Cold Creek and Crystal Lake Outlet Flow Monitoring

Crystal Lake & Watershed Association

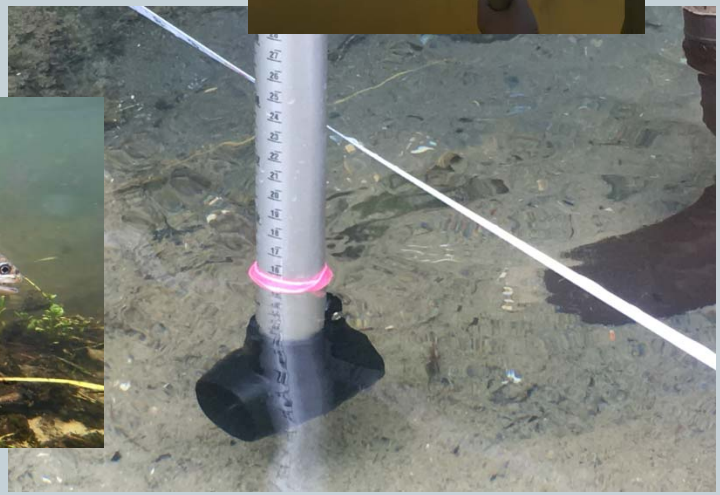
BENZIE CONSERVATION DISTRICT

BENZIE CONSERVATION DISTRICT & CRYSTAL LAKE AND WATERSHED ASSOCIATION

Michigan Clean Water Corps

Why Monitor Stream Flow?

- The amount of water flowing down a stream of river controls almost all aspects of a stream's ecology
  - Biota – fish, amphibians, and insects
  - Sediment and nutrient loads
- Affects the stream as well as any waterbody it discharges into
- Implications for watershed management decisions



Project Justification

The Betsie River/Crystal Lake Watershed Management Plan updated Sept. 2016

"**Siltation and nutrients flowing** into Crystal Lake from muck soils on a former vegetable farm along Cold Creek"

"The state designated uses of "Coldwater Fishery" and "Other Indigenous Aquatic Life and Wildlife" on Cold Creek are believed to be at risk due to **nutrients**, **sediment** and invasive species."

