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### Palmer River Water Discharge and Nutrient Study

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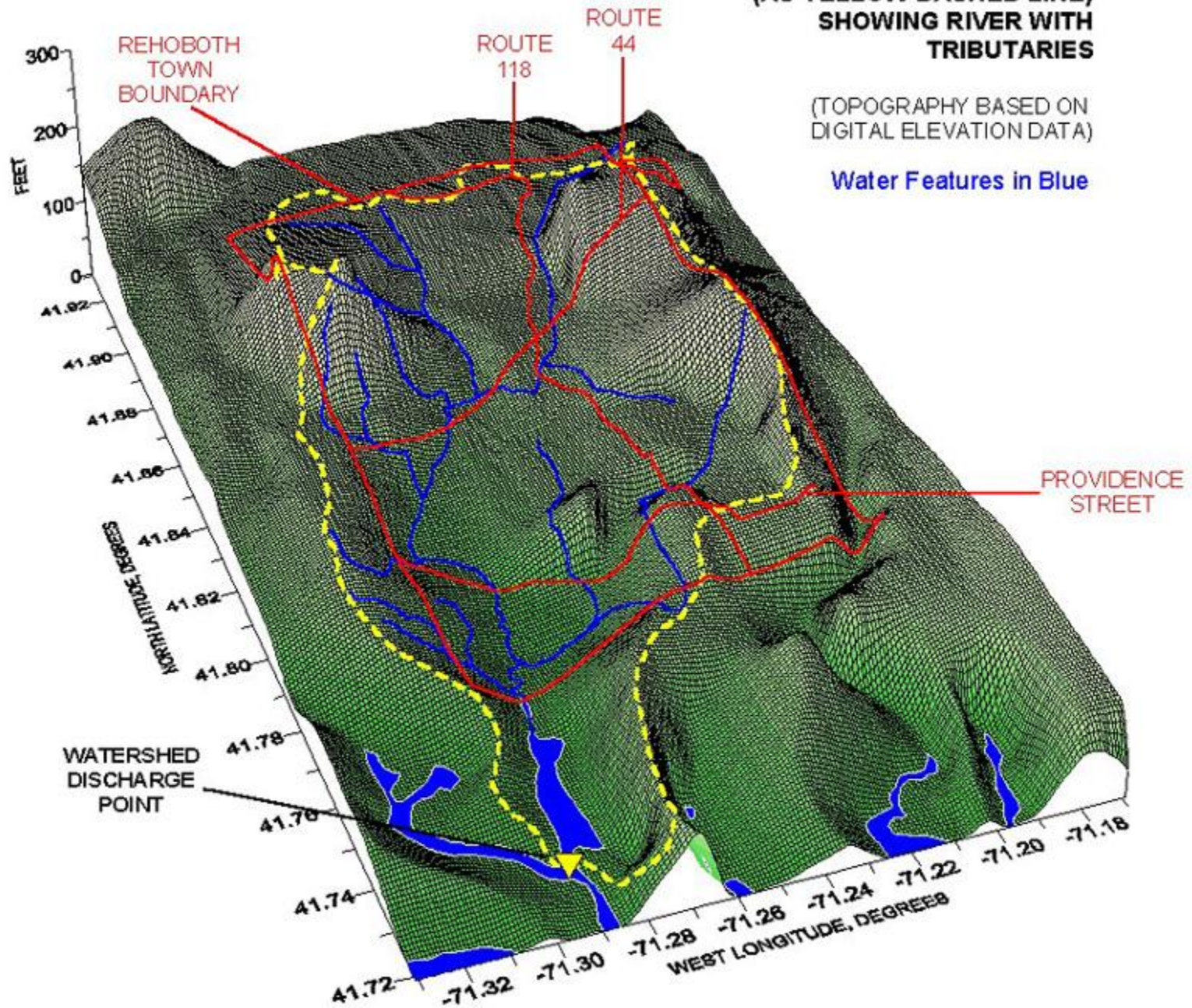
# *Painter River Water Discharge & Nutrient Study*

Conducted by Dighton-Rehoboth  
Regional High School  
Environmental Science Class

