Spring Creek Tracer Testing Update

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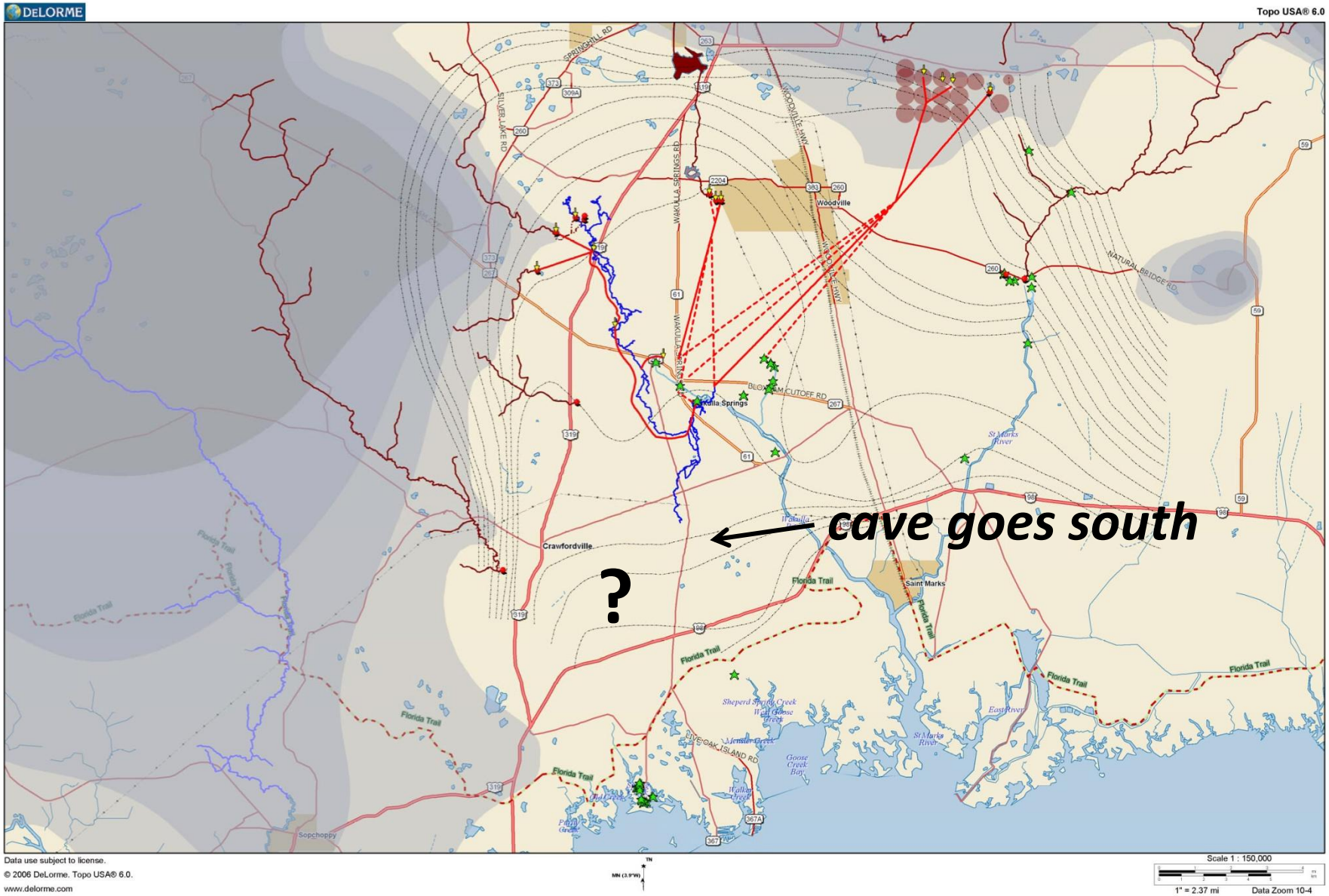
Background & Objectives



Timeline …

- May 4, 2007: Inject 10 kg Uranine into Turner Sink
  - Travels rapidly to Wakulla Spring
  - 8 & 19 days after injection
  - Turns Wakulla green
  - No recovery at Spring Creek
- May 29, 2008: Inject 10 kg Uranine into Lost Creek Sink
  - Travels rapidly to Spring Creek Vent #10
  - Less than 5 days travel time
  - Recovery curve stops shortly afterward – Spring Creek Reversing
  - Subsequent recovery at Revell (~50 days after injection)
  - Subsequent Recovery at Wakulla Spring (~56 days after injection)
- July 14, 2009: Inject 15 kg Uranine into Lost Creek Sink
  - Spring Creek reversing
  - First detection @ Revell Sink
  - Changed direction toward Spring Creek (Spring Creek Flowing)
  - Detection @ Punch Bowl
  - Recovery at all major Spring Creek Vents

