Lamprey River Protected Instream Flow Study and Water Management Plan

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NH DES

Instream Flow Pilot Studies

Instream Flow Protection Pilot Project

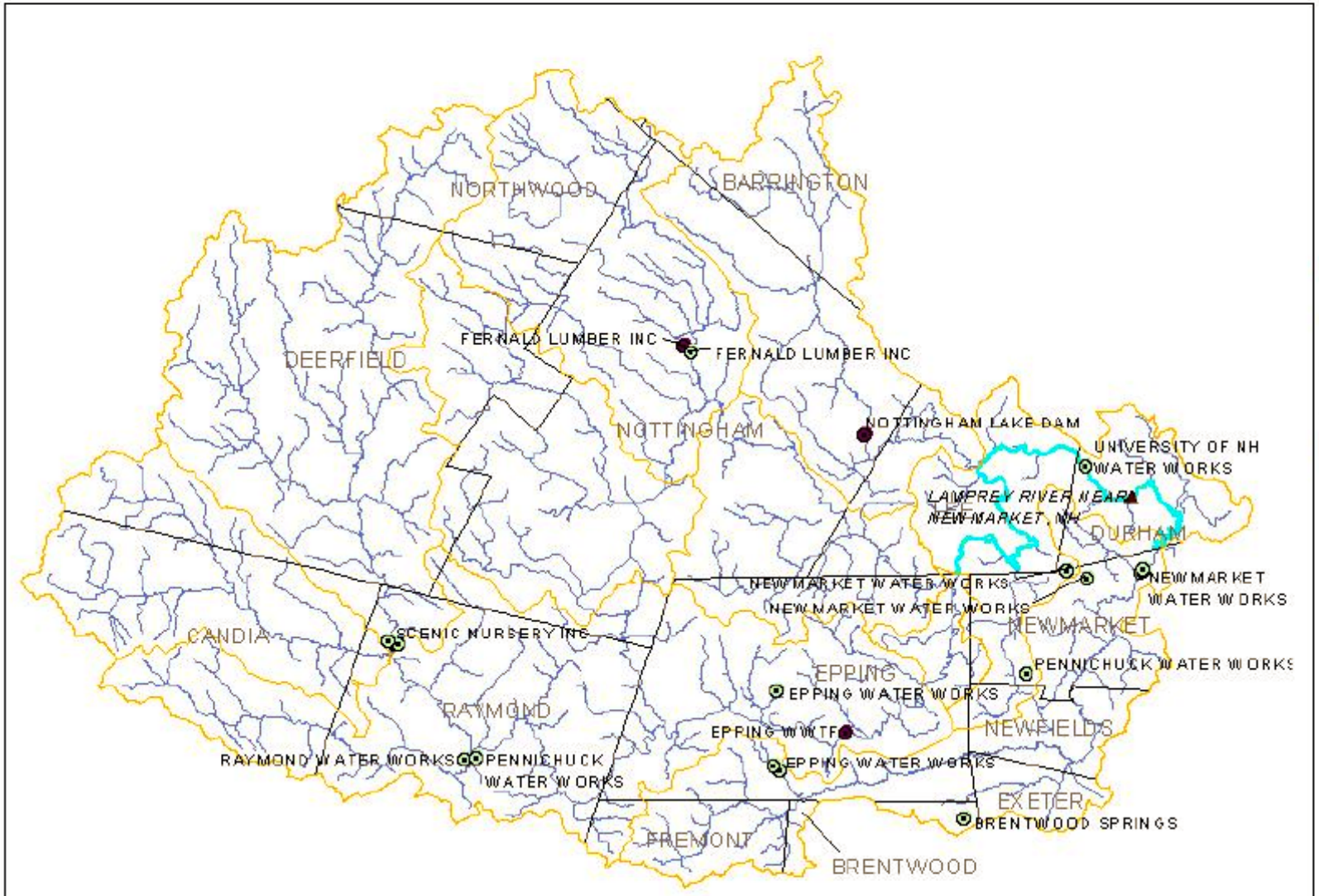
Instream Flow protection under RSA 483

Instream public uses are defined as including the flow-dependent components of navigation, recreation, fishing, conservation, maintenance and enhancement of aquatic life, fish and wildlife habitat, protection of water quality and public health, pollution abatement, aesthetic beauty, public water supply, and hydropower production.

Instream Flow Protection Pilot Program

Two of the fourteen designated rivers - the Lamprey River and the Souhegan River. With the advice and input of the statewide Rivers Management Advisory Committee (RMAC), DES adopted Instream Flow Rules that apply to the Souhegan and Lamprey Rivers. The rules describe the process for conducting a Protected Instream Flow study and developing a Water Management Plan to implement the study results. If the pilot program is successful, the rules would be amended before they could be applied to other Designated Rivers.

Lamprey River Affected Water User Facilities: Source and Discharge Locations



Legend

Lamprey Water Users

- Source
- Discharge

Stream Gages

- Active
- Inactive
- Designated Reach
- Hydrology
- State boundary
- Town boundary
- Lamprey WMPA

N

0 1 2 Miles

The coverages presented are under constant revision as new sites or facilities are added. They may not contain all of the potential or existing sites or facilities. NHDES is not responsible for the use or interpretation of this information. Not intended for legal purposes. Water users database last updated January 2004.

Map produced January 22, 2004

Protected Instream Flows (PISF)

Flows that protect and maintain protected entities

Instream Public Uses, Outstanding Characteristics, and Resources (IPUOCR) Flow Dependent??

- Recreation (swim/boat)
- Water Storage
- Pollution Abatement

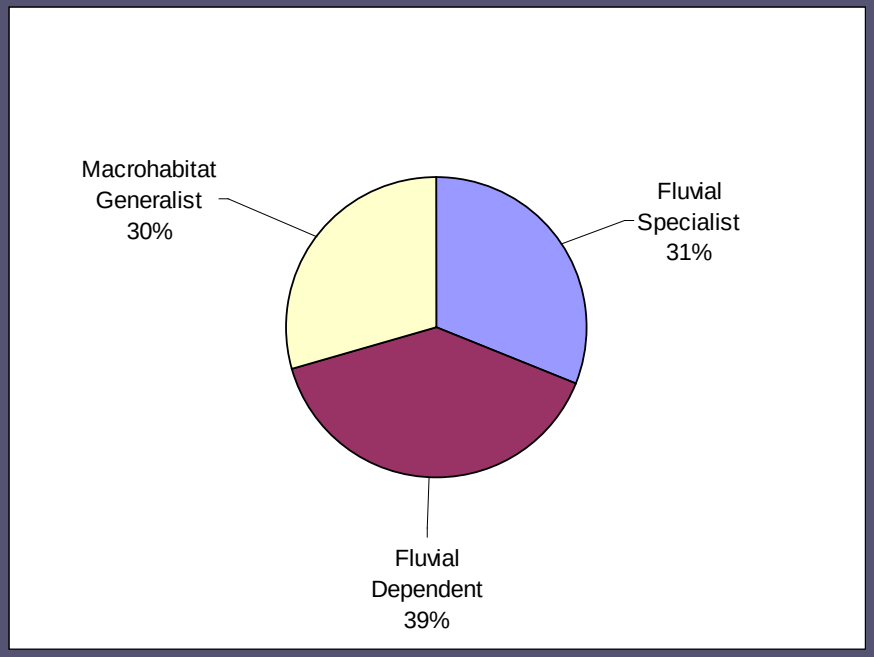
- Wood Turtle
- Spotted Turtle
- Blanding's Turtle
- Pied Billed Grebe
- Osprey
- Bald Eagle
- Pied billed Grebe
- Sedge Wren
- Water marigold
- Sharp-flowered mannagrass
- Knotty Pondweed
- Blunt Sphenopholis
- Small-crested Sedge

