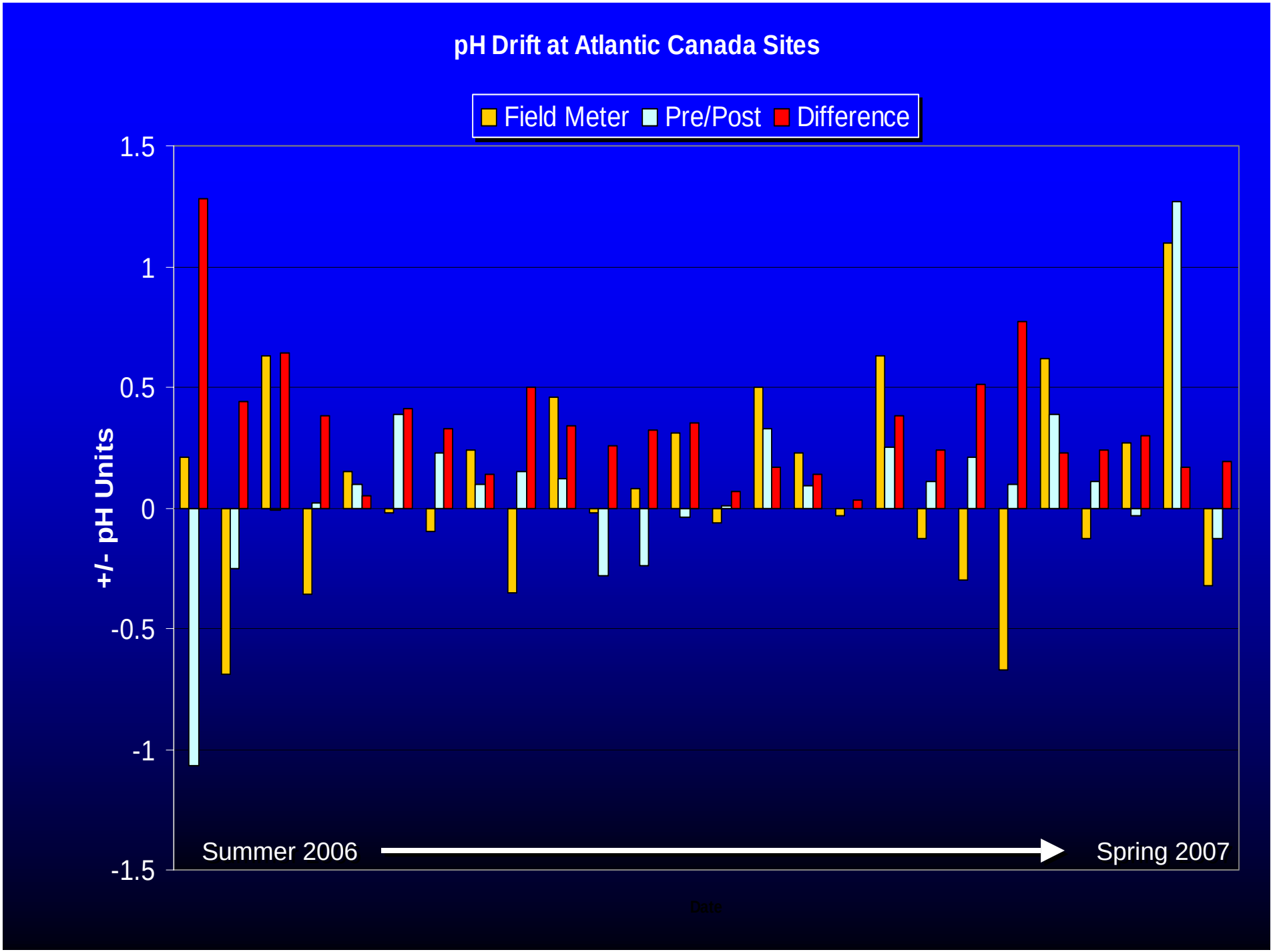
- All probes calibrated using same method – draft document
- Calibrating solutions are either purchased or prepared in house – EC Moncton Laboratory
- Calibration results entered into standardized spreadsheet
- Measurements taken with second meter prior to removing probe from river and again prior to re-deploying into river
- Real-time data is corrected for drift