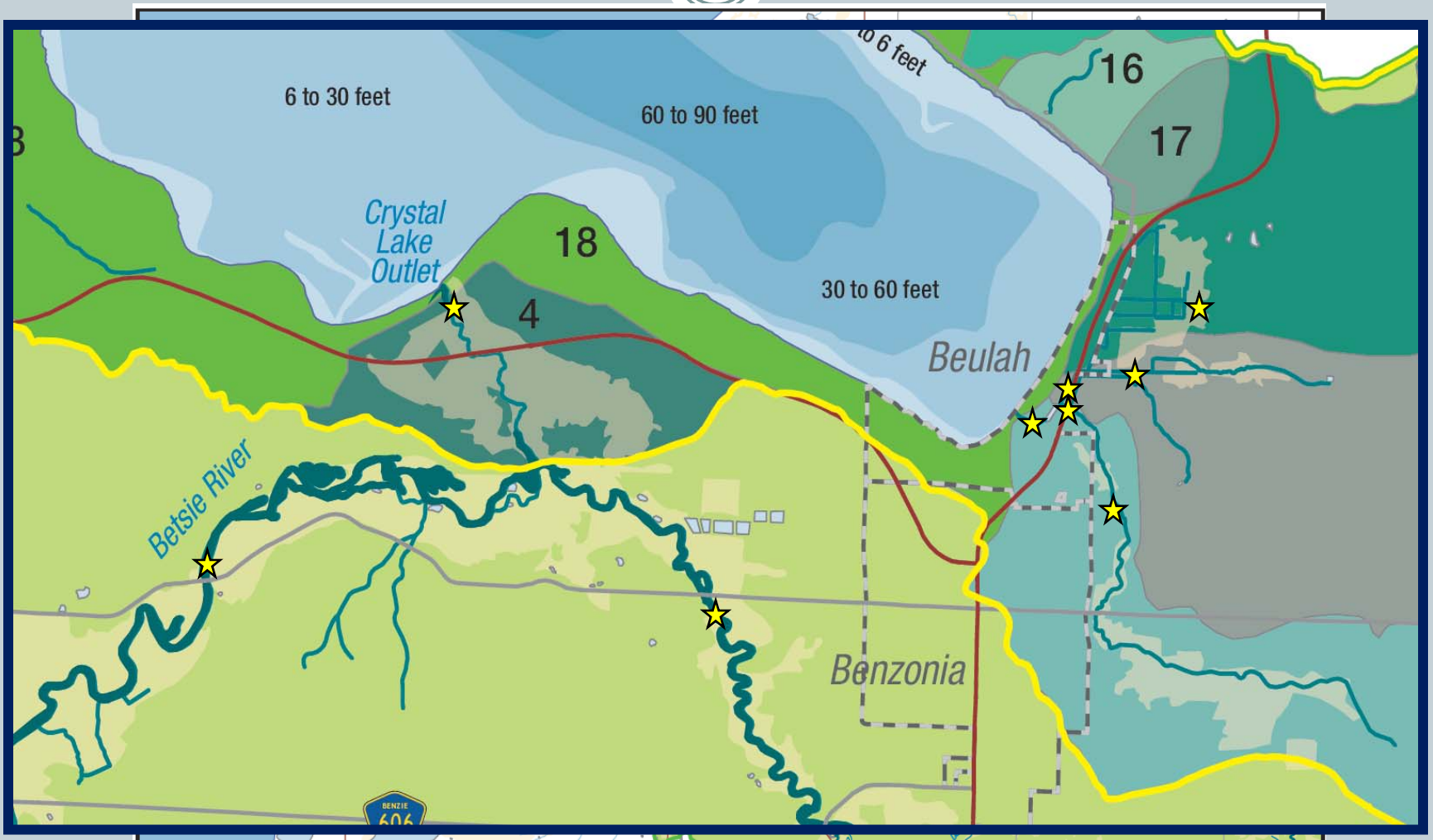
"The **cost of maintaining** the Cold Creek sediment basin, which cost is borne entirely by the Village of Beulah and the Township of Benzonia"

"...existing data on **nutrient and sediment loading** are **inconsistent** and may be **outdated**. Additional monitoring is included in the plan in order to confirm those findings."

