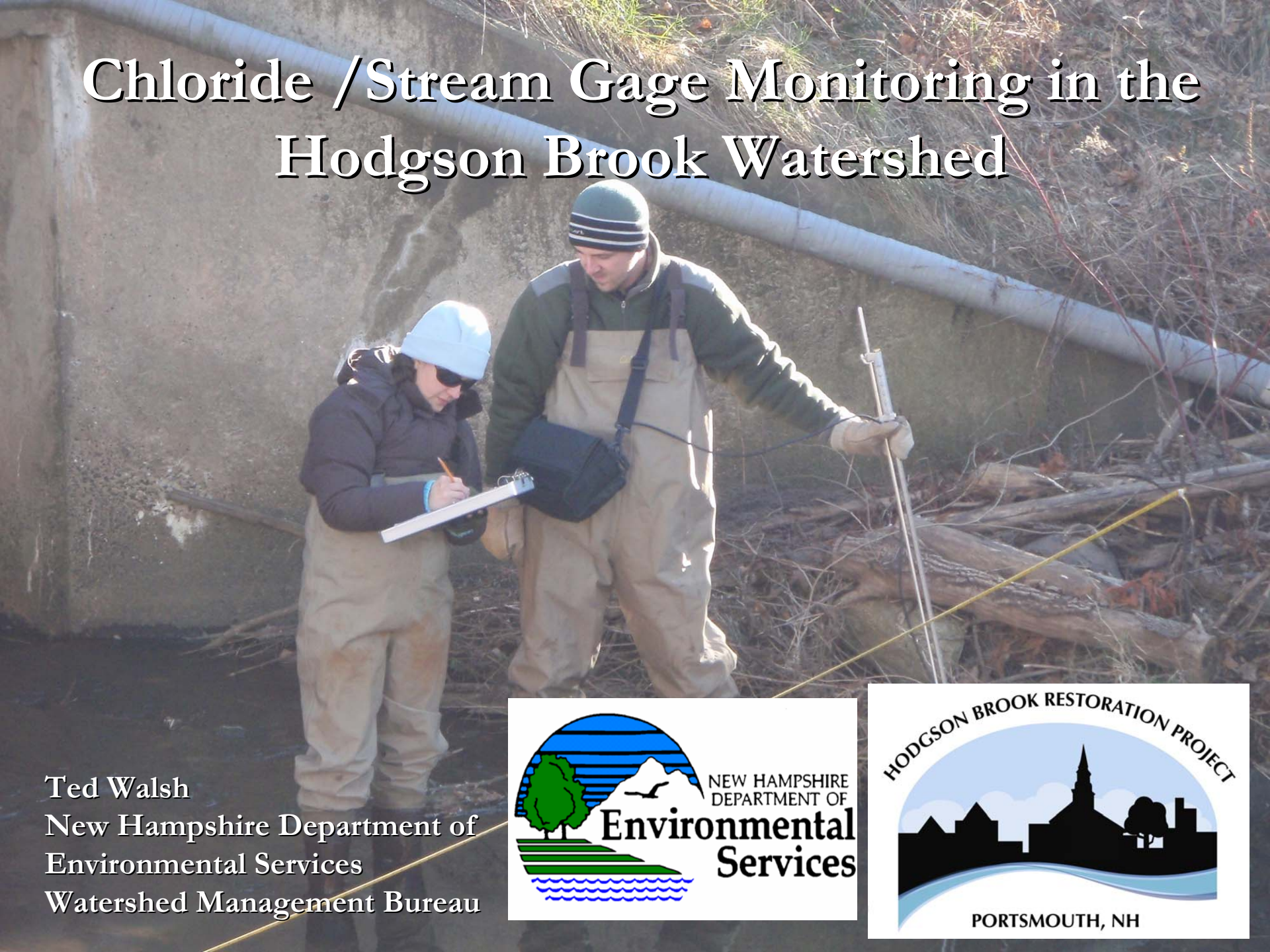
US EPA ARCHIVE DOCUMENT

Chloride /Stream Gage Monitoring in the Hodgson Brook Watershed



Ted Walsh
New Hampshire Department of Environmental Services
Watershed Management Bureau

NEW HAMPSHIRE DEPARTMENT OF Environmental Services

HODGSON BROOK RESTORATION PROJECT
PORTSMOUTH, NH


Hodgson Brook Watershed
3.4 sq. mi.
01K-HOB

Hodgson Brook Challenges

Stormwater Inputs

Road Salt

Neglect and Dumping

Channelization

- In 2005 Hodgson Brook Restoration Project began a water quality monitoring program to determine baseline water quality conditions and to provide data for restoration efforts and effective use of financial resources.
- Water quality monitoring led to Hodgson Brook being listed on the NH 303(d) list for chloride, *E.coli*, dissolved oxygen, benthic macroinvertebrates, and pH
- Data also indicates elevated nutrients.
- As of 2002 watershed consisted of 32% impervious surface area and this amount has increased since.

Hodgson Brook Project Outline and Goals

- Building off of the I-93 chloride TMDL's develop a methodology for collecting the same quality of data to develop a TMDL at a much lower cost.
- Develop a chloride TMDL for Hodgson Brook
- Partner with the Hodgson Brook Restoration Project to implement methods of reducing salt application in the watershed.
- Educational component – continued outreach and partnership with the City of Portsmouth and Pease Development Authority

Motivation and Jurisdiction

- Section 303(d) of the Clean Water Act
  - Each State shall identify those waters not meeting applicable water quality standards ("impaired waters").
  - For the impaired waters, each State shall establish the **total maximum daily load** for the pollutants causing the impairment. Such load shall be established at a level necessary to implement the applicable water quality standards with seasonal variations and a margin of safety.
- Hodgson Brook has been shown to be impaired for chlorides with road salt presumed as the primary source.

TMDL Definition and Requirements

- The TMDL is the maximum daily load of a pollutant which a waterbody can assimilate without violating WQS.
- The TMDL must be set at a level so that WQS are met for all conditions including seasonal variations.
- The TMDL must have a margin of safety (MOS) which takes into account scientific uncertainty.