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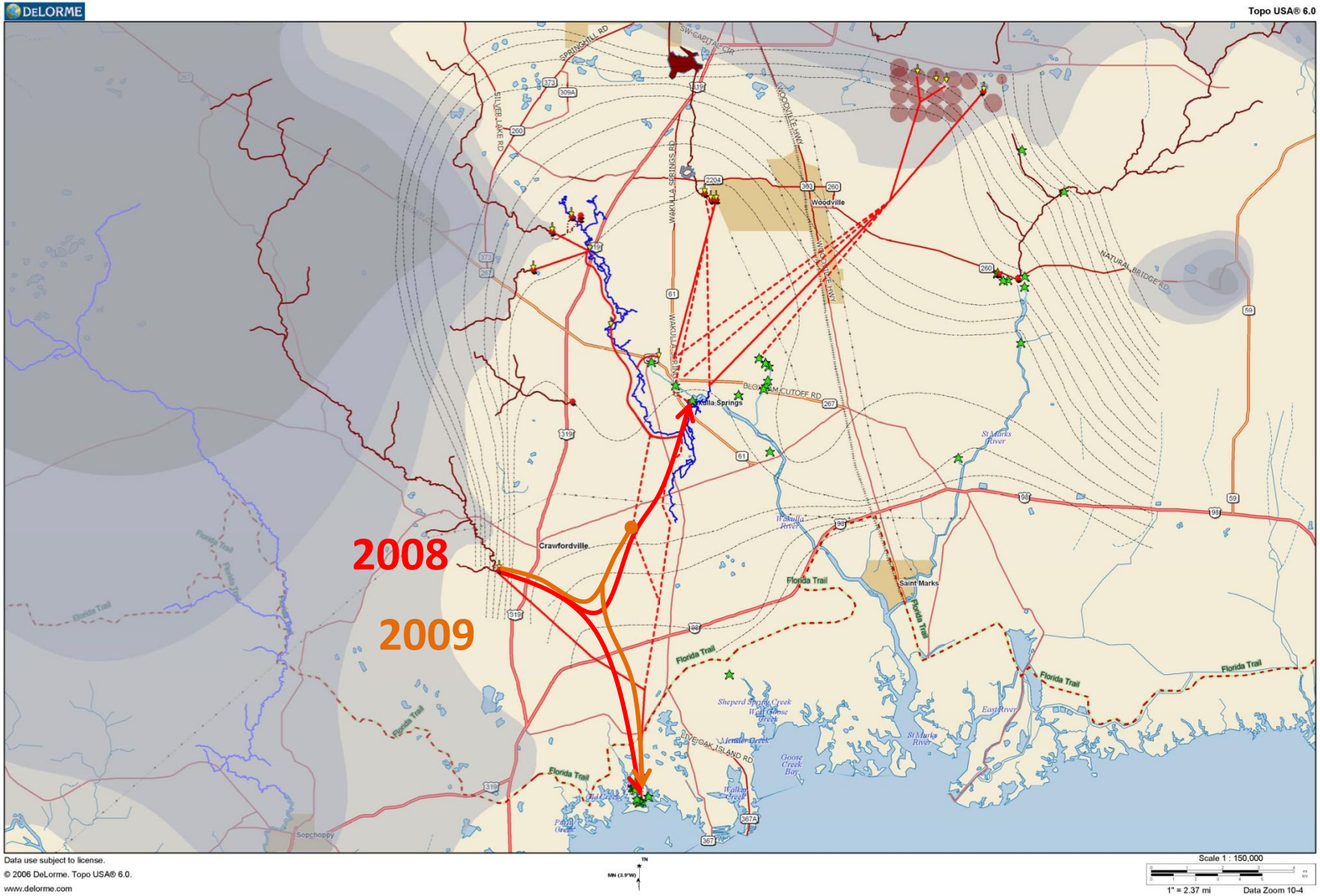
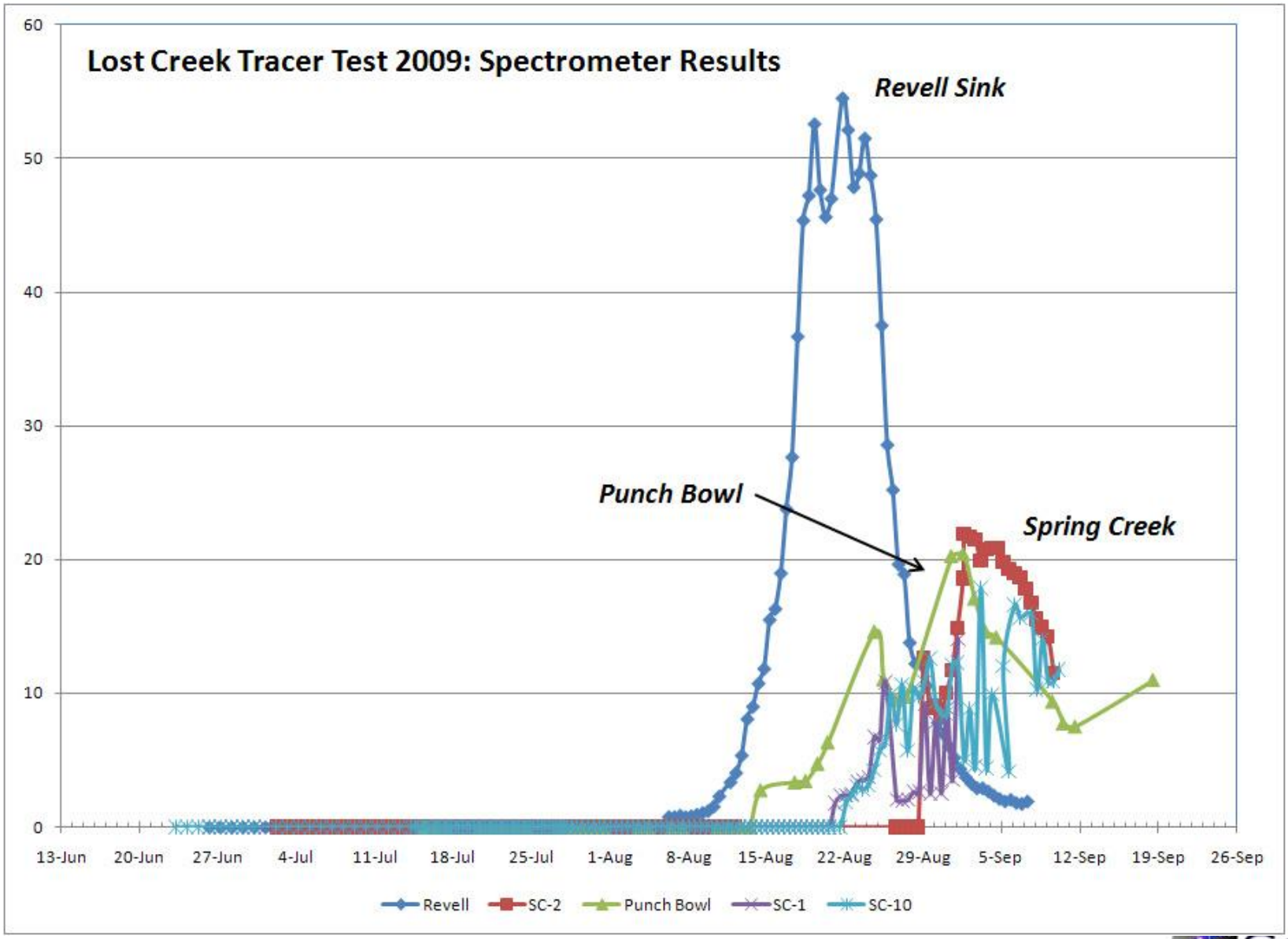
New Confirmed Pathways