**PALMER RIVER WATERSHED  
(AS YELLOW DASHED LINE)  
SHOWING RIVER WITH  
TRIBUTARIES**

(TOPOGRAPHY BASED ON  
DIGITAL ELEVATION DATA)

Water Features in Blue



# What we looked for:

- **Stream Discharge:** Width x Depth x Velocity
- **Nutrient concentration** (mg/L)
- **Load:** Discharge x Concentration
  - **Nutrients examined:**
    - Phosphates
    - Nitrates
    - Dissolved Oxygen
    - pH
    - Temperature



# The tools!

Dissolved Oxygen, Temperature & pH Sensor



Sigma Probe Sampler –  
Phosphates & Nitrates



Tape Measure -Width





# More tools!

Velocity Sensor  
& Depth Rod



Wooden Float & Anchor  
For Mooring sensors  
Overnight



Life Jackets for Analysts going  
Into Deeper waters. Yikes!



2 of our fearless  
leaders: Mr. Evans &  
Mrs. Borges-Dubois



# Site 1: Wilmarth Bridge Road

- Located just off of Route 44 approximately  $\frac{3}{4}$  the way to Seekonk
- Rehoboth is <10% Impervious cover
- Very quiet, low population density neighborhood

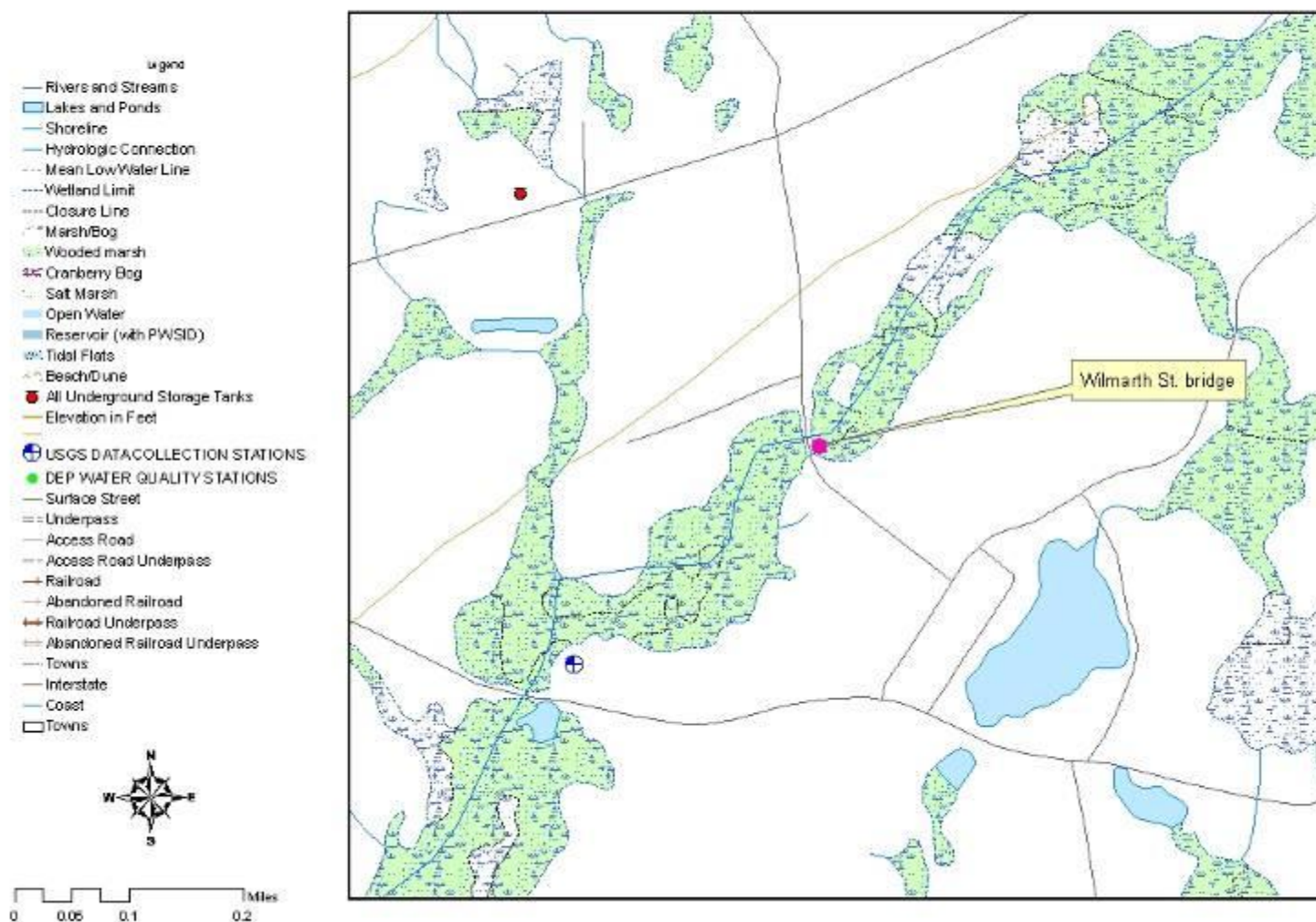


# Wilmarth Bridge Road Analyst Team

Sarah, Christy, Alida, Janine, Leslie,  
Alyssa, Patrick, Joe, Mark, Devin, &  
Kirk