Chloride TMDL's Outline and Goals

Collect year-round specific conductance/chloride data in three Seacoast watersheds that contain major DOT roadways.

Use this additional data to hone in on the threshold of tons/mi^2 of applied road salt where violation will occur.

Hodgson Brook, Portsmouth (I-95)

Cains Brook, Seabrook (I-95, Route 1)

Norris Brook, Exeter (Route 101)

Initiation of Long-term Continuous Monitoring

In May 2008 the Hodgson Brook Restoration Project applied for an EPA equipment loan grant to acquire water level and flow monitoring equipment for the purpose of:

1) to understand the hydrologic inputs of the brook and its tributaries

2) to calculate the response to storm events and estimate pollutant loads using the water quality and discharge data

3) to monitor the pollutant and stormwater trends over time as we implement restoration projects.

4) to complete a chloride TMDL for the watershed and calculate the threshold of tons/mi^2 of applied road salt where violations will occur.

Stream Gage Equipment Costs

HOBO Water Level Logger Deluxe kit $ 1,137.00

- U20-001-01 HOBO Logger
- U20-001-04 HOBO Barometric pressure logger
- U-DTW-1 HOBO waterproof shuttle with coupler
- U20-Case-1 Carrying case
- BHW-PC HOBOware Pro software

$1,137

Additional installation materials

- Cable for securing loggers to well cap
- 2-Inch ProHydro Well Cap
- 10’ PVC Schedule 40 electrical conduit $5.15
- Brackets, masonry screws/bits
- Stream gage
- Padlock

~$200

Additional Costs

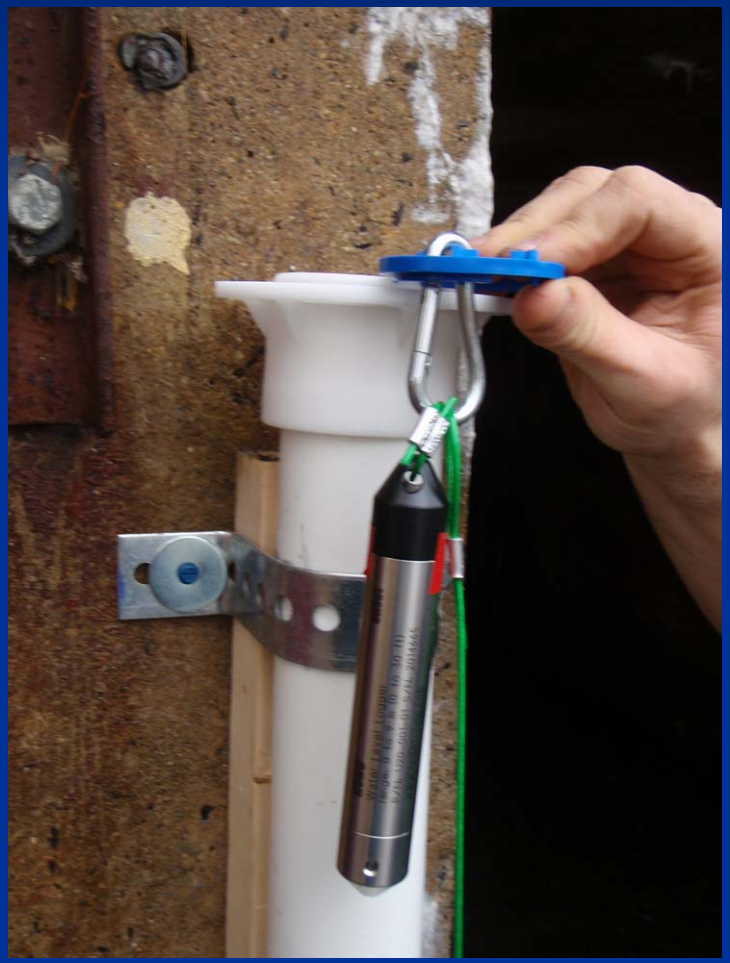
- Chloride samples processed at NHDES using benchtop chloride meter at no cost.
- Staff time for site visits to develop rating curve – interns for 50% of the visits (thus far 9 visits)
- Monthly datalogger maintenance
- HBRP assisting w/ keeping the gage clear of debris and reading gage
- Use of online USGS gage on the Winnicut River to time site visits for flow measurements