Tracer Detections



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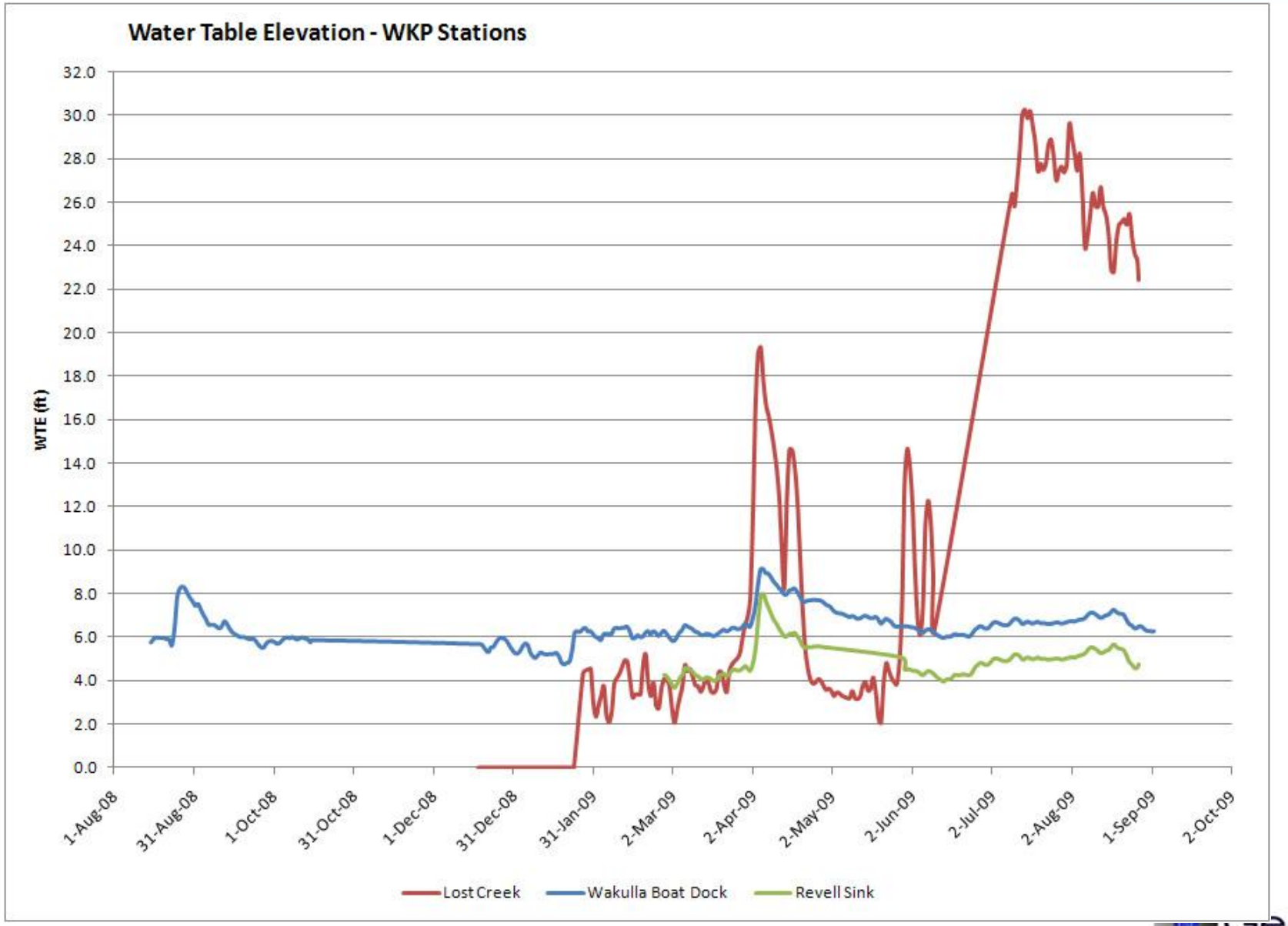
Water Table Elevations