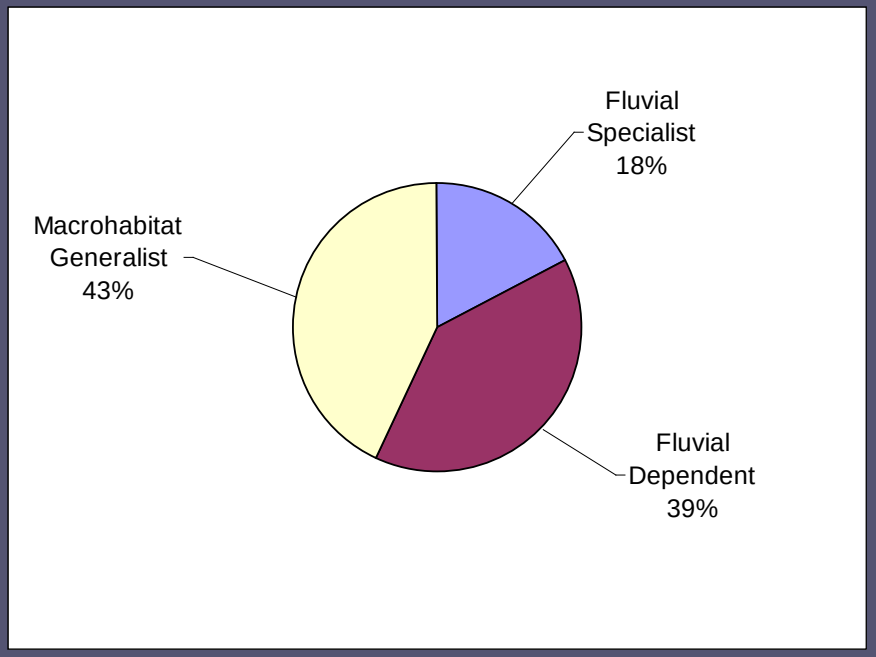
- Slender Blue Flag
- Climbing Hempweed
- Emergent Wetlands
- Swamp white oak floodplain forest, oxbow marsh, floodplain vernal pool, floodplain forest, oxbow shrub-swamp, high energy riverbank, river rapids

- Fish and Fish Habitat
- Mussels
- Insects
- T/E Bridled Shiner
- Banded Sunfish
- Endangered Brook Floater

- Public Water Supply
- Groundwater

Instream Flow Conditions and Habitat Availability

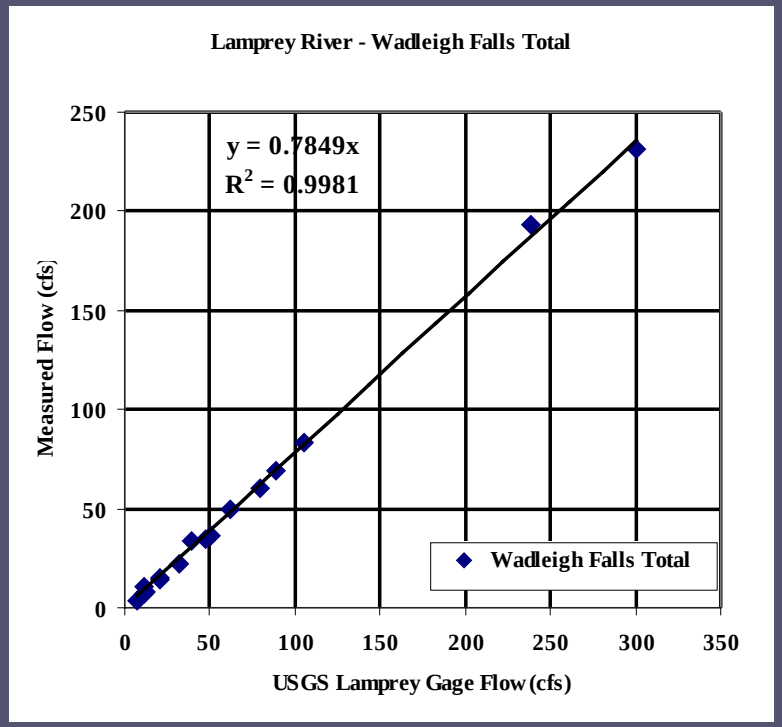


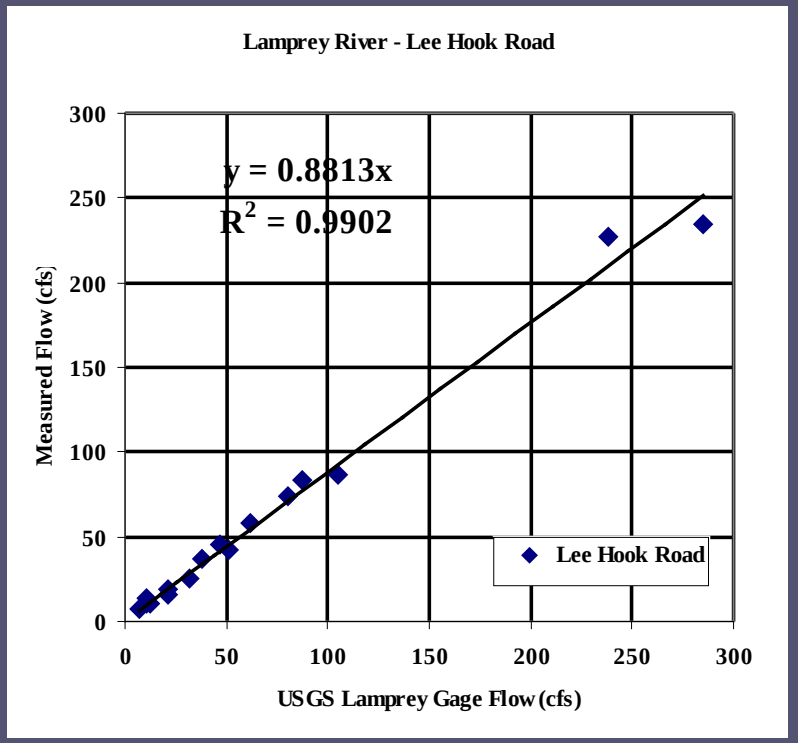


Target Community **Existing Community**

Example: Fish Communities

Streamflow Now and Then





Wadleigh Falls **Lee Hook Road**

Concurrent Flow

Lamprey River Protected Instream Flow Study and Water Management Plan

http://www.des.state.nh.us/rivers/instream/lamprey.asp

http://www.unh.edu/erg/lamprey/

Understanding Hyporheic Exchange and Groundwater Contribution in a Northeastern Stream Using Heat as a Tracer

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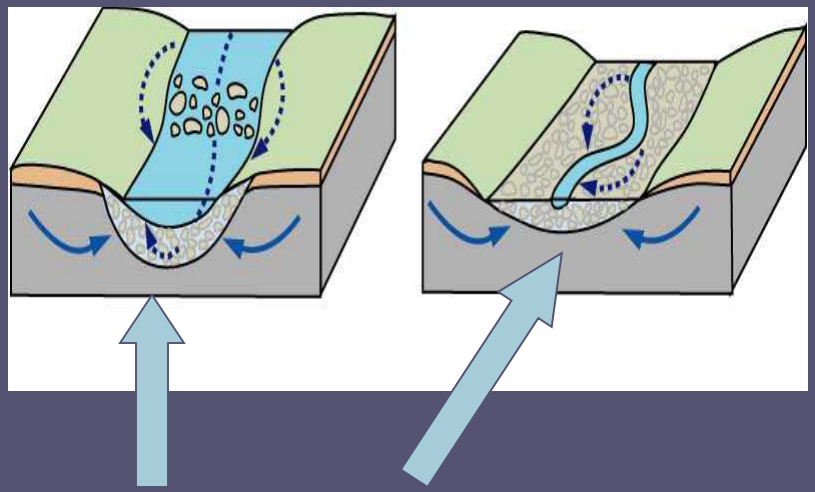
Goals of Research

- Understand temporal extent and exchange of streamwater in the streambed
- Determine temperature measurement techniques most effective for study
- Relate stream morphology and temperature variations

What is streambed exchange?