Challenges

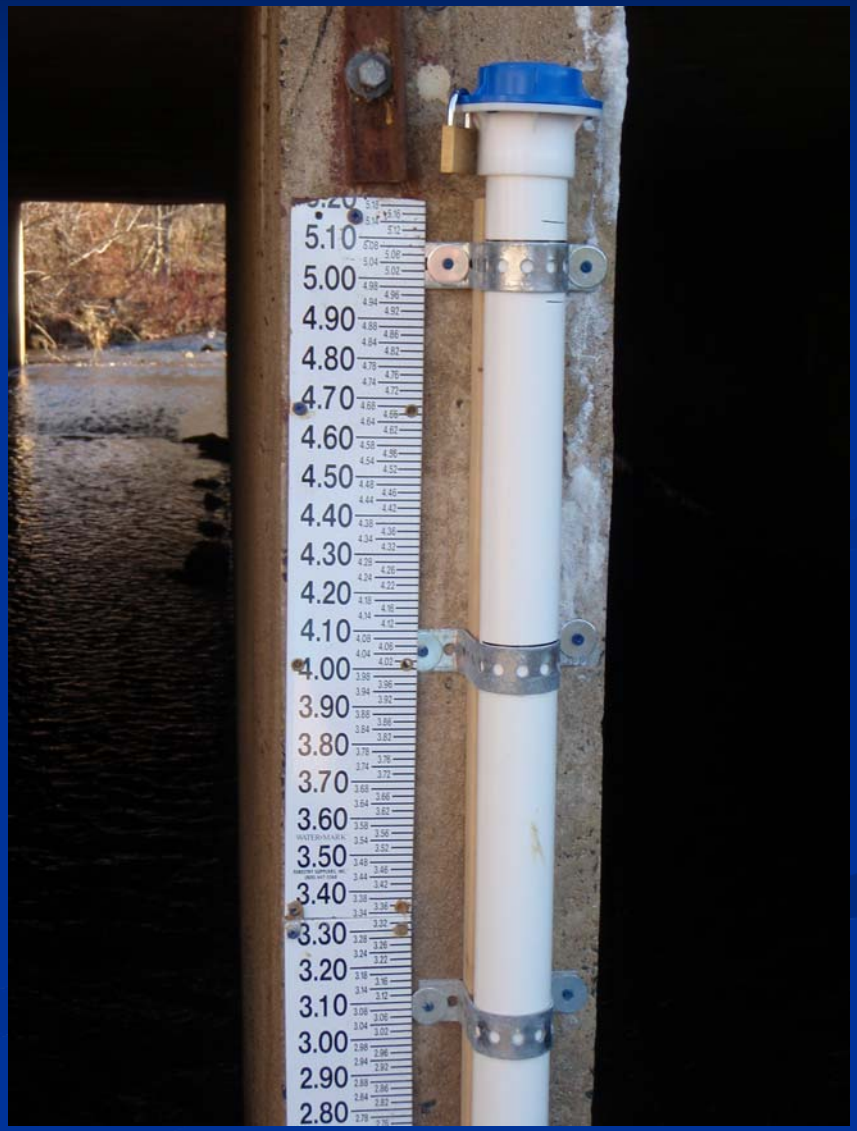
Constructing the Stilling Well

Securing the Stilling Well

Securing Water Level Dataloggers



Final Product



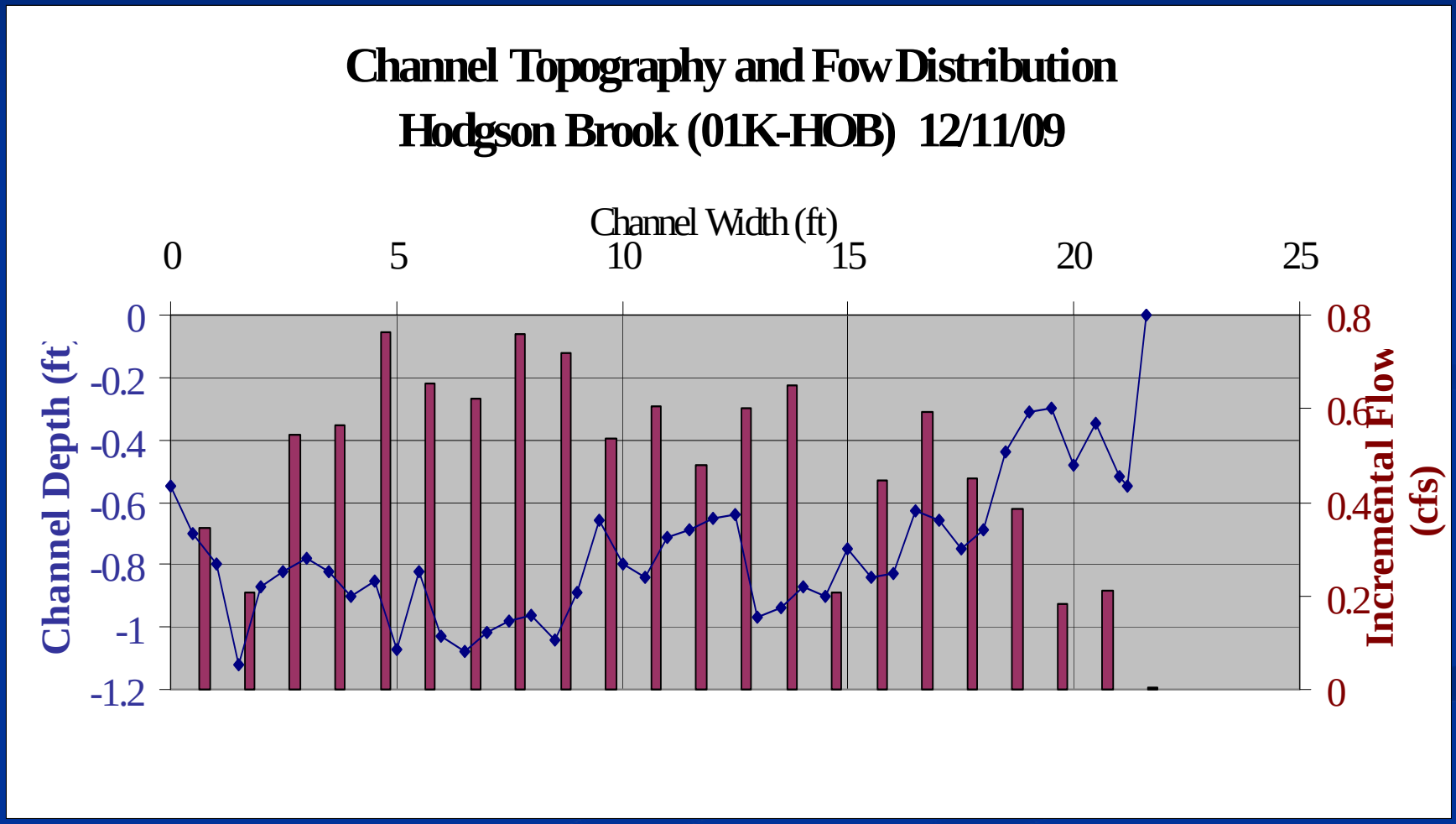
Installing Water Quality Datalogger

Specific Conductance/Chloride Data

- In Situ Troll 6000 deployed to collect 15 minute specific conductance and water temperature data
- During monthly visits chloride samples are collected to confirm the relationship between specific conductance and chloride
- Handheld measurements taken during monthly visits and during flow measurements
- Water quality monitoring conducted under June 2006 QAPP- "Total Maximum Daily Load For Chloride For Waterbodies in the Vicinity of the I-93 Corridor from Massachusetts to Manchester, NH"