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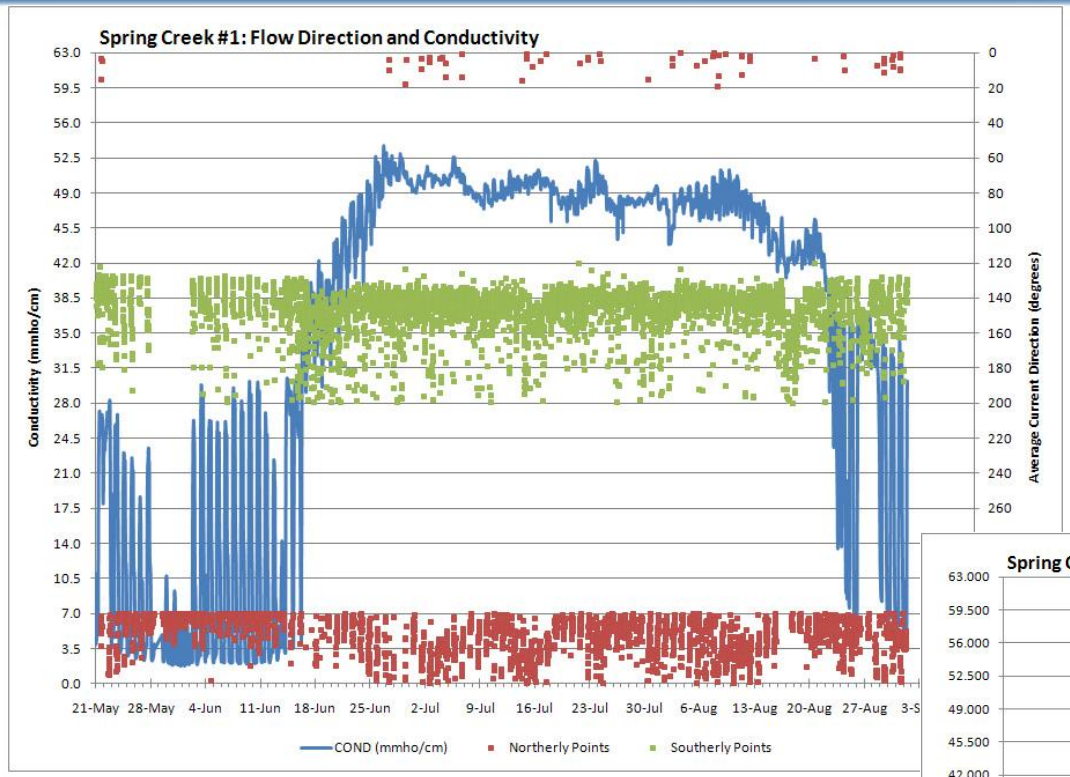