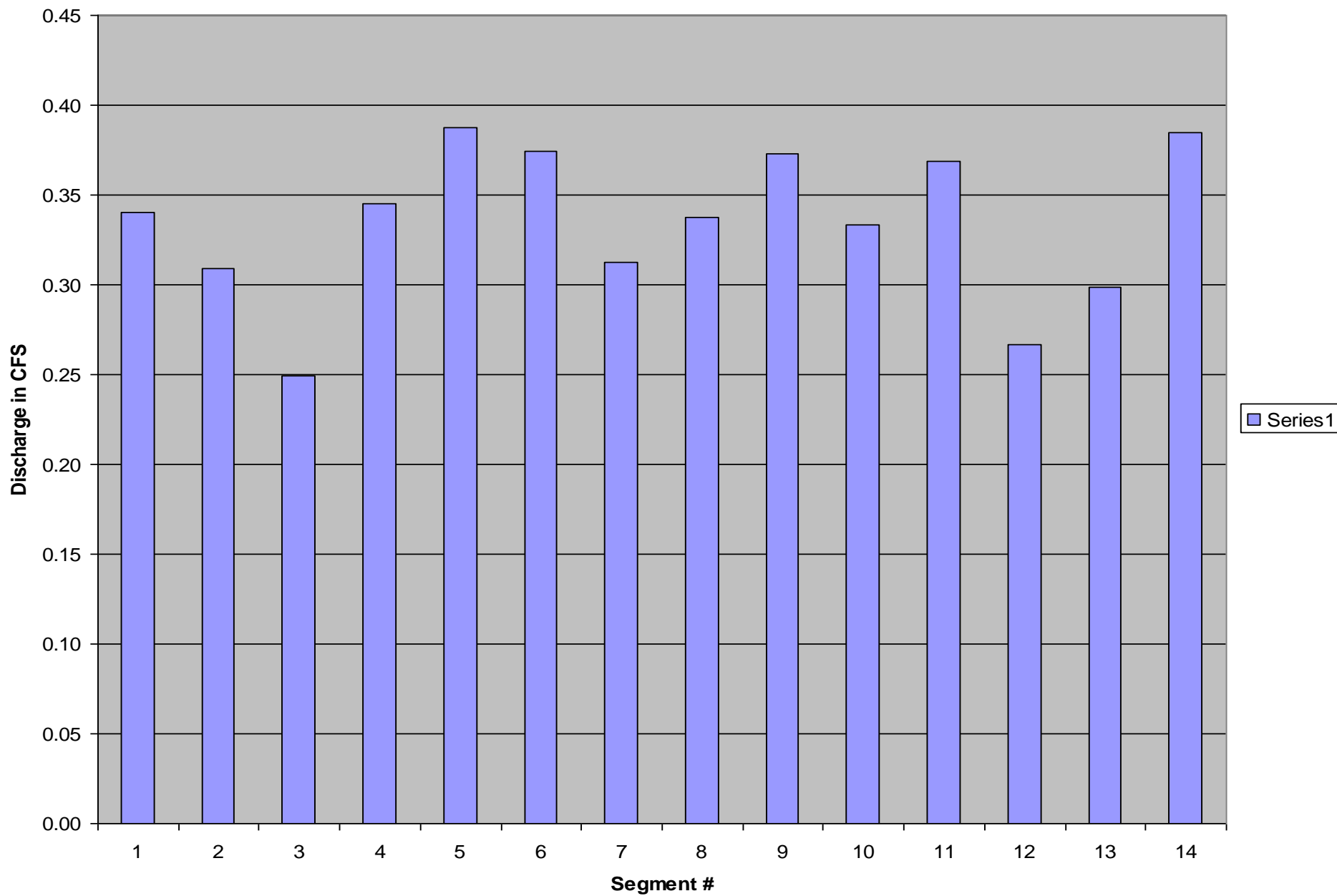
# Wilmarth Bridge Road site



## Wilmarth Bridge Road site

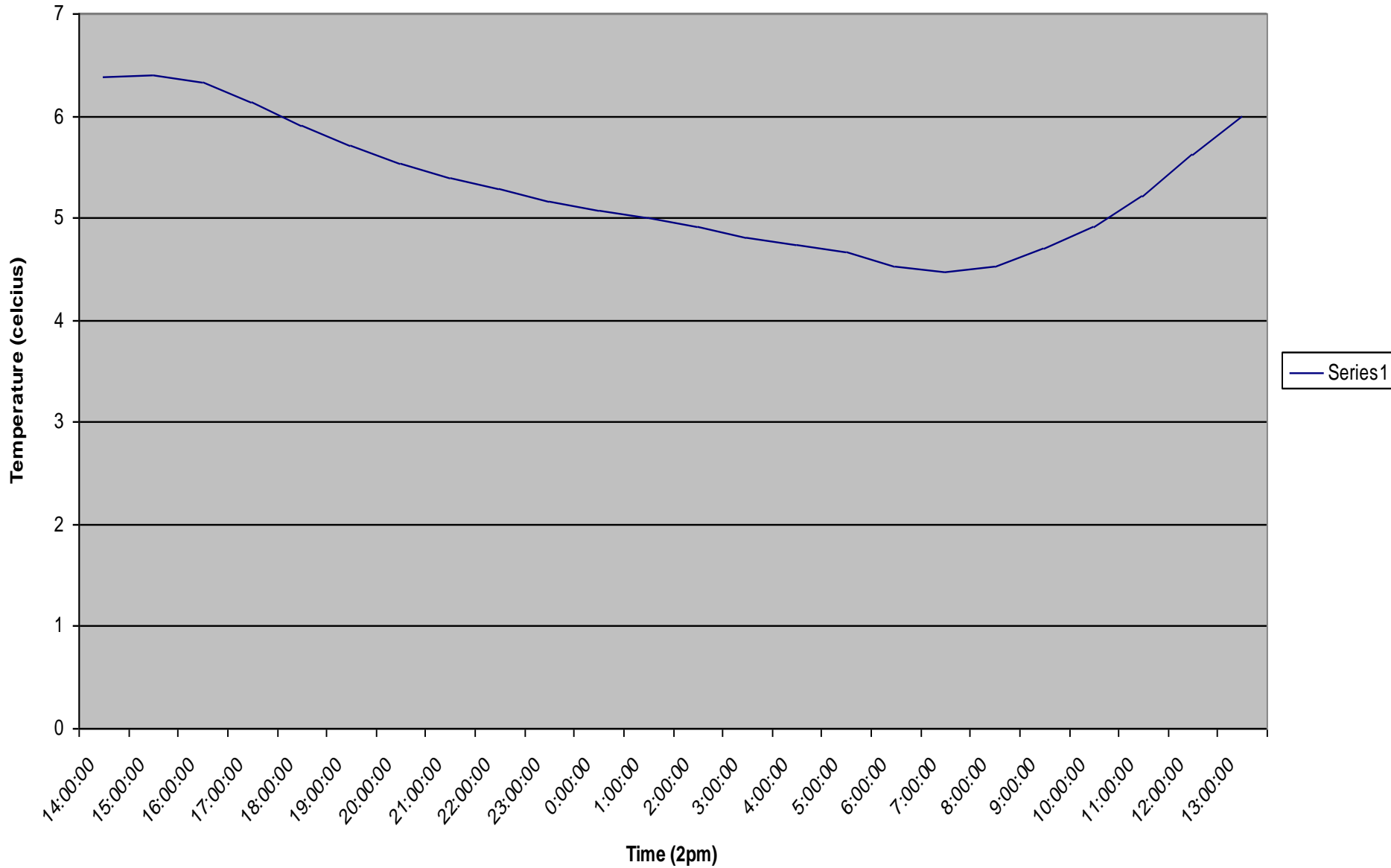