Development of a Rating Curve

Development of Rating Curve



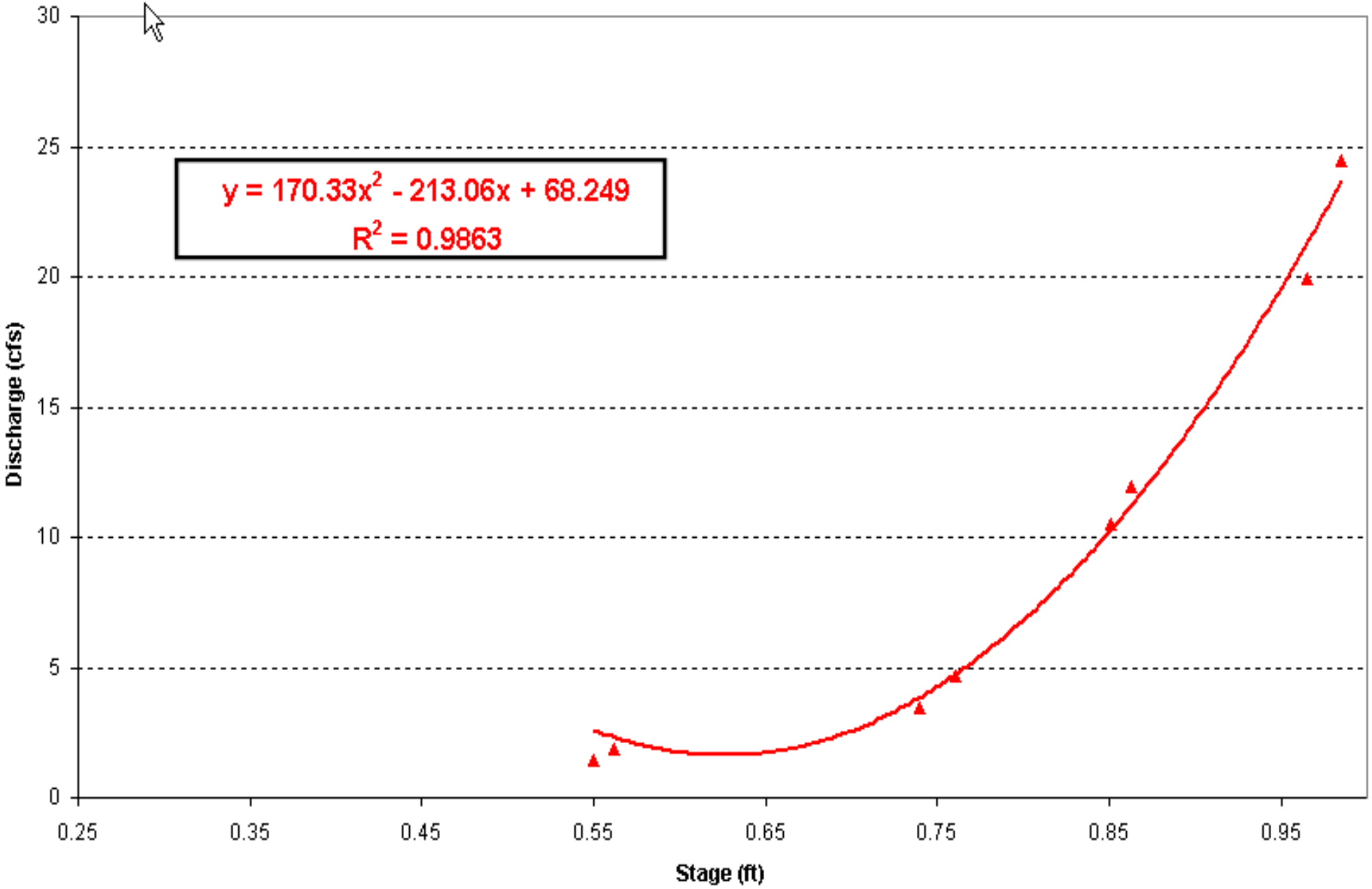
Challenges to Calibrating Rating Curve

- Water level logger underwater subject to biological growth during warmer water periods. This led to drift during deployments.
- Correction factor applied to water level datasets where biological growth was determined to cause drift.
- Difficult to take flow measurements at high water levels.