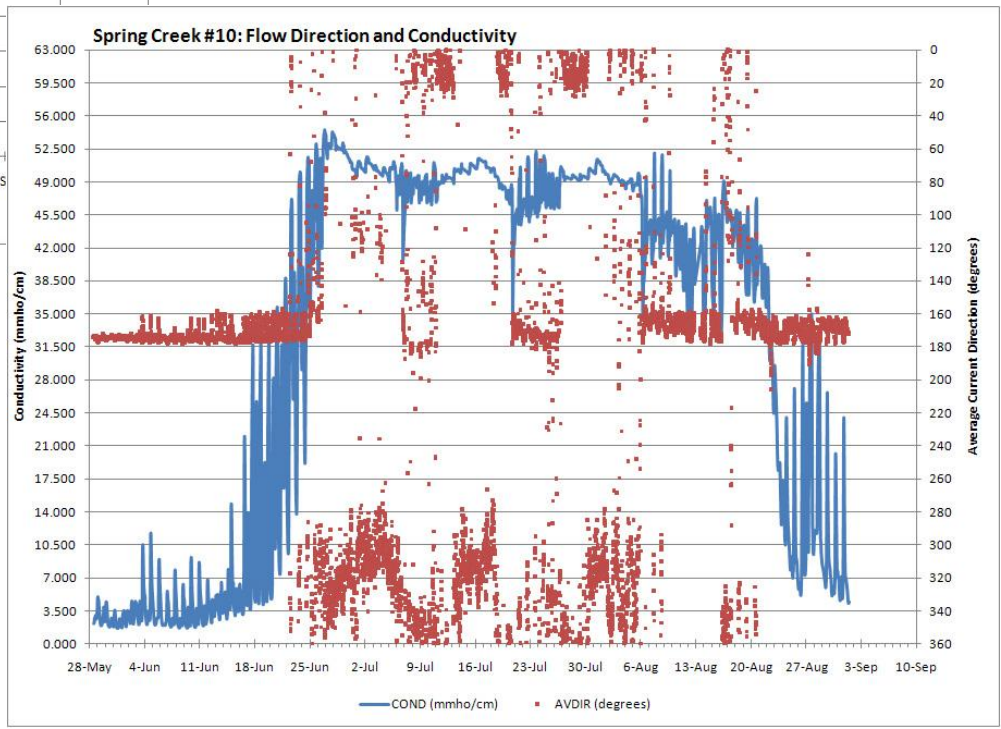
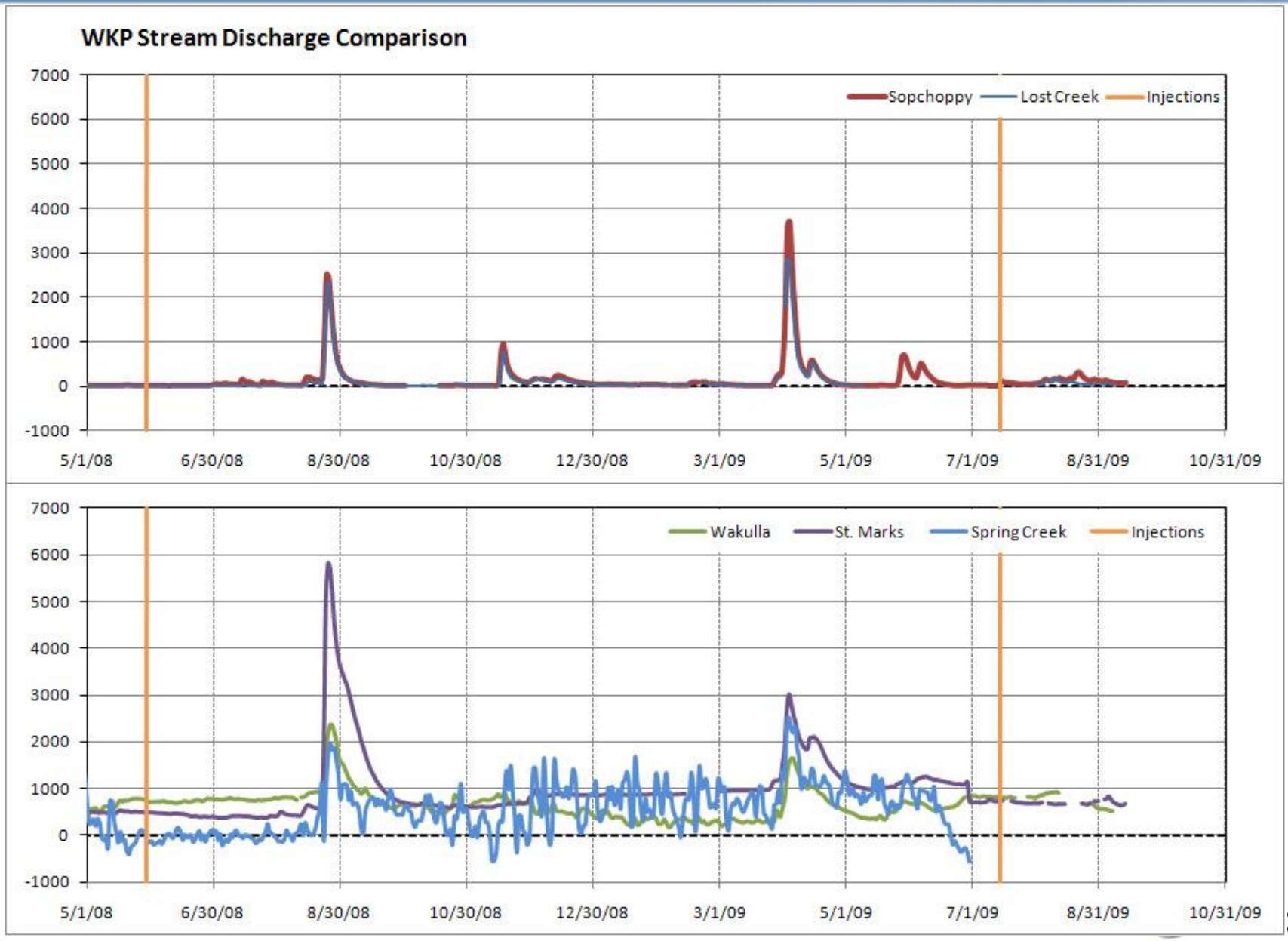
Spring Creek Reversals