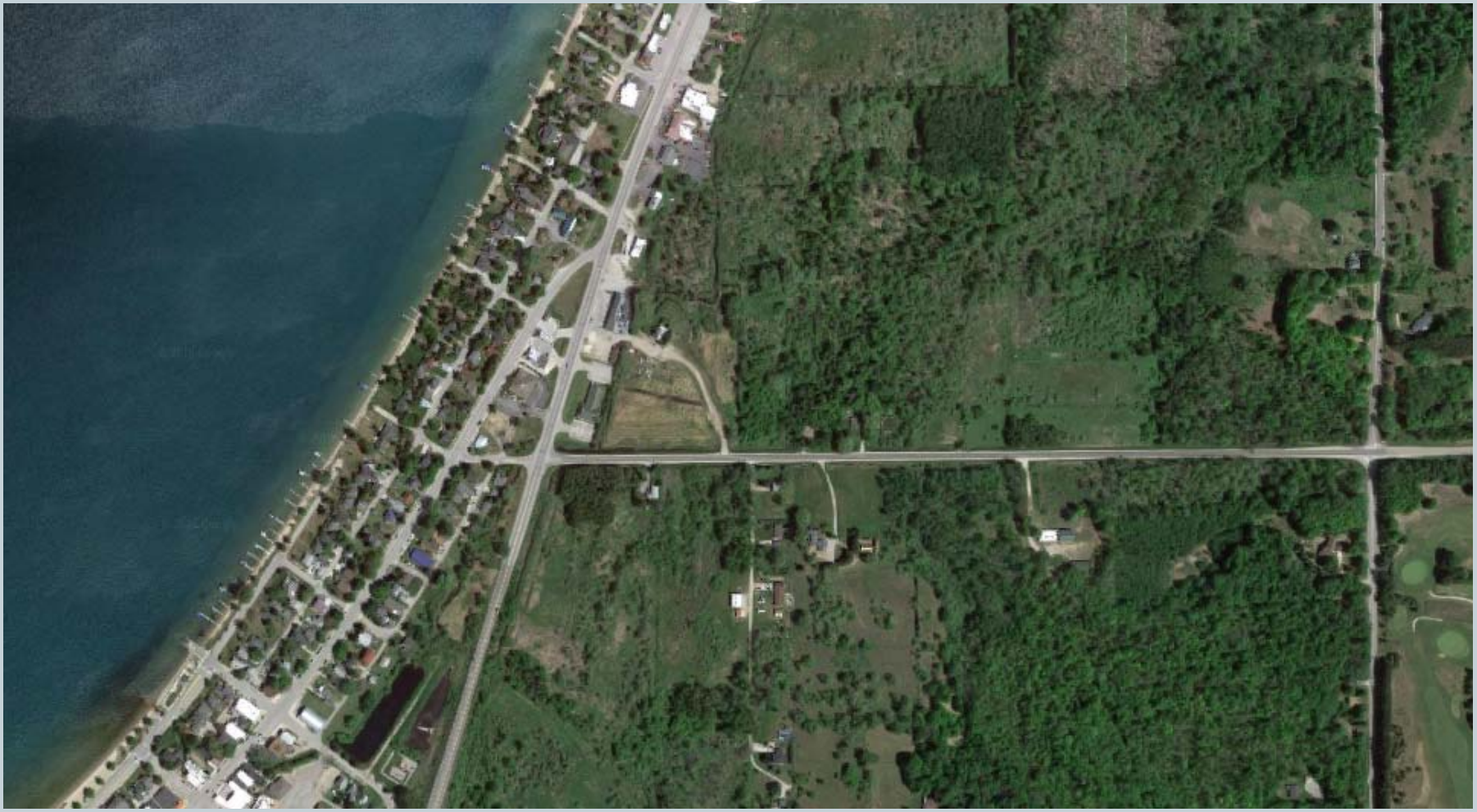
Flow Monitoring Requirements

- Select 10 sites – particular interest in streams < 30 ft in width
- Each site:
  - Flow measure 3 times between July 1 and September 30th
  - Base flow conditions
  - Measurements > 2 weeks apart
  - Two different sets of people have to take measurements
- Quality control at USGS gauge

Monitoring sites



Cold Creek

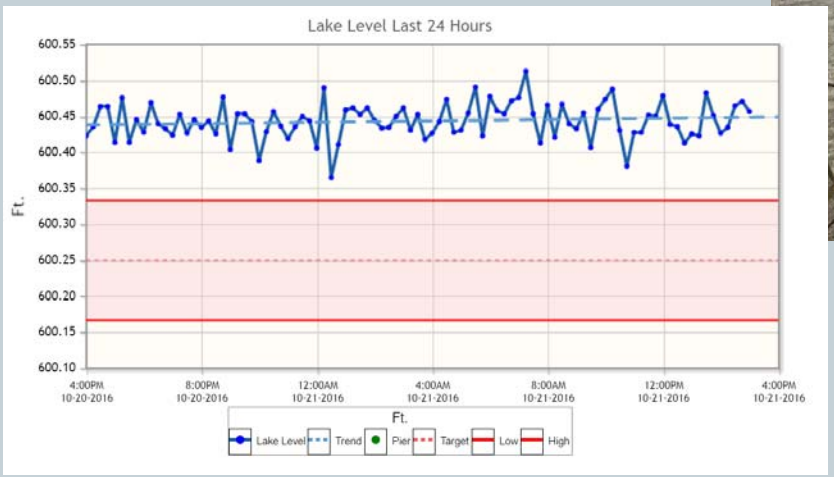


Crystal Lake Outlet

Crystal Lake Outlet Dam controls lakes levels

Typically higher flow in the spring and fall

Low or no flow in the summer



Monitoring Equipment

Provided
- Flow meter
- Measuring tape
- Stakes

Not Provided
- Waders
- Clipboards
- Pencils
- Committed volunteers
- 40+ years of watershed experience

Monitoring Procedures

For subsection 1:

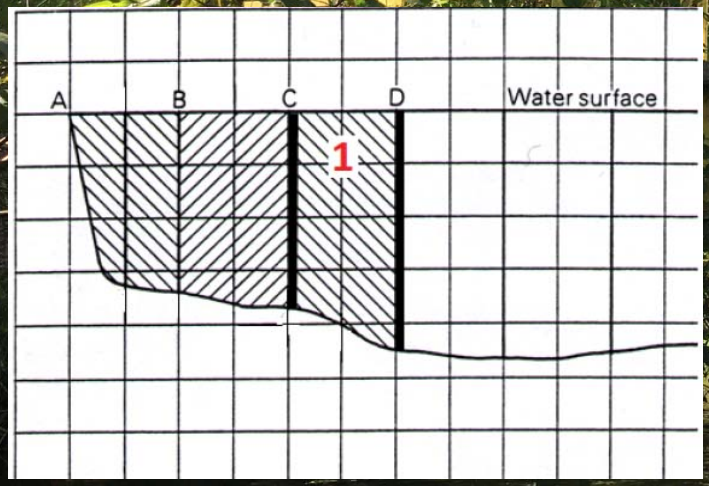
Width (feet) = Distance from C to D

Depth (feet) = Average depth of C and D

Velocity (feet/sec) = Average velocity of C and D

Discharge of Subsection 1 (cubic feet per second, cfs) = Width x Depth x Velocity

Total Discharge (cfs) = Sum of all subsection discharges



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MiCorps Volunteer Stream Flow Monitoring