Correction Factor Used to Account for Drift

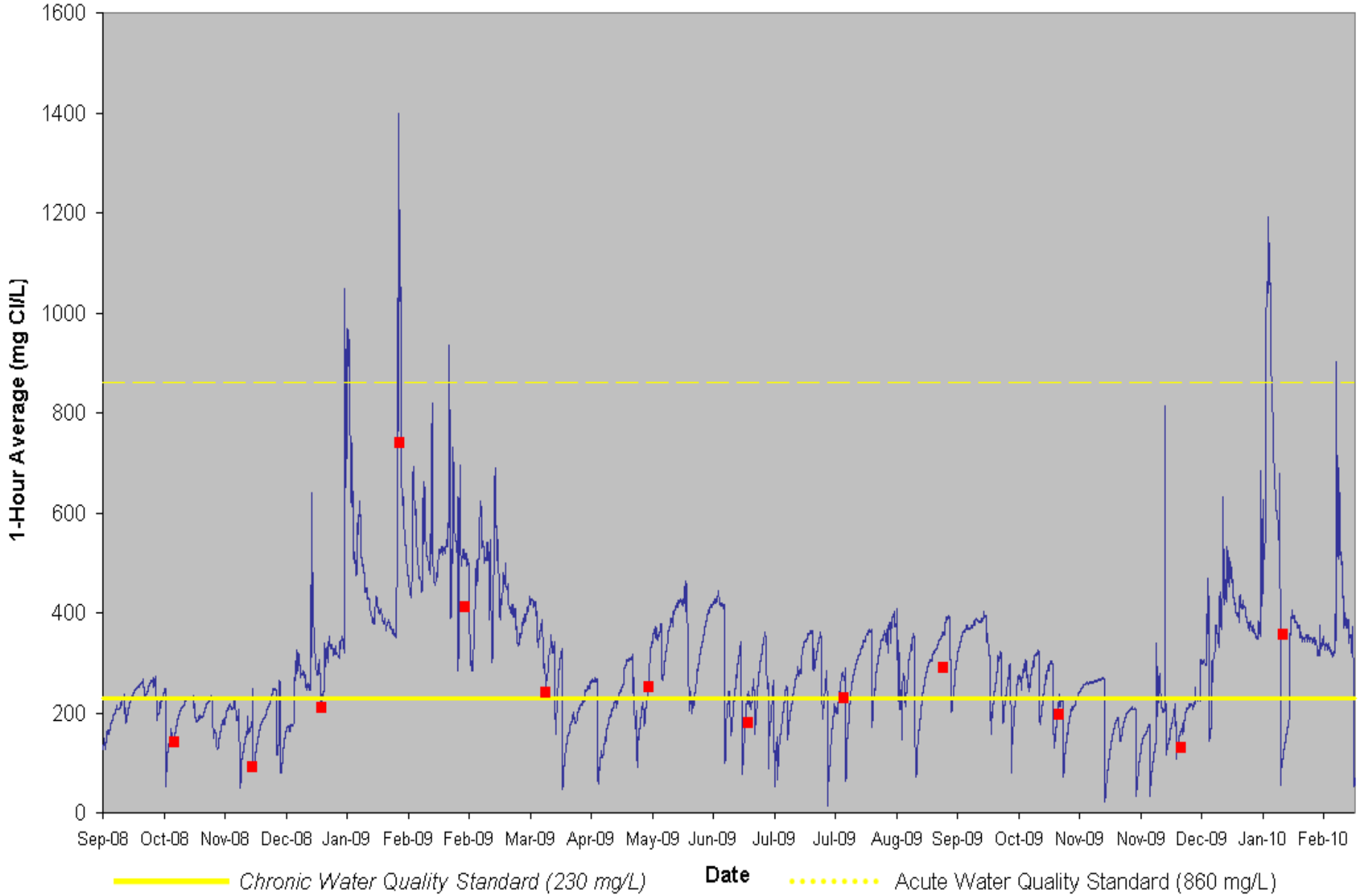
Time, GMT-05:00	Sensor Depth, feet	Correction Factor	Sensor Depth, feet (corrected)
3/31/2009 10:15	0.813		
3/31/2009 10:30	0.802		
3/31/2009 10:45	0.807		
3/31/2009 10:53			
3/31/2009 10:53			
3/31/2009 11:00	0.824		
3/31/2009 11:15	0.818		
3/31/2009 11:30	0.824		
9/10/2009 10:15	0.564	1.000	0.523