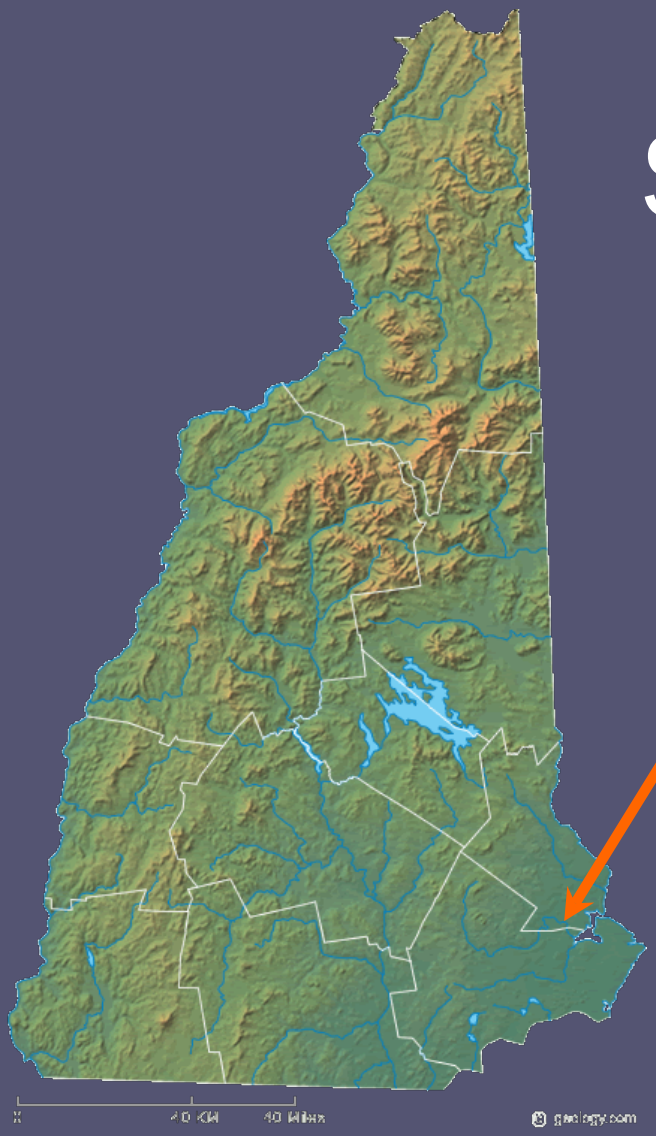
Saturated zone immediately beneath and adjacent to a stream

Stream water flows into and out of this zone

Characterized by short flow paths and exchange multiple times within a stream reach.

Functions/Importance of the Streambed Exchange

- Biogeochemical - Stores and transforms dissolved organic matter and nutrients, other chemical constituents
- Ecological - Moderates stream temperature and provides cool refuge for fish and spawning, houses other biota
- Hydrologic/Resource Management - Stores stream baseflow, holds 2-5 times water in stream itself. Buffer between groundwater and surface water.