Discharge by segment-Wilmarth

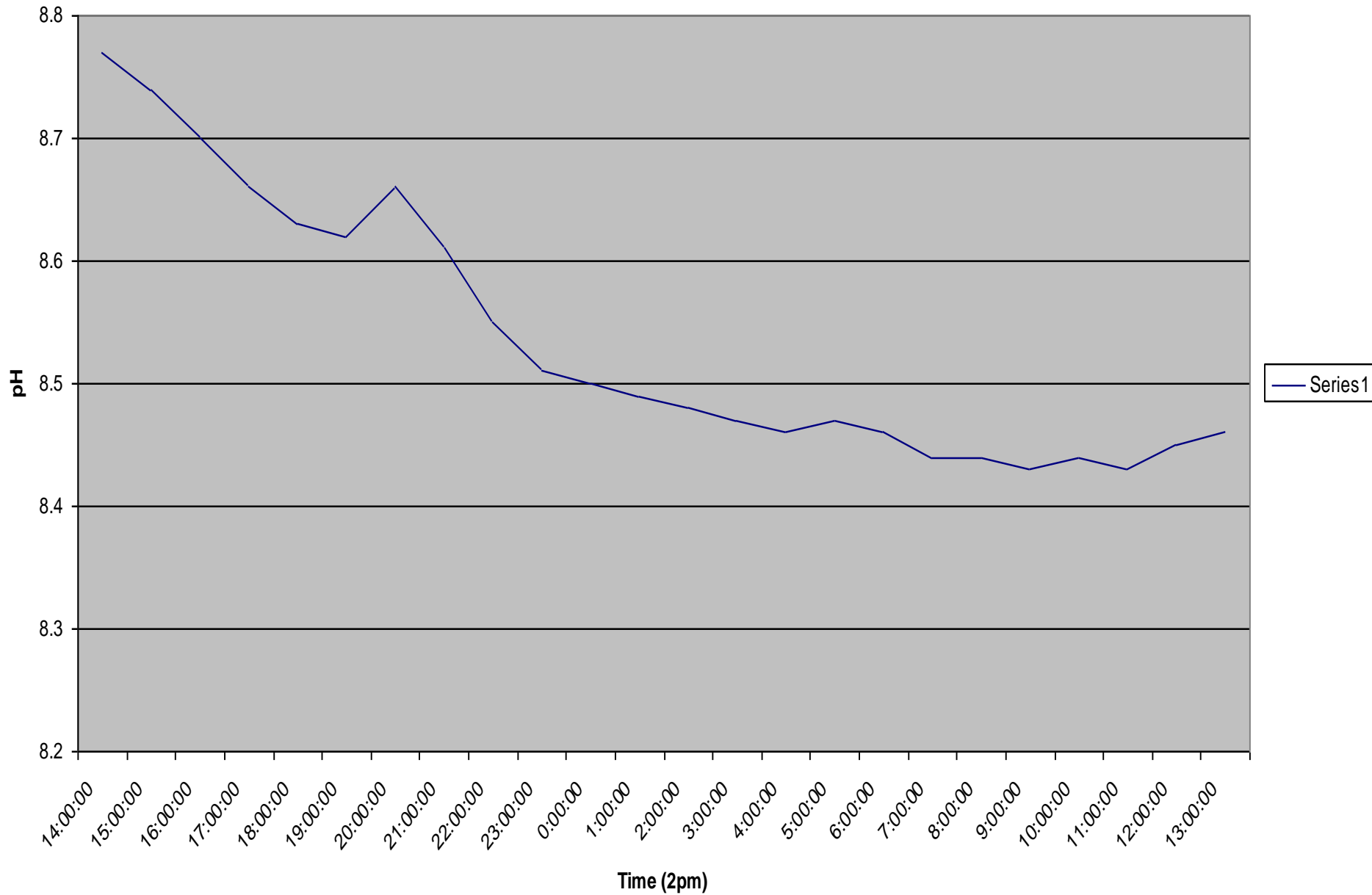




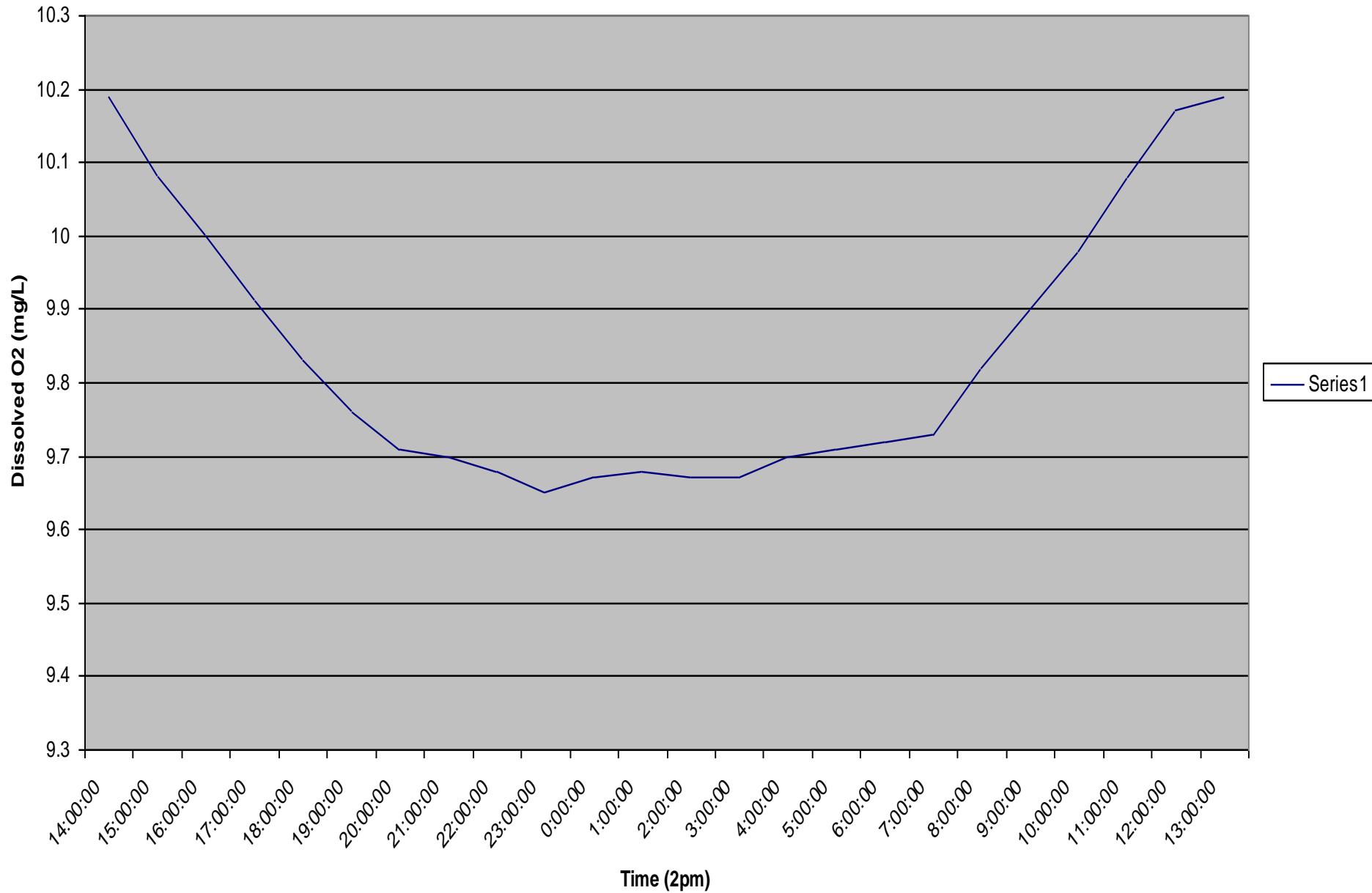
Wilmarth: Temperature vs. Time



Wilmarth: pH vs. Time



Wilmarth: Dissolved Oxygen vs. Time





# Site 2: Reed Street & the Shad Factory Pond

- Located in southern Rehoboth – Near Swansea
- Site of the Shad Factory Pond
- Less than 10% Impervious cover
- Site of Fish Ladder Reconstruction project