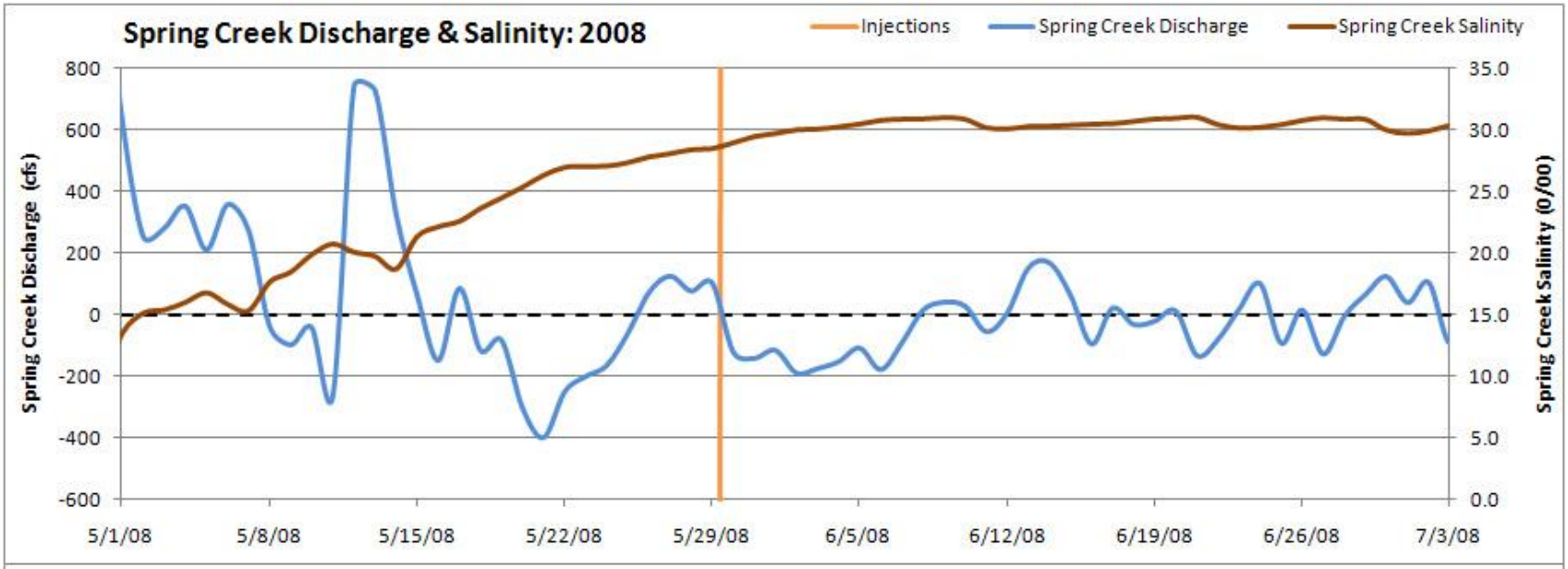


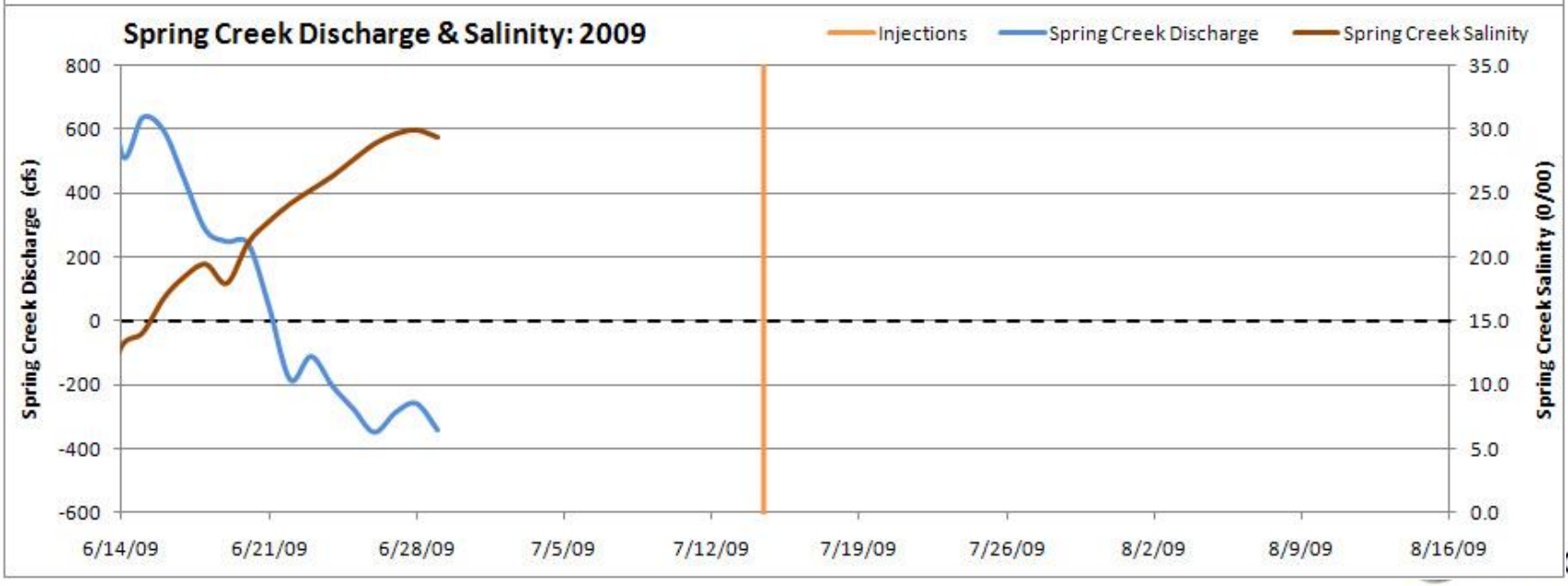


River Flow Trends



Spring Creek Conditions





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