Study Location

Wednesday Hill Brook

Strafford County

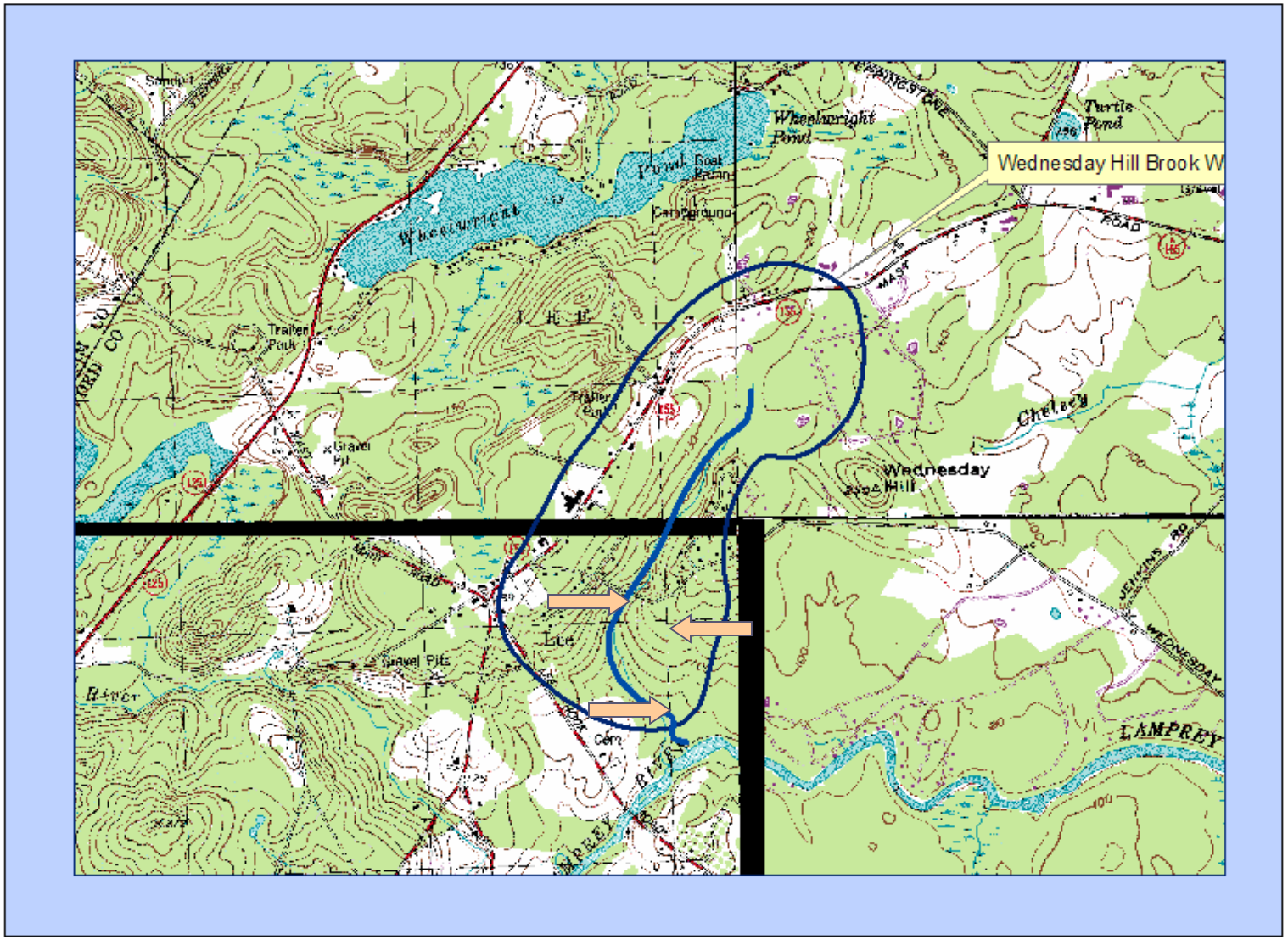
Lee, New Hampshire

Lamprey River Watershed

1st Order Stream with 1.5 km^2 drainage area

Study Area – 500 m reach

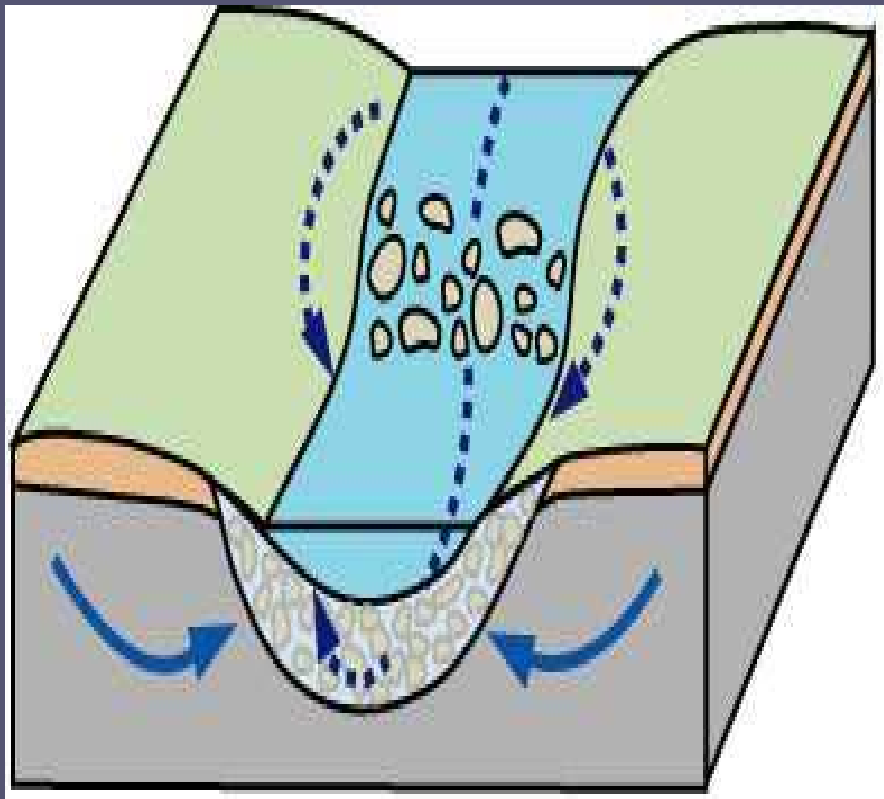
Location of Study Site, Wednesday Hill Brook, Lee, NH



- Upper reach dissects glacial sand and gravel deposit.
- Contains step-pool region armored with cobbles

- Gradient moderates and stream valley broadens.
- Hyporheic zone composed of sands and gravels and bounded by silt and clay
- Location of focus reach