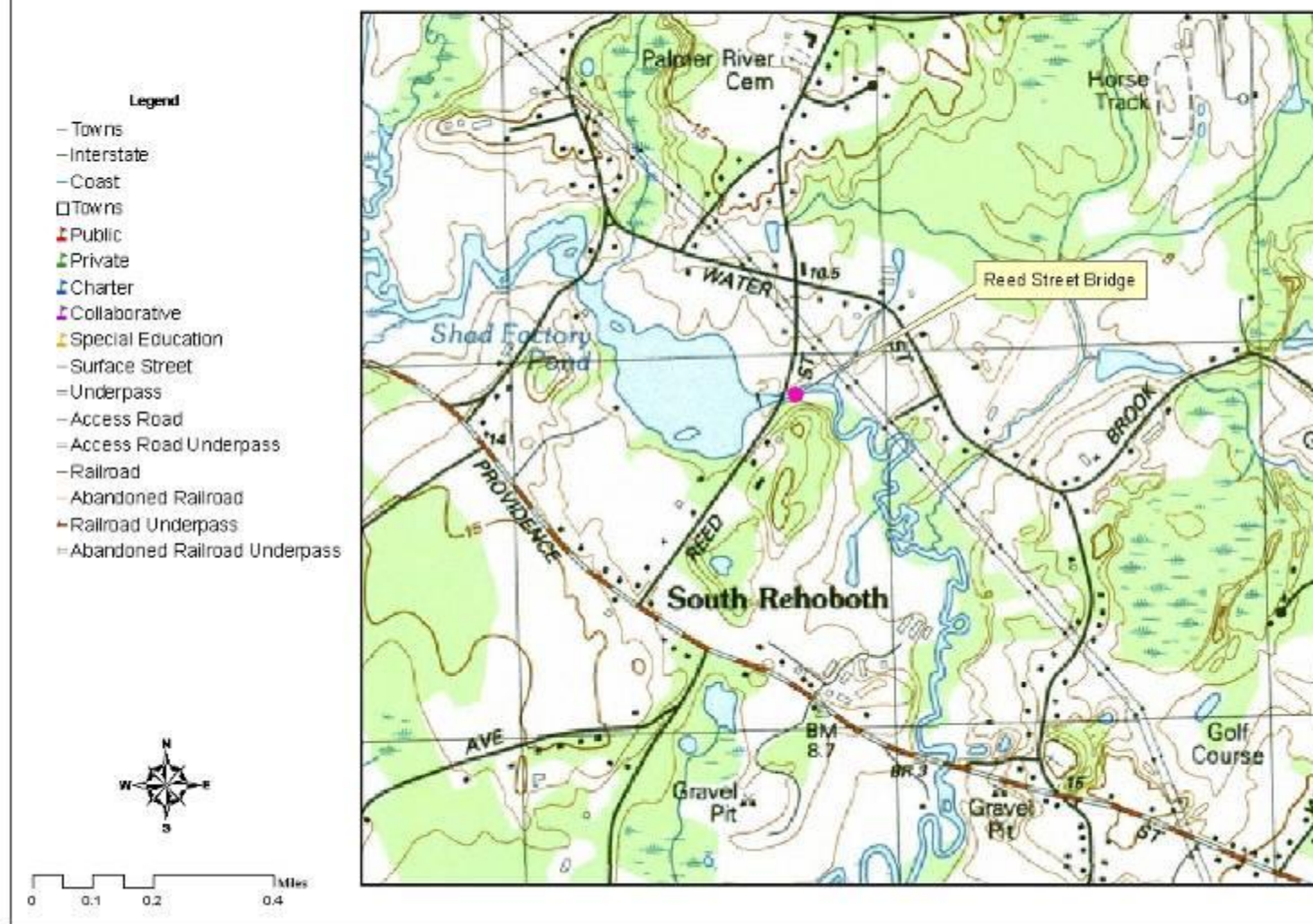


# Reed Street Analyst Team

Colin, Jeremy, Kristen, Lindsey,  
Josh, Tyler, Ryan, Spencer,  
Meghan, Kevin, & Ryan