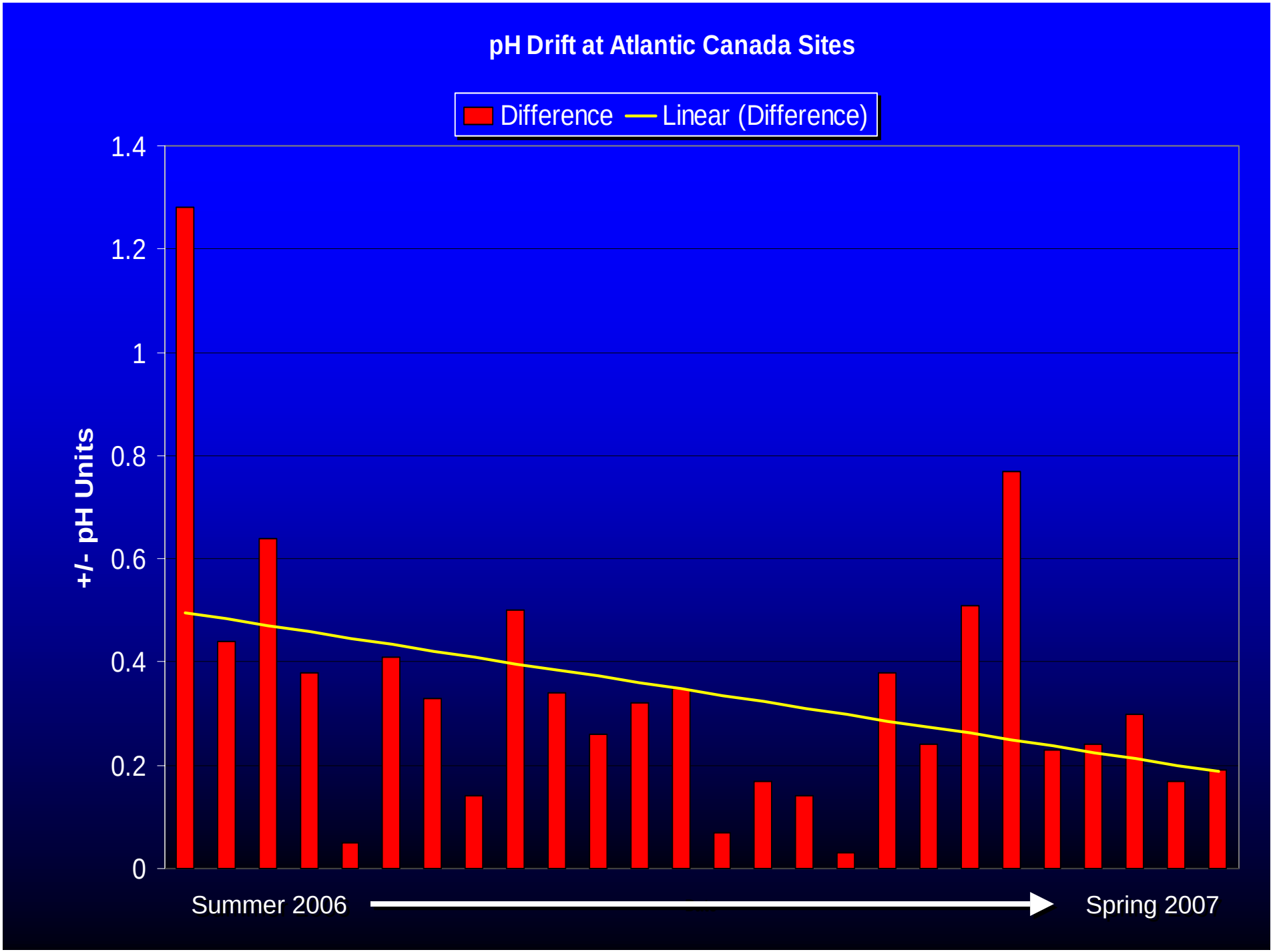
Evaluating Drift:

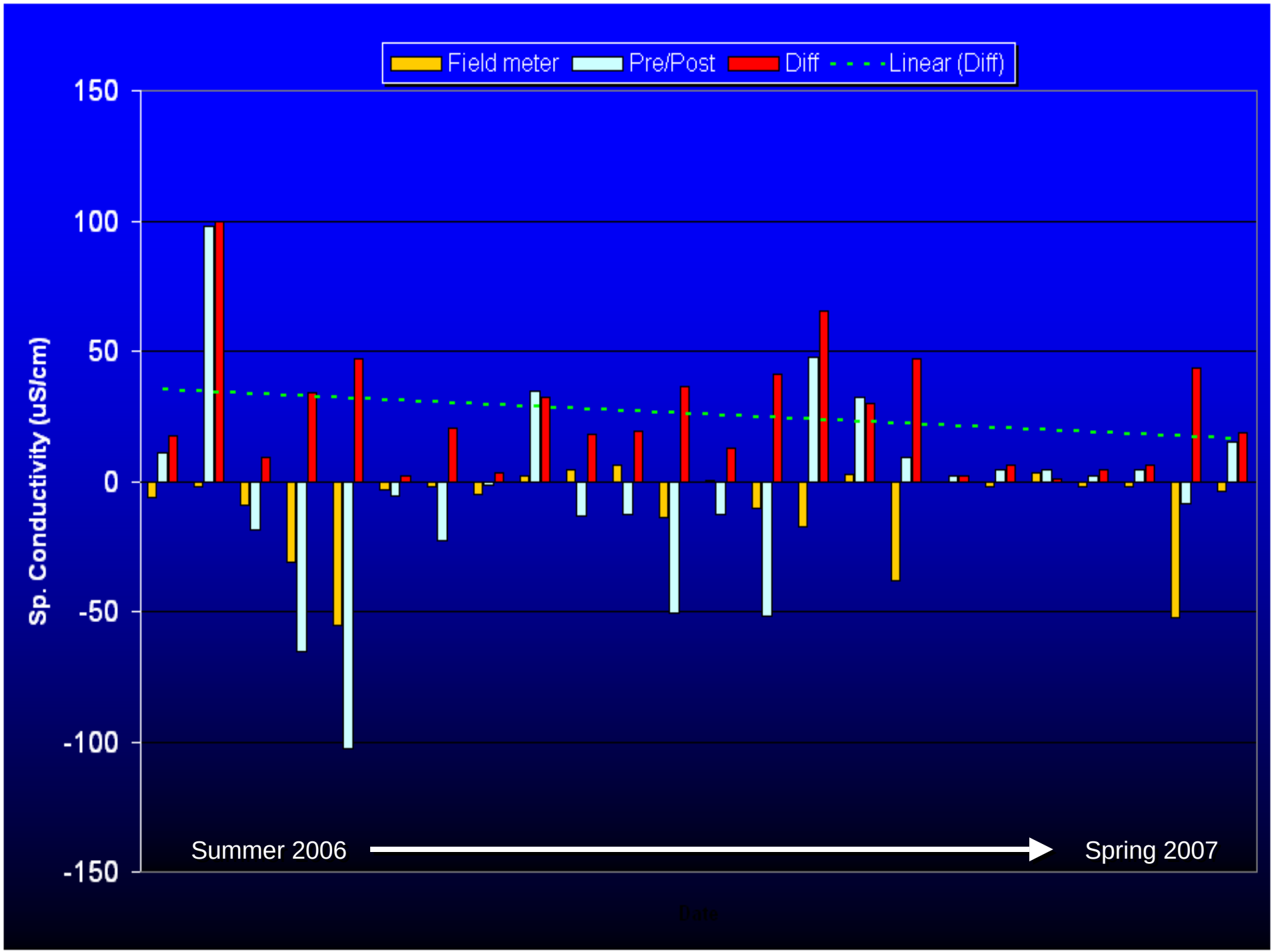
- Two main methods are used
  - using recently calibrated field meter
  - Taking pre-cleaning and post-cleaning readings using the deployed probe

  - Which one works best ?


pH Drift Across Atlantic Sites
Field Meter
Pre/Post
1.5
1
0.5
0
-0.5
-1
-1.5
+/- pH Units
Summer 2006
Spring 2007
Date


pH Drift at Atlantic Canada Sites
Field Meter
Pre/Post
Difference
1.5
1
0.5
0
-0.5
-1
-1.5
+/- pH Units
Summer 2006
Spring 2007
Date


pH Drift at Atlantic Canada Sites
Difference
Linear (Difference)
+/- pH Units
1.4
1.2
1
0.8
0.6
0.4
0.2
0
Summer 2006
Spring 2007


Field meter
Pre/Post
Diff
Linear (Diff)
150
100
50
0
-50
-100
-150
Sp. Conductivity (uS/cm)
Summer 2006
Spring 2007
Date