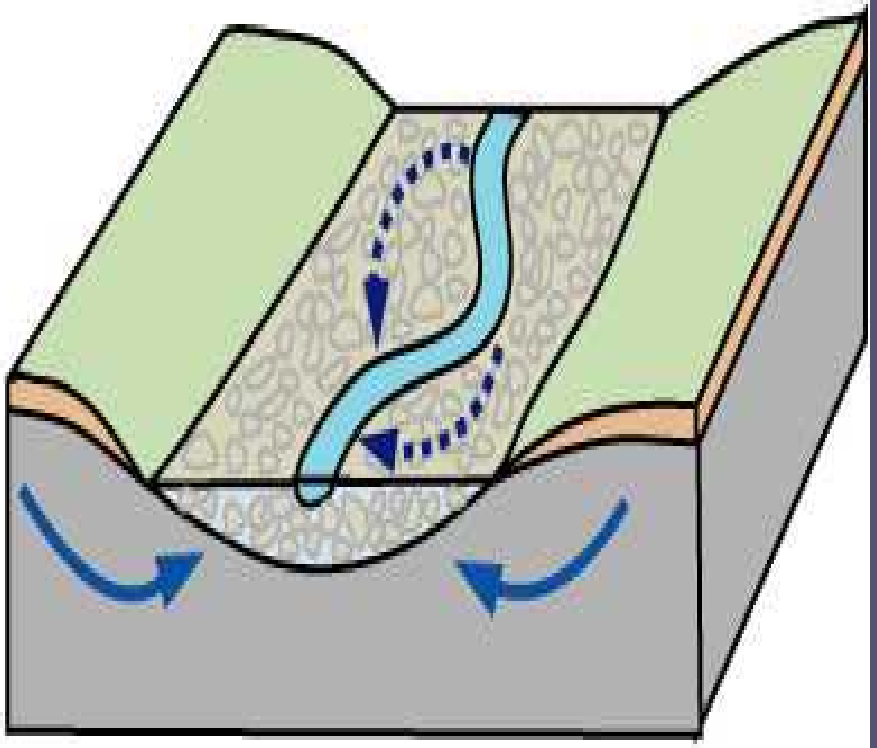
Upper Reach



Cobbles, gravel and sand underlain by silt and clay

Limited exchange

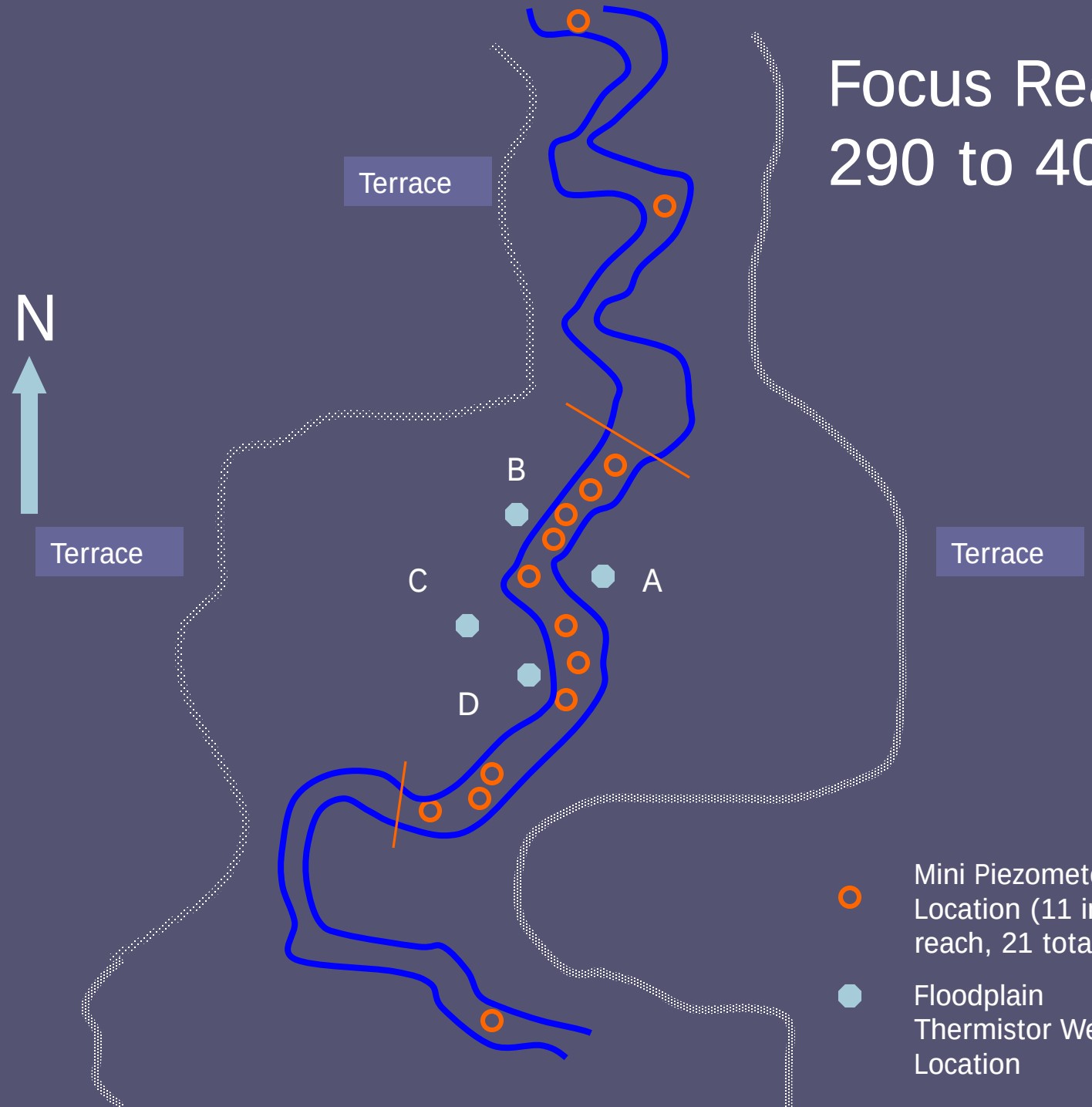
Focus Reach



Sand and gravel underlain by silt and clay

Broader and deeper exchange

Focus Reach – 290 to 400 m



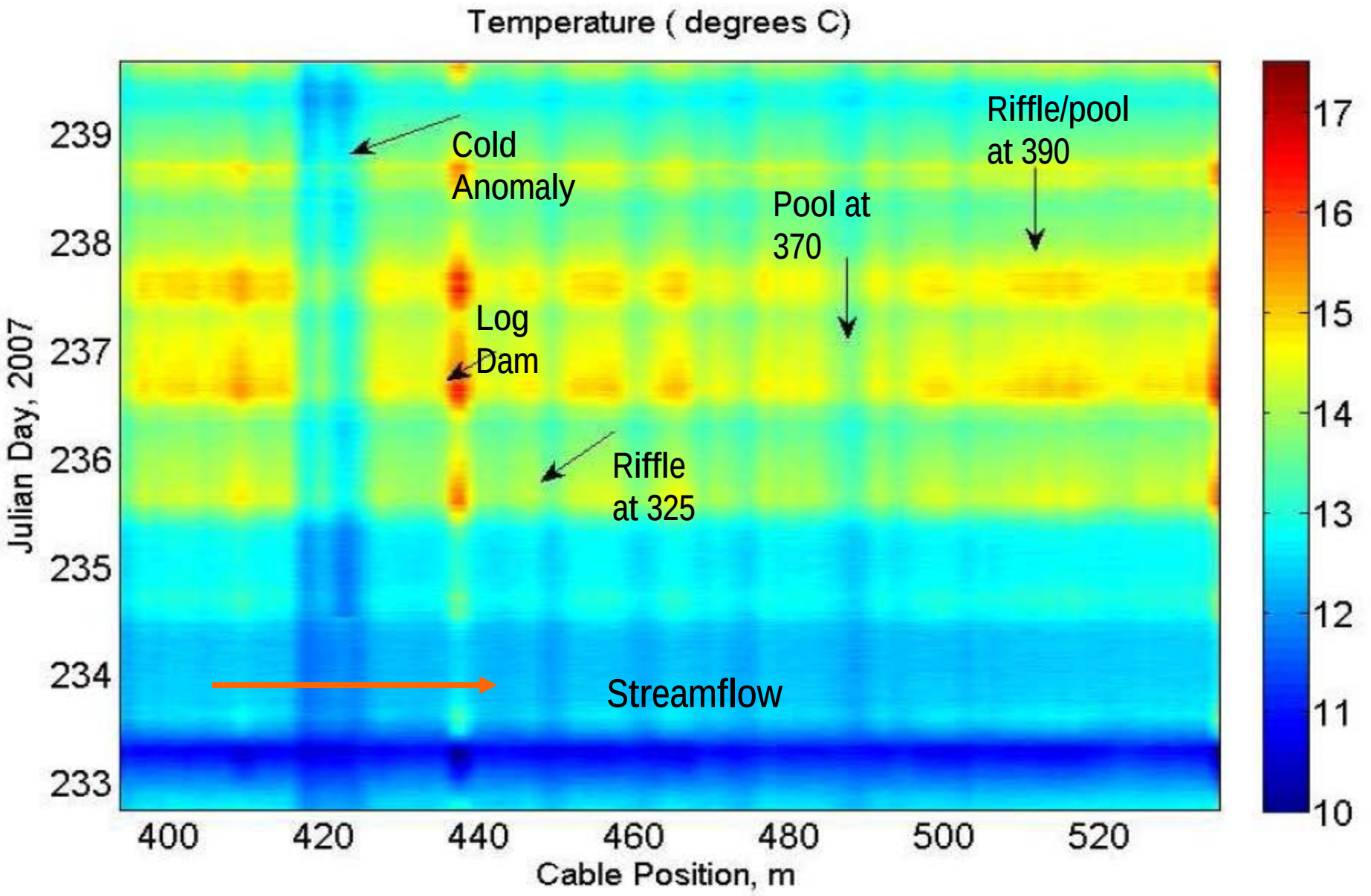
Mini-piezometers fitted with thermocouple wire

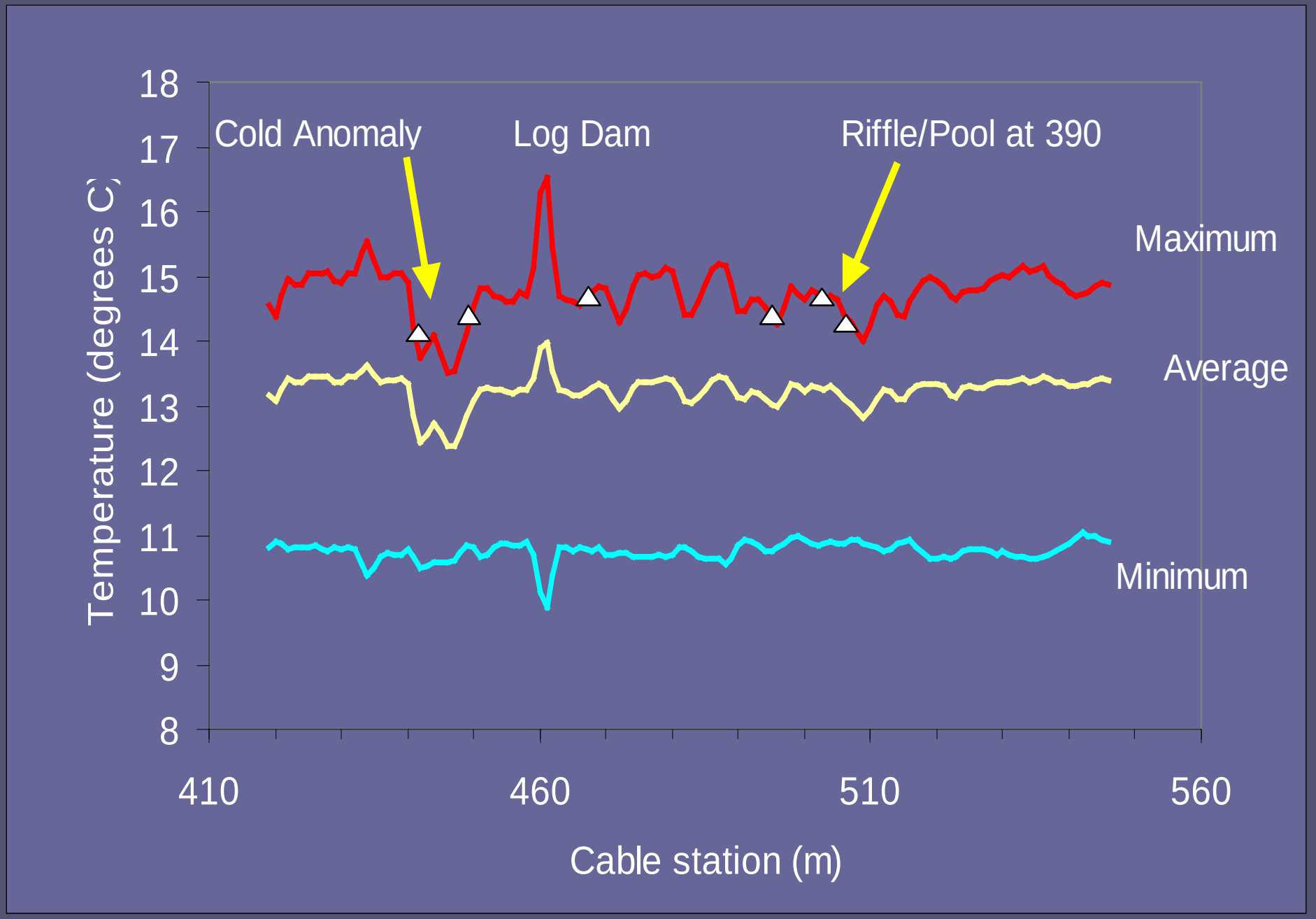
- Advanced to bottom of streambed (40 to 80 cm bss)
- Screened at bottom for head measurement
- Thermocouple at bottom, 20 cm and at intermediate depths