9/10/2009 10:30	0.567	1.000	0.526
9/10/2009 10:45	0.562	1.000	0.521
9/10/2009 11:00	0		
9/10/2009 11:06	**0.564**		
9/10/2009 11:06	**0.523**		
9/10/2009 11:15	0.517	0.000	0.517
9/10/2009 11:30	0.524	0.000	0.524
9/10/2009 11:45	0.528	0.001	0.528

Hodgson Brook (01K-HOB) Rating Curve



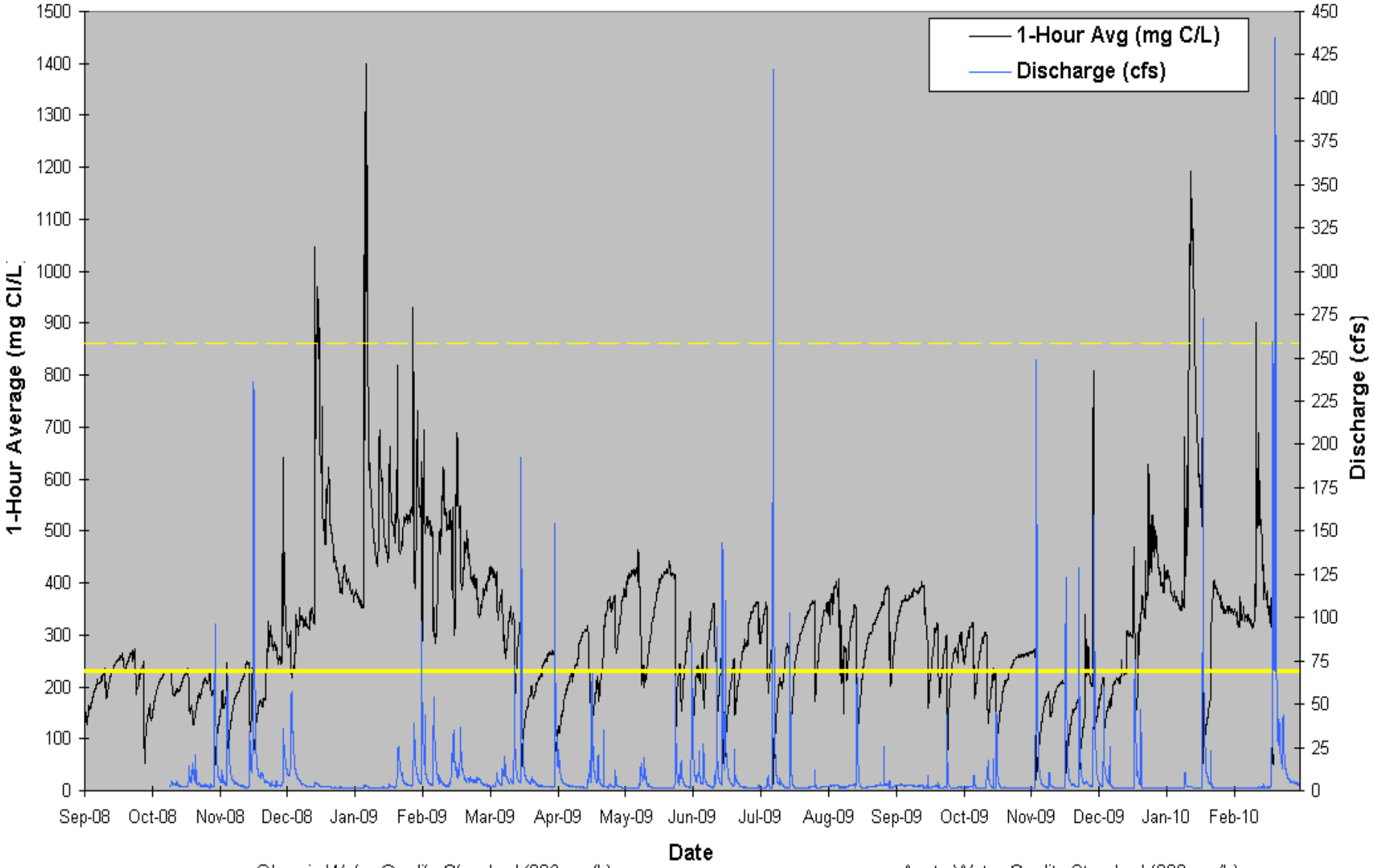
Chloride Concentration at 01K-HOB (9/1/08 - 2/24/10)