Stream/Site Name:_____ MiCorps Database ID:_____

Watershed:_____ HUC:_____

Latitude:_____ Longitude:_____

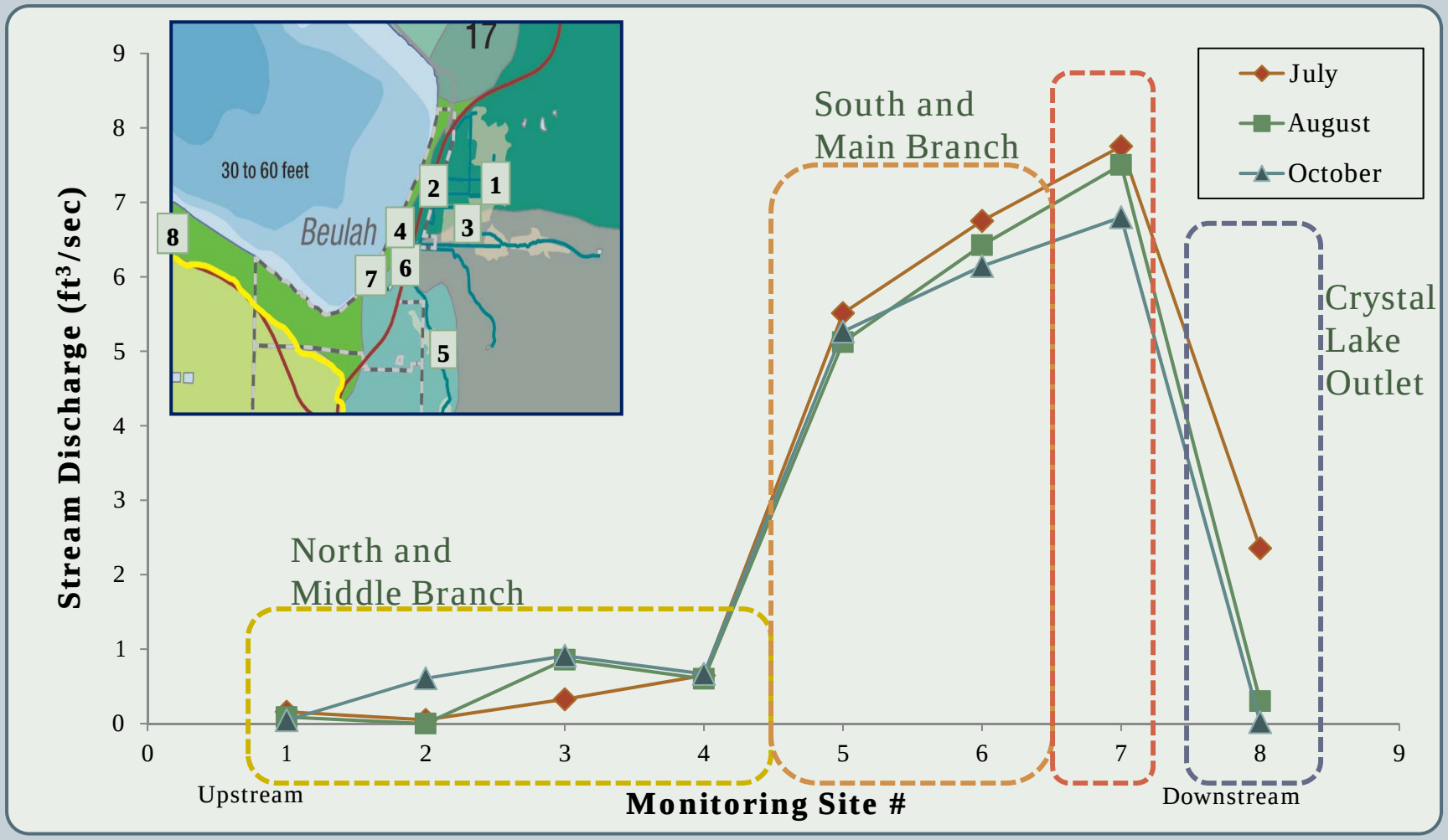
Date:_____ Team Members:_____

Date(s) of last rainfall:_____ Amount of previous rainfall (inches):_____

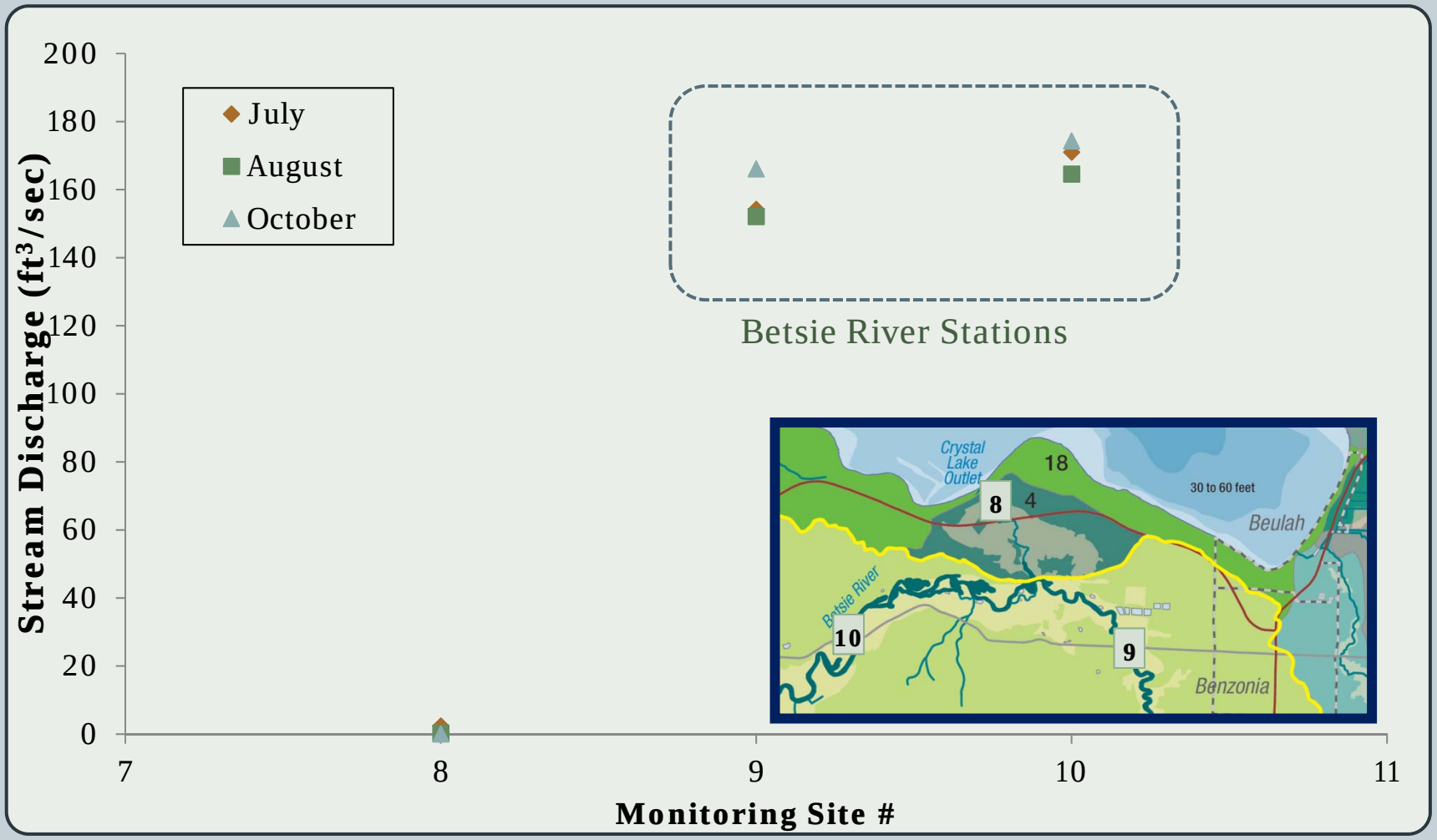
Total Stream Width:_____ Expected Subsection Width:_____