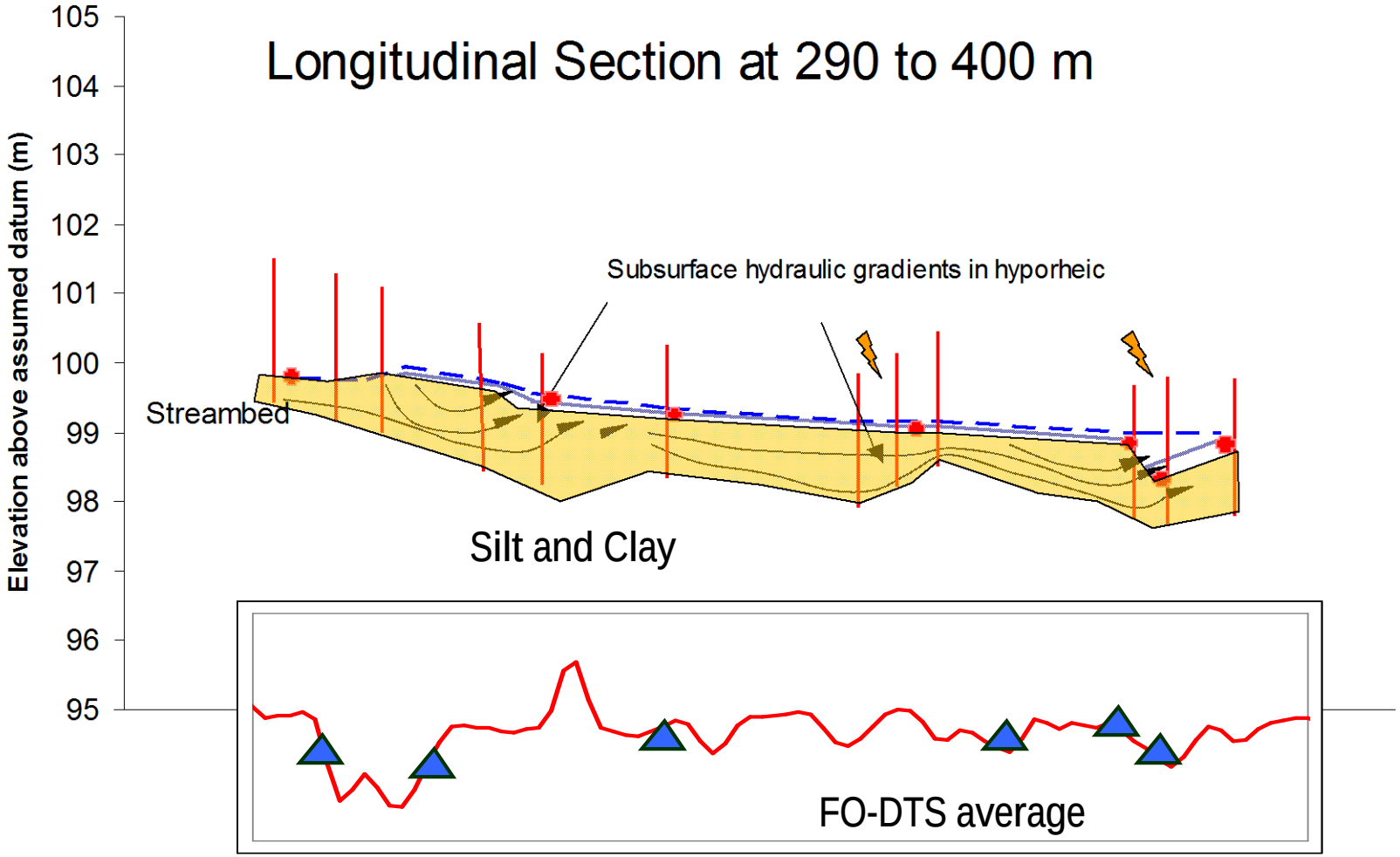
Hobo^{tm} thermistor data loggers attached to streambed and installed at 20 cm depth