The blue line is from datalogger measurements. The red dots are spot measurements with a hand-held meter.

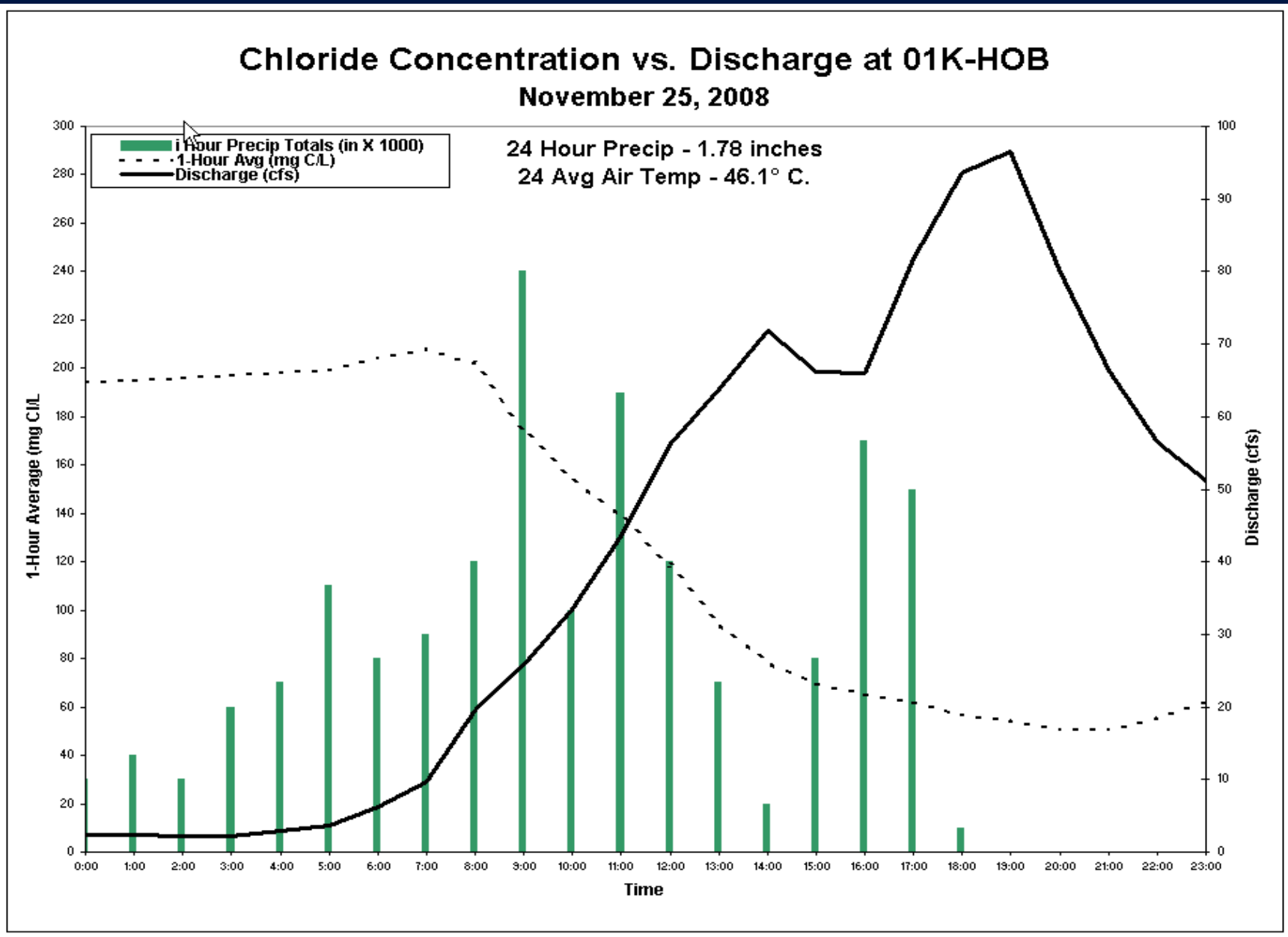


Chloride Concentration vs. Discharge at 01K-HOB

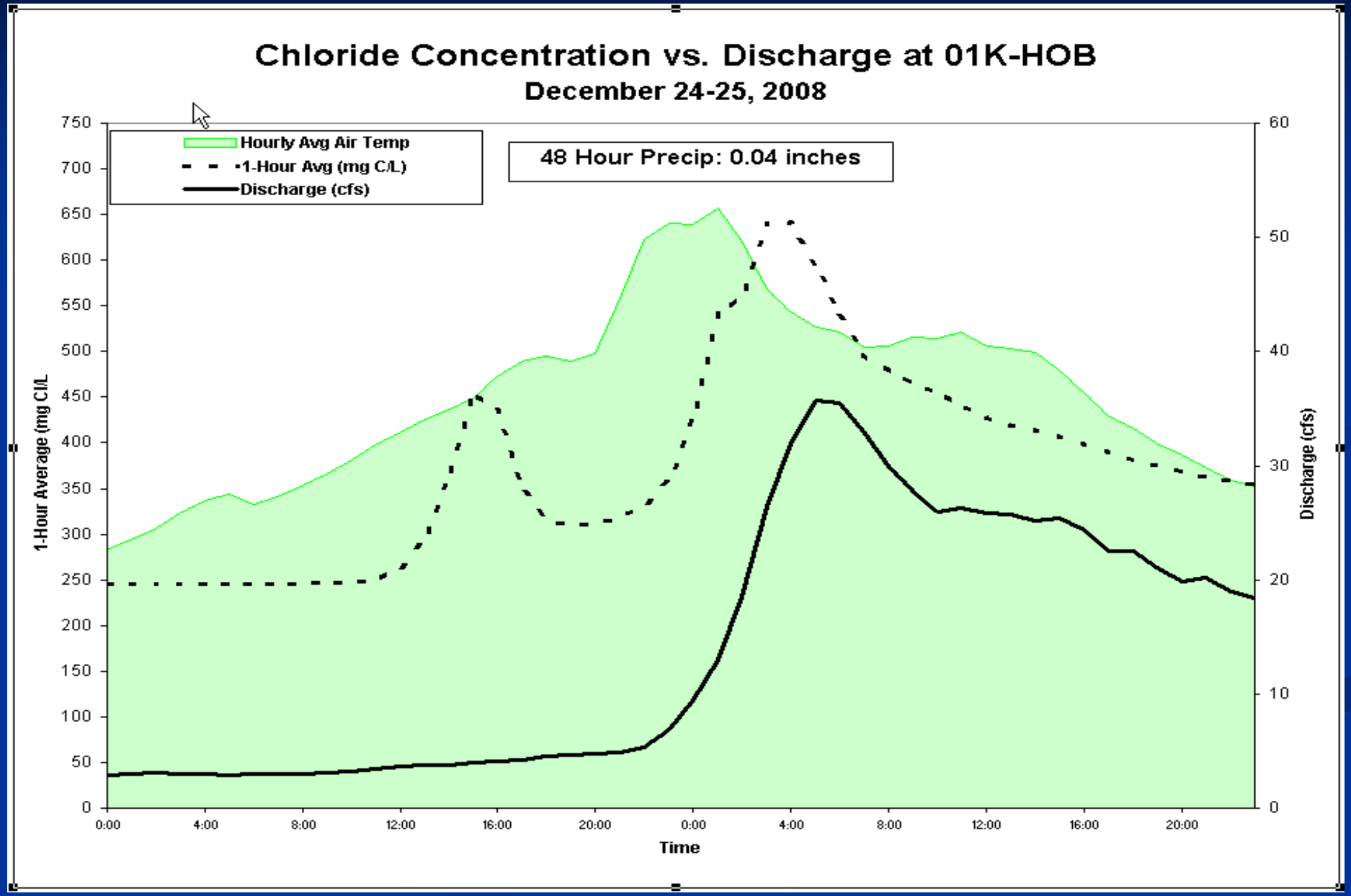
(9/1/08 - 2/24/10)