Measurement	Reading of Tape Measure (feet)	Depth (feet)	Depth(s) of Velocity Measurement(s)	Velocity (ft/sec)
1 (Water's Edge)				
2				
3				
4				
5				
6				
7				
8				
9				
10				
11				
12				
13				
14				
15				
16				
17				
18				
19				
20				
21 (Water's Edge)				

Cold Creek Flow



Betsie River Monitoring



What worked?

- The equipment and protocol
- Volunteers and training
- Data collection and entry
- Overall success

USGS check	Measured (cfs)	Gauge (cfs)	% error
1	133.3	130	2.5
2	121.7	118	3.1
3	135.3	118	14.7

Challenges

Challenges

- Site selection
- Scheduling
  - weather!
- Equipment
  - Low flow
- Time consuming
  - 6-9 hours to do all sites

Recommendations

- Get out there early
- Have more volunteers than needed
- Be patient?
- Extra volunteers
- Two flow meters

Project Breakdown

- Project manager ~ 30-40 hours
- Intern ~ 35 hours
- Volunteers (4) ~ 37 hours

- Minimum 2 person crew
  - 3 with two flow meters

Future projects

- Combine flow data with:
  - Nutrients
  - Sediment
  - E. coli
  - Crystal Lake Outlet flow and level gauge
  - Stream hydrology citizen science program

Acknowledgements

- Volunteers and interns
  - Stacy, Ed, Dave, Max, Ashley, and Jane
- Paul Steen

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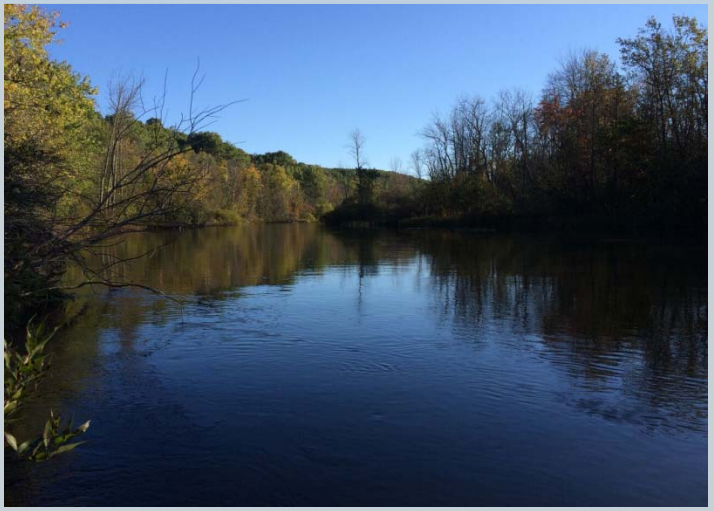

Questions?