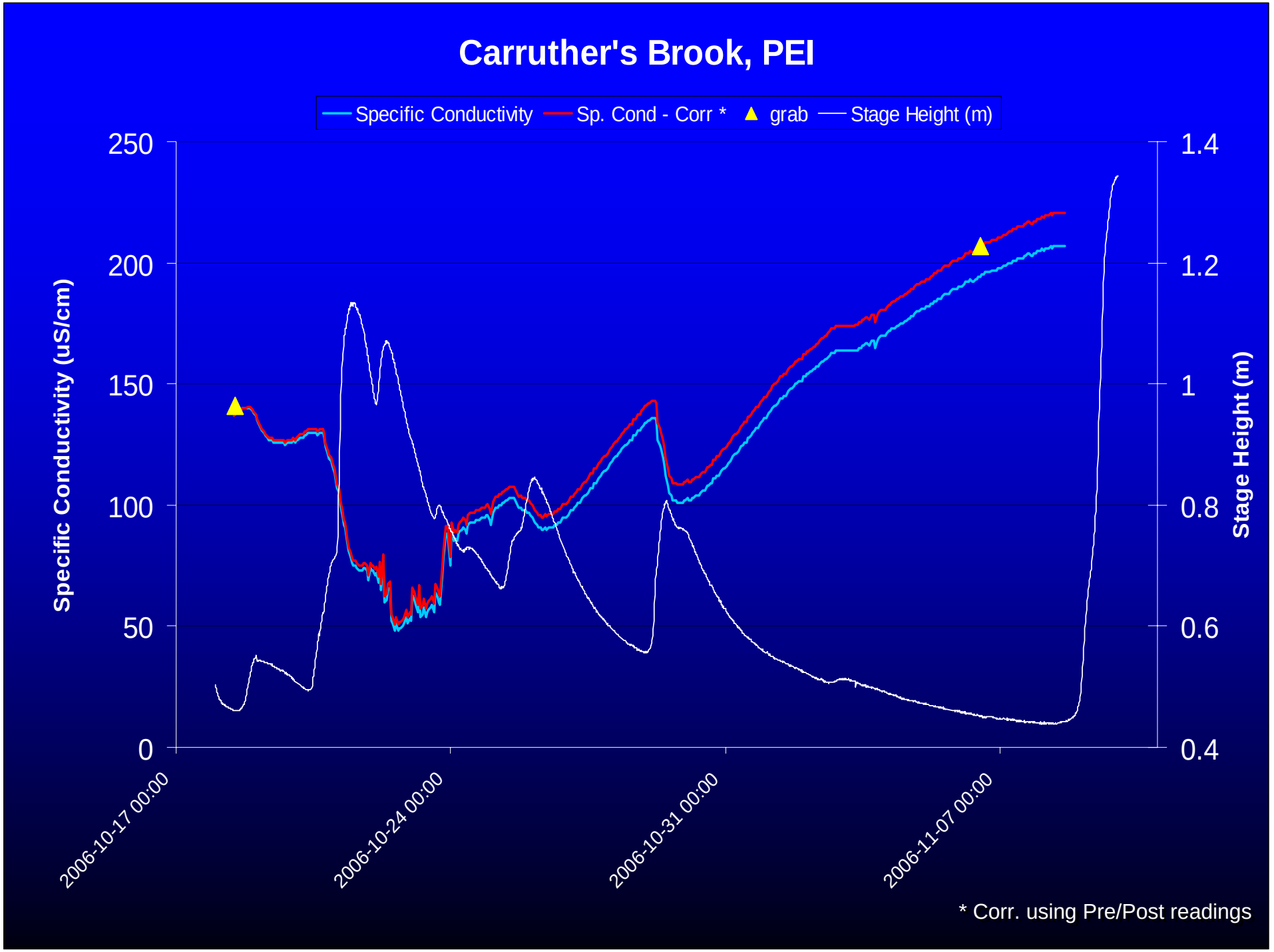
Quality Assurance/Quality Control (QA/QC)