Seasonal Variations – Precipitation Driven



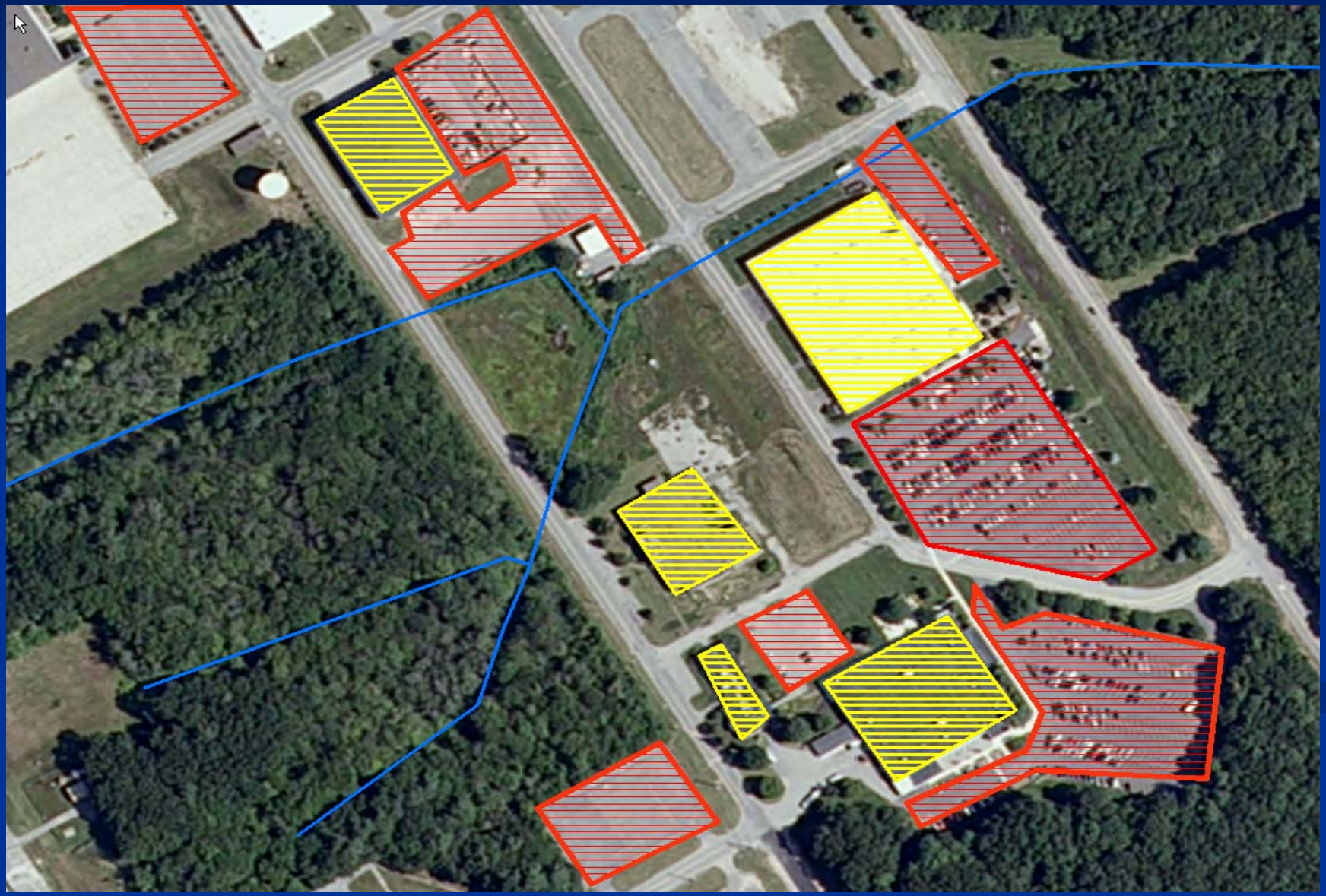
Seasonal Variations – Melt Driven



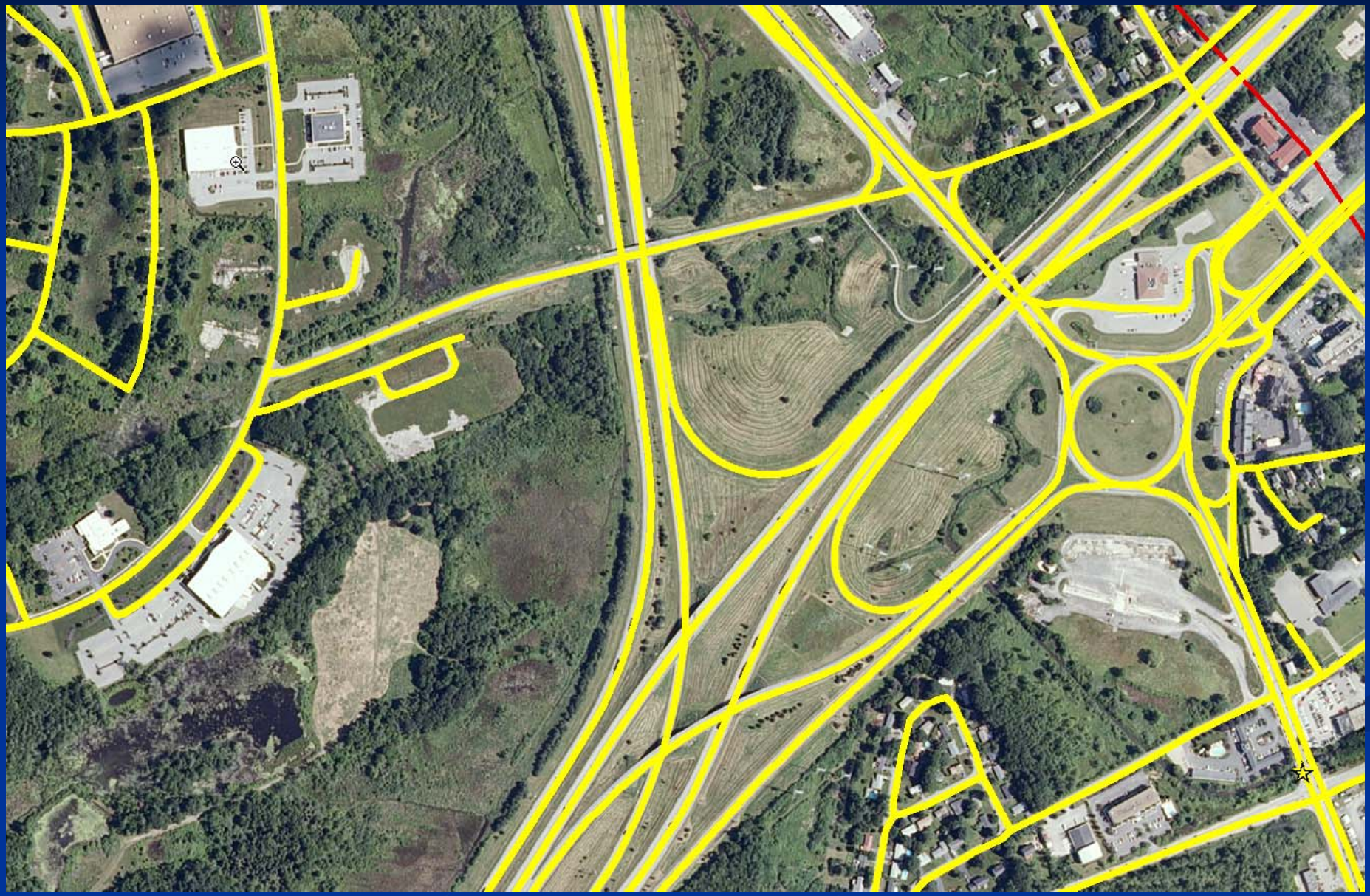
What's Next

- Continue long-term collection of water level and water quality data
- Determination of total salt imports to watershed.
- Develop chloride TMDL for Hodgson Brook watershed
- Initiate efforts to encourage better salt management practices and to reduce salt application in the watershed
- Track implementation of restoration projects and installation of BMP's

Determination of Salt Imports – Parking Lot Delineation



Determination of Salt Imports – Lane Miles



Tracking Restoration/BMPs

Tree Box Filters

Rain Barrels

Contributors

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EPA Region 1

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