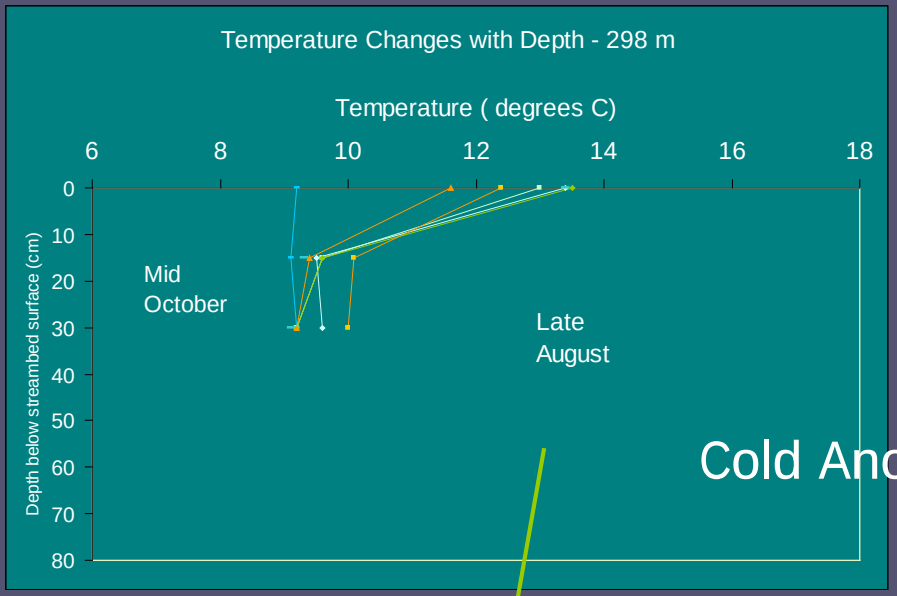

4830 JOBMAST

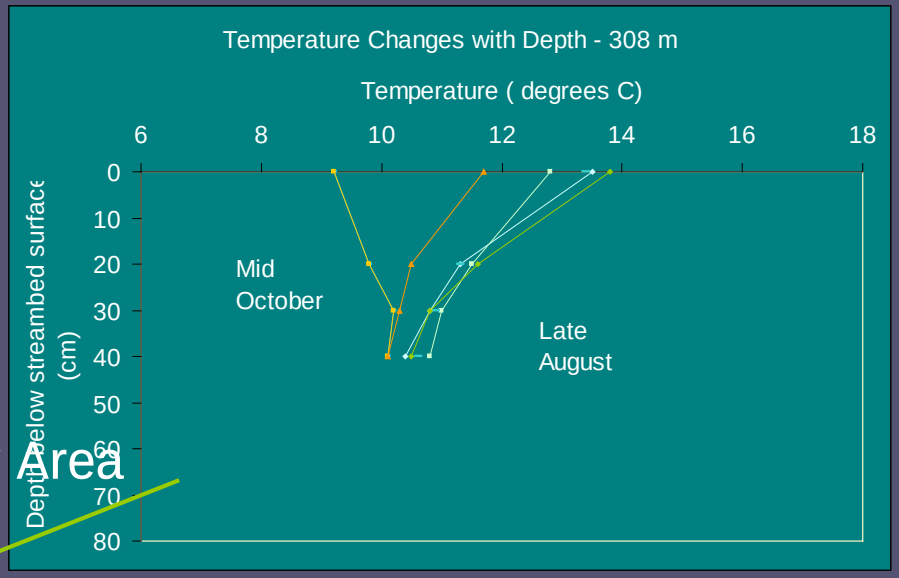
FO-DTS plot of Focus Reach – 8/22 to 8/28



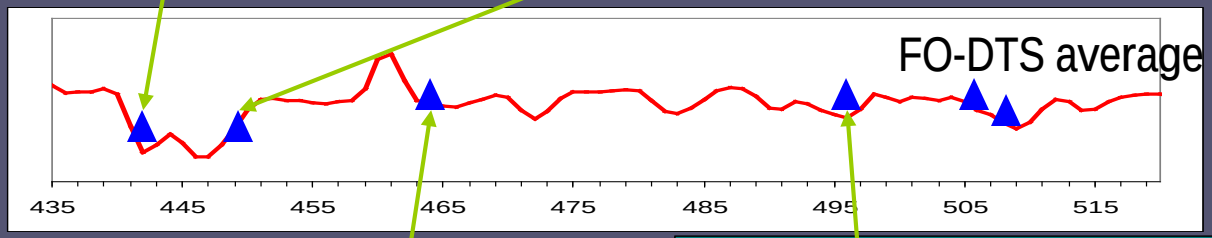

Cold Anomaly
Log Dam
Riffle/Pool at 390
Maximum
Average
Minimum
Temperature (degrees C)
18
17
16
15
14
13
12
11
10
9
8
410
460
510
560
Cable station (m)

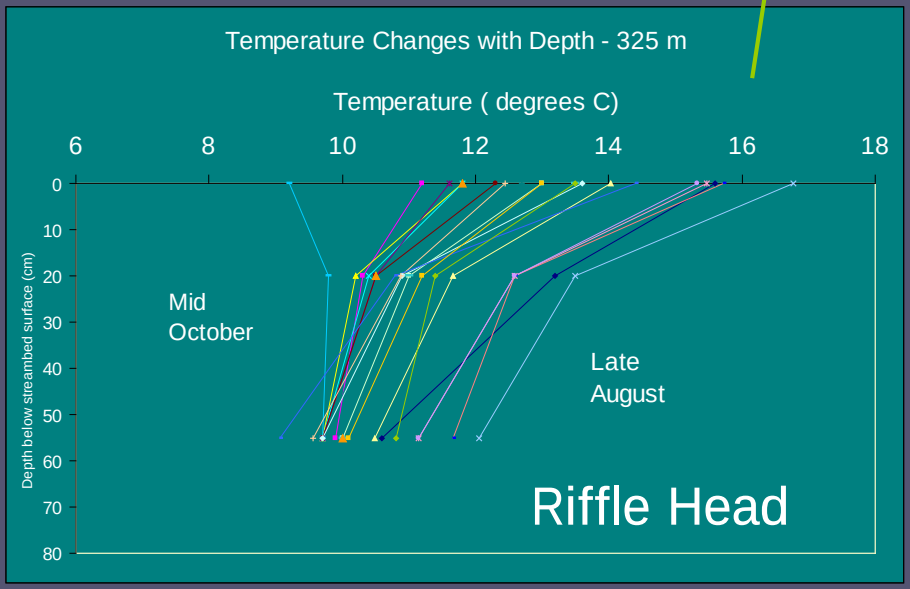

Longitudinal Section at 290 to 400 m
Elevation above assumed datum (m)
105
104
103
102
101
100
99
98
97
96
95
Subsurface hydraulic gradients in hyporheic
Streambed
Silt and Clay
FO-DTS average