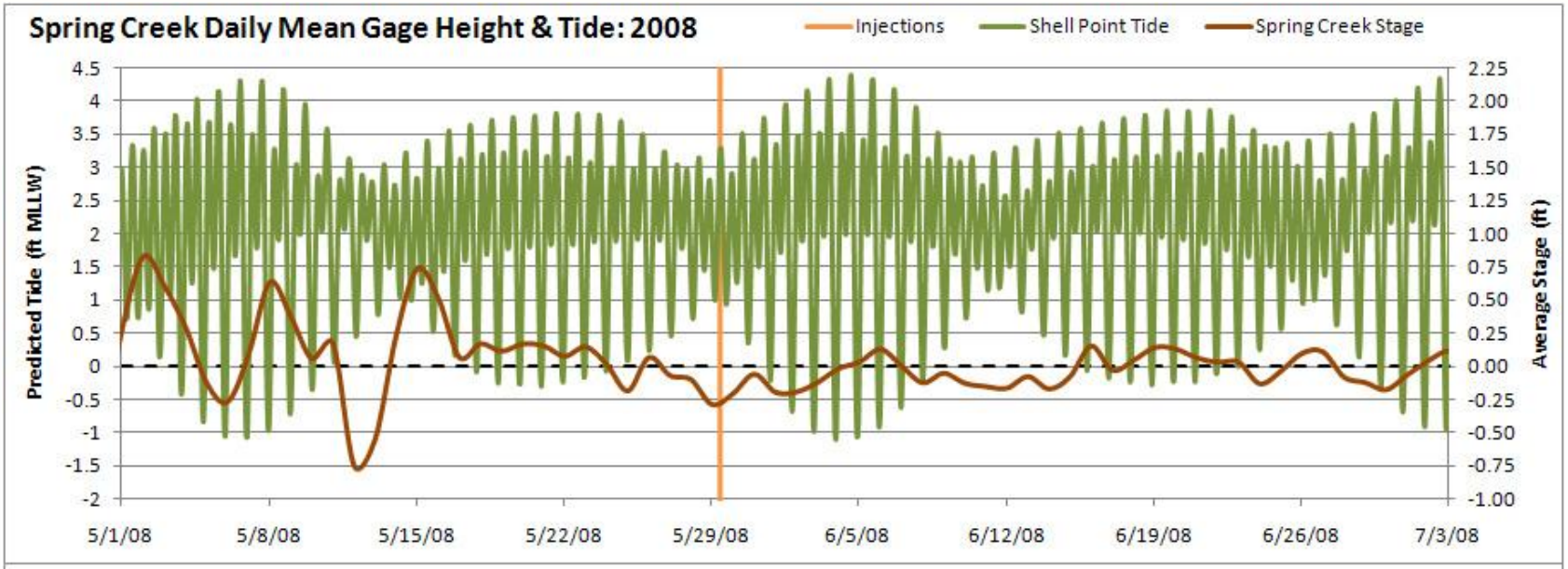
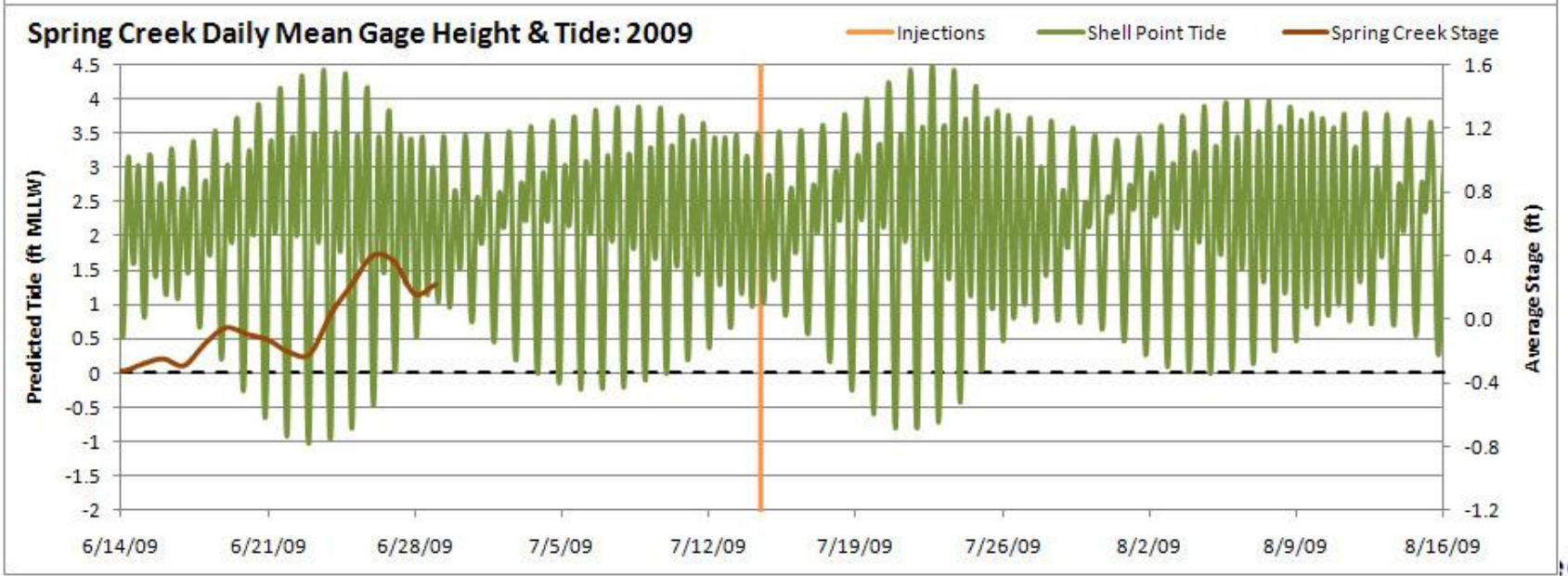
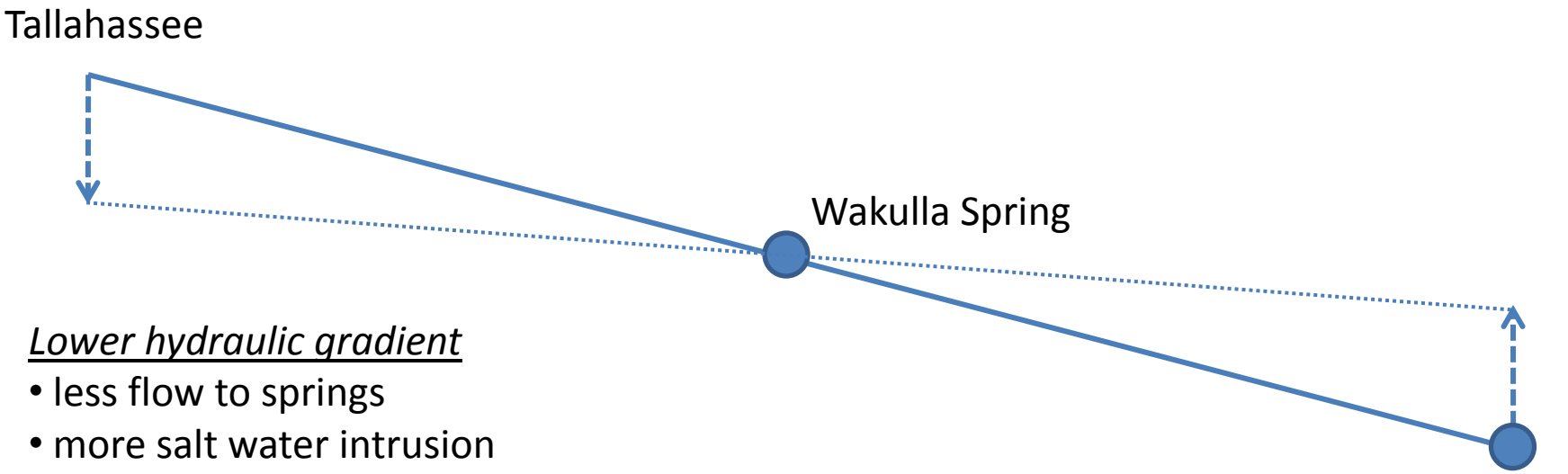
Spring Creek Tide