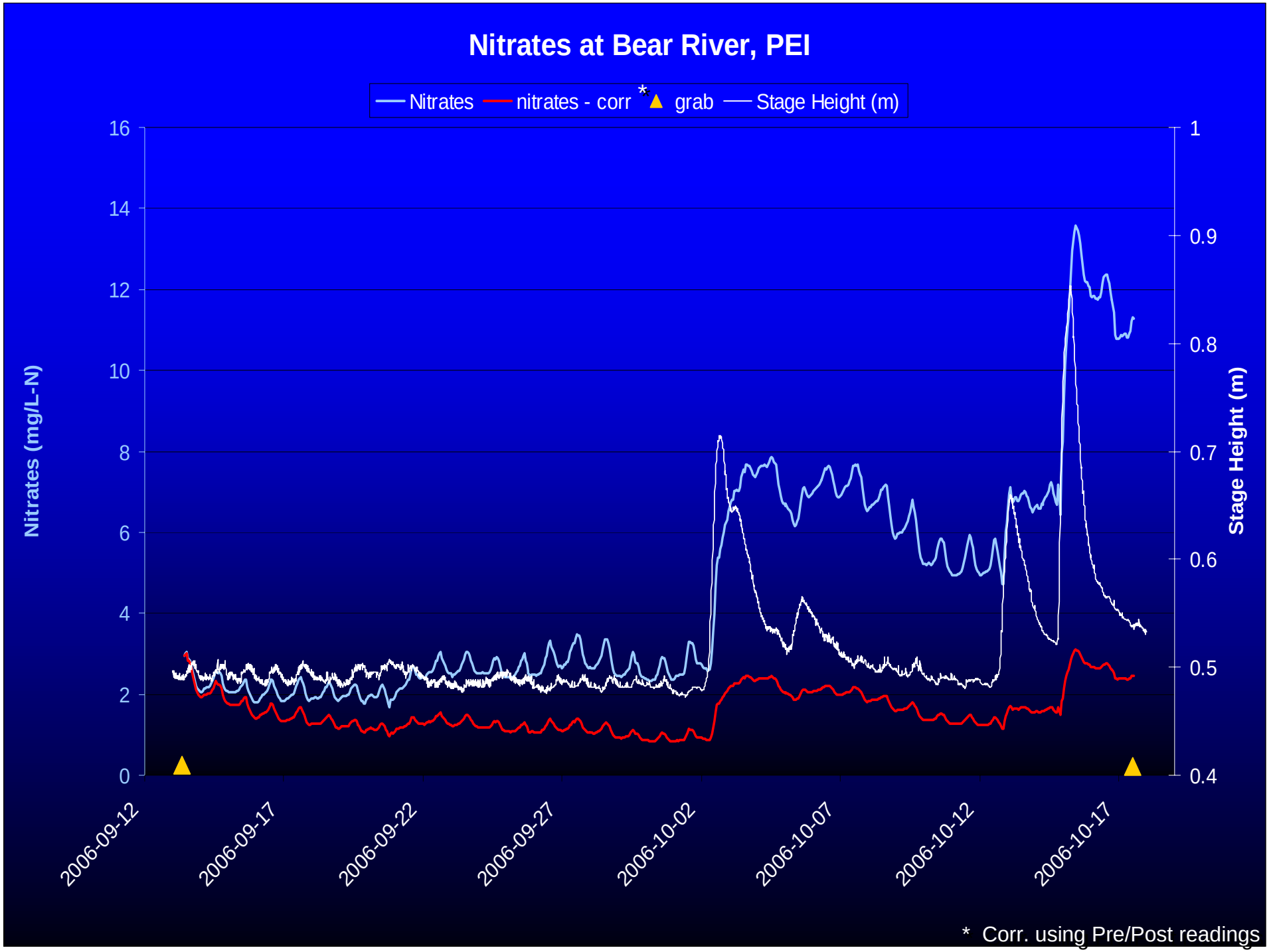
Drift Correction:

- As our experience increases, the difference between using another field meter and taking pre/post cleaning measurements is decreasing for all parameters
- Data using two methods doesn't always agree
- No way to predict when they will/won't agree

Which works best?

- Depends on several variables (temperature, river type, parameter measured)
- Very useful to have both sets of results to compare
- At this point, we are still evaluating both methods and would not want to pick one over the other
- Documentation is critical to evaluating drift


Carruther's Brook, PEI
Specific Conductivity
Sp. Cond - Corr *
grab
Stage Height (m)
Specific Conductivity (uS/cm)
Stage Height (m)
250
200
150
100
50
0
1.4
1.2
1
0.8
0.6
0.4
2006-10-17 00:00
2006-10-24 00:00
2006-10-31 00:00
2006-11-07 00:00
* Corr. using Pre/Post readings


Nitrates at Bear River, PEI
Nitrates
nitrates - corr *
grab
Stage Height (m)
Nitrates (mg/L-N)
Stage Height (m)
16
14
12
10
8
6
4
2
0
1
0.9
0.8
0.7
0.6
0.5
0.4
2006-09-12
2006-09-17
2006-09-22
2006-09-27
2006-10-02
2006-10-07
2006-10-12
2006-10-17
* Corr. using Pre/Post readings

Future Directions

- Continue using both drift measurement methods
- Real-time network for EC Atlantic will likely stay at current size for near term
- Focus on improving and documenting all our protocols to ensure consistent data of high quality is reported
- Continue work within EC to have a database for storing raw and corrected real-time data
- Near real-time web reporting to the public (internal only at present)
- Evaluate software to process/correct real-time data automatically
- Continue our partnership with Provinces to share knowledge and experiences with real-time monitoring challenges, and to combine our financial and human resources towards generating real-time water quality data of high quality that will be useful for the public, industry, and the decision makers

Thank you!

Thanks to our Network Partners:

- Water Survey of Canada, EC
- Province of Newfoundland & Labrador
- Province of Nova Scotia
- Province of New Brunswick
- Province of Prince Edward Island
- Parks Canada Agency
- The Clean Annapolis River Project

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