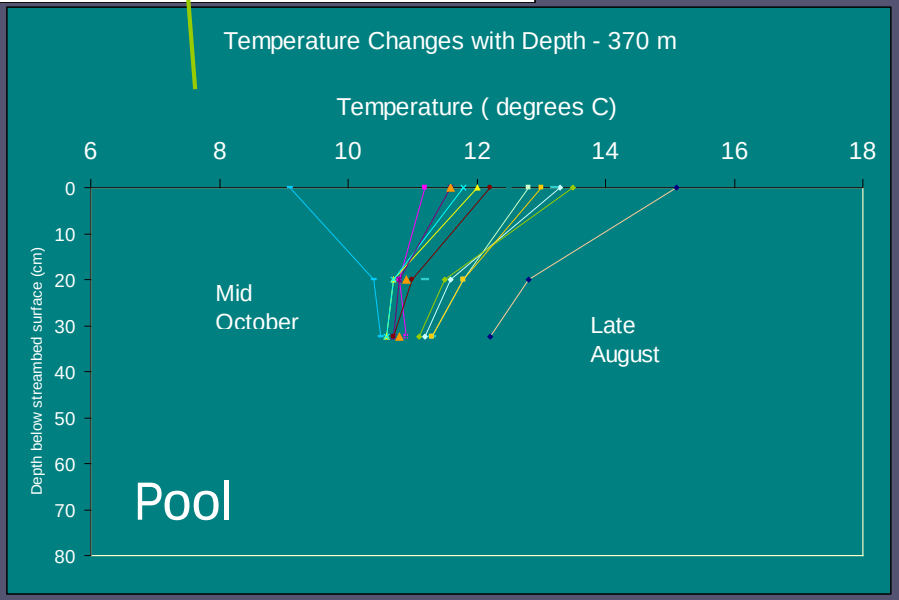


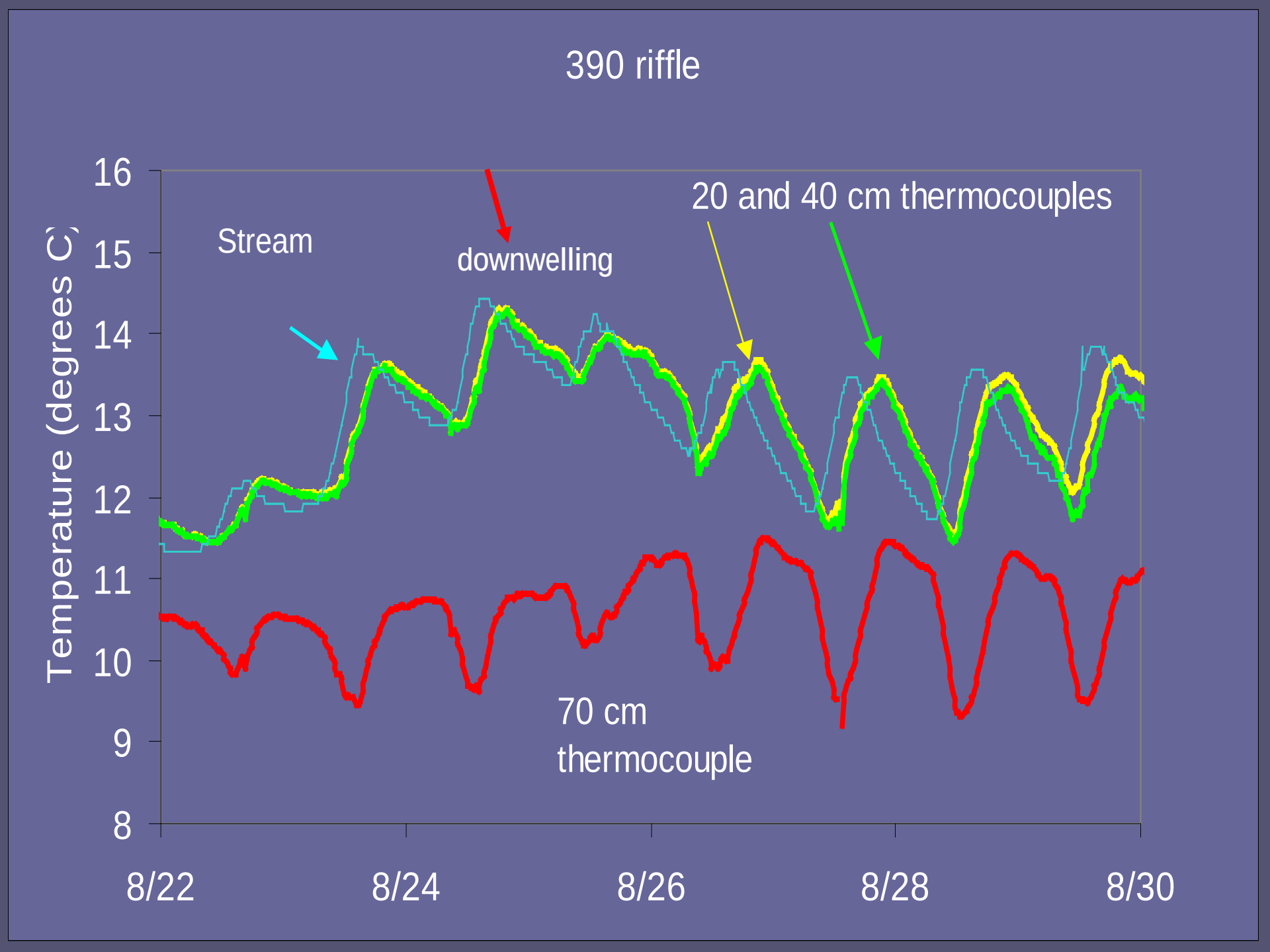


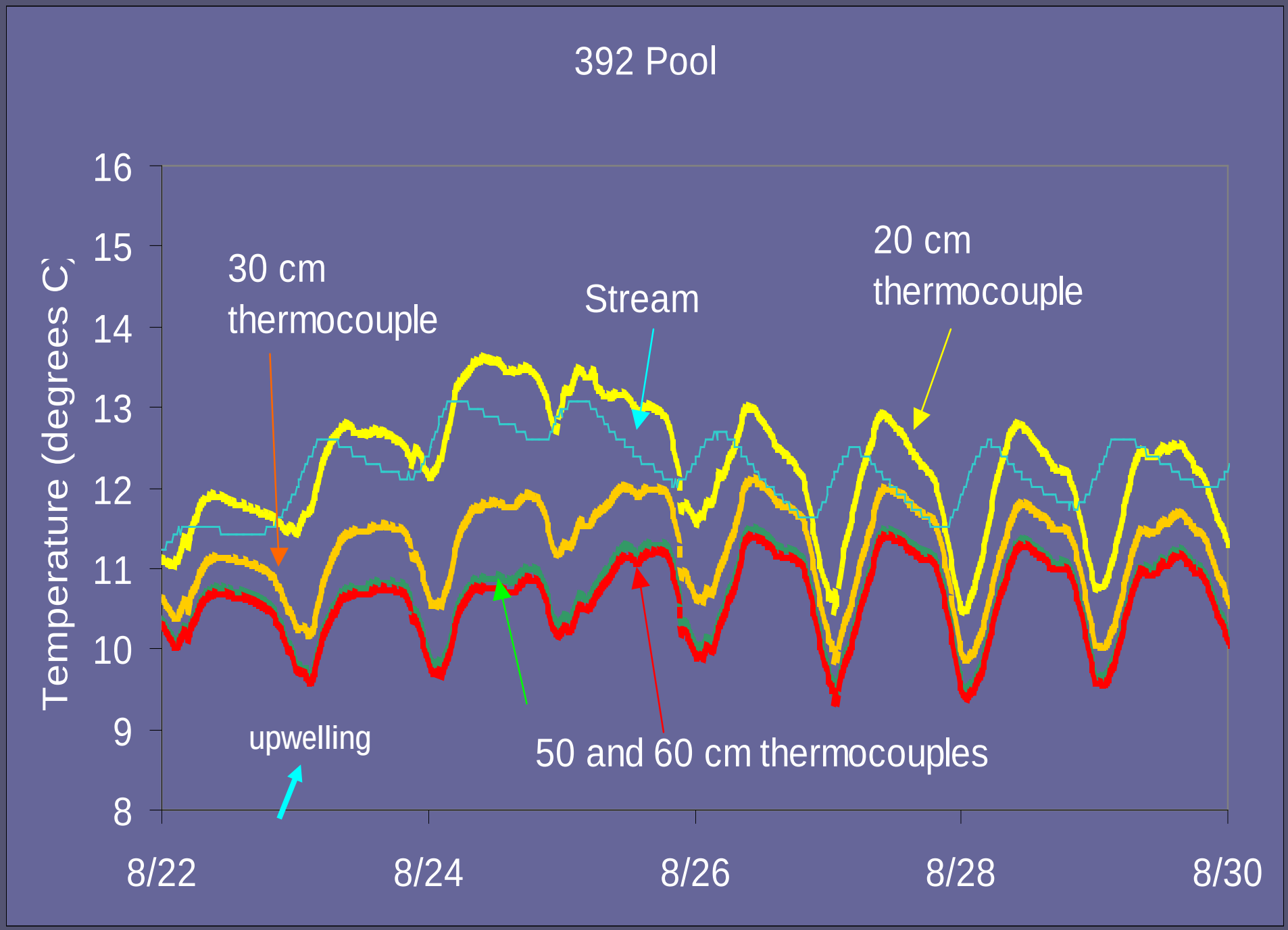
Cold Anomaly Area








390 riffle
Temperature (degrees C)
16
15
14
13
12
11
10
9
8
8/22
8/24
8/26
8/28
8/30
Stream
downwelling
20 and 40 cm thermocouples
70 cm
thermocouple


392 Pool
Temperature (degrees C)
16
15
14
13
12
11
10
9
8
8/22
8/24
8/26
8/28
8/30
30 cm thermocouple
Stream
20 cm thermocouple
upwelling
50 and 60 cm thermocouples

Additional Analyses

- Model temperature/flux using VS2DH to define stream / GW dynamics
- Fly LIDAR to obtain high resolution topography
- Evaluate stream morphology vs. temperature at several scales
- Use FO-DTS results to scale extent of hyporheic zone heat flux