Hydraulic Gradient



Lower hydraulic gradient

- less flow to springs
- more salt water intrusion

Changing water levels

- depressed conditions in north
- deeper unsaturated zone
- elevated conditions in south
- reduced unsaturated zone

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Summary - 1

- Wakulla and Spring Creek are connected by one or more large conduits.
- When Spring Creek reverses, Wakulla takes it's groundwater flow – i.e. the Wakulla Springshed expands to include all of the area that formerly contributed to Spring Creek.
- Diminished water clarity conditions in summer at Wakulla are likely due to water quality of Spring Creek water.

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Why does Spring Creek reverse?

- Not sure – but trying to find out…
- Consensus focuses on depressed groundwater gradients and tide.
- Under low flow conditions, high tides likely reverse gradient at spring Creek.
- Denser salt water flows into the large caves.
- Denser water requires relatively larger gradient to drive it out.
- Water levels in the southern part of the WKP stay high (flooded sinks…) until the groundwater gradient rises sufficiently to drive the salt water out of the Spring Creek caves.
- When the gradient reaches the critical level, the Spring Creek vents begin to flow, the elevated water levels in the south fall, and Wakulla's flow drops.

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Summary - 2

- Water clarity at Wakulla is, in part, dependent on the duration of the Spring Creek reversals.
- If trends continue (sea-level rise & groundwater level declines), the duration of Spring Creek reversals will increase.
- Reducing upland groundwater declines would contribute to reducing the duration of the Spring Creek reversals.
- Protecting water clarity requires an understanding of the groundwater budget and how extractions impact that budget.
- Achieving these protections will require continued (probably expanded) data collection.
  - Groundwater levels
  - Flows
  - Spring Creek variability

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