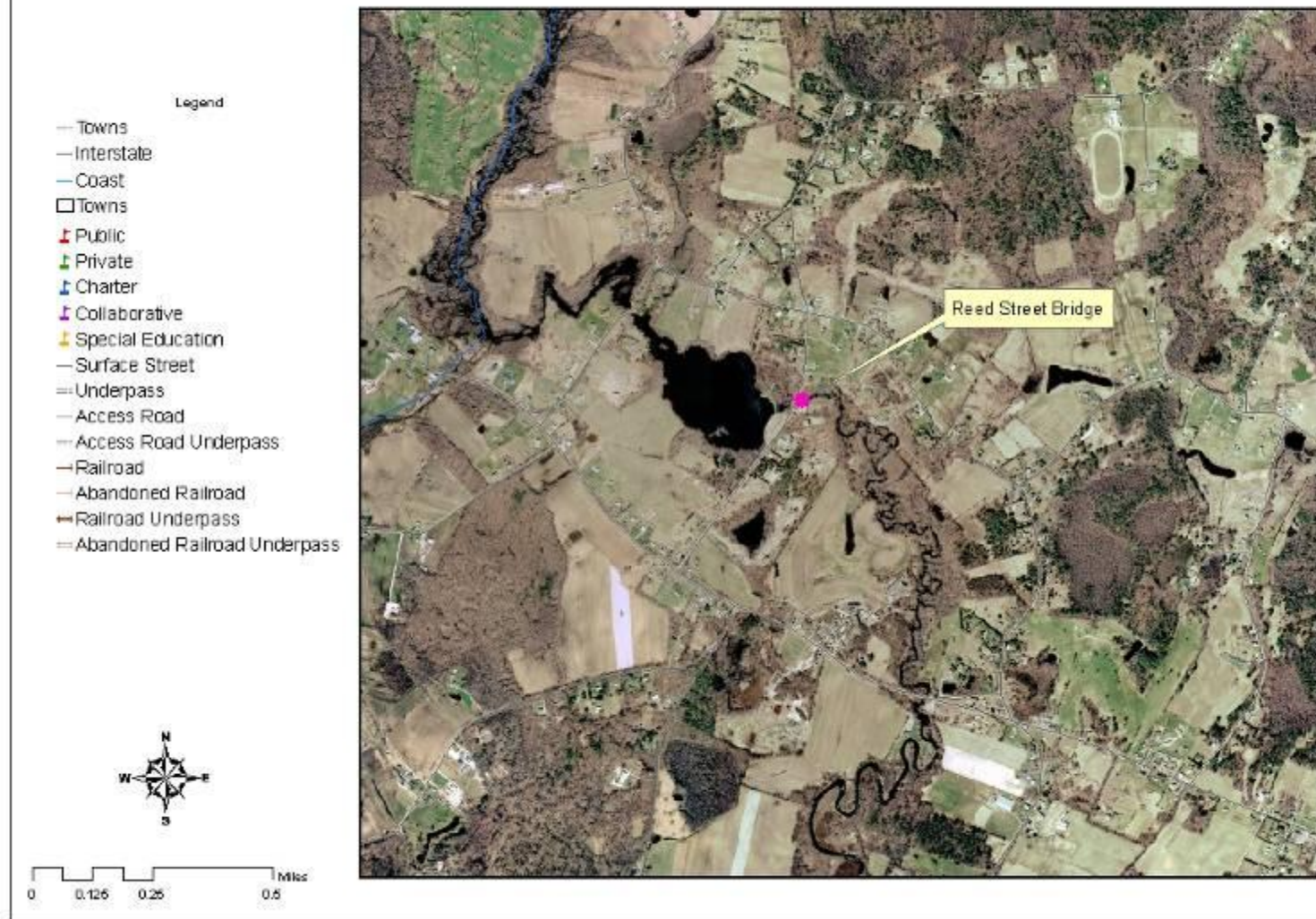


# Reed Street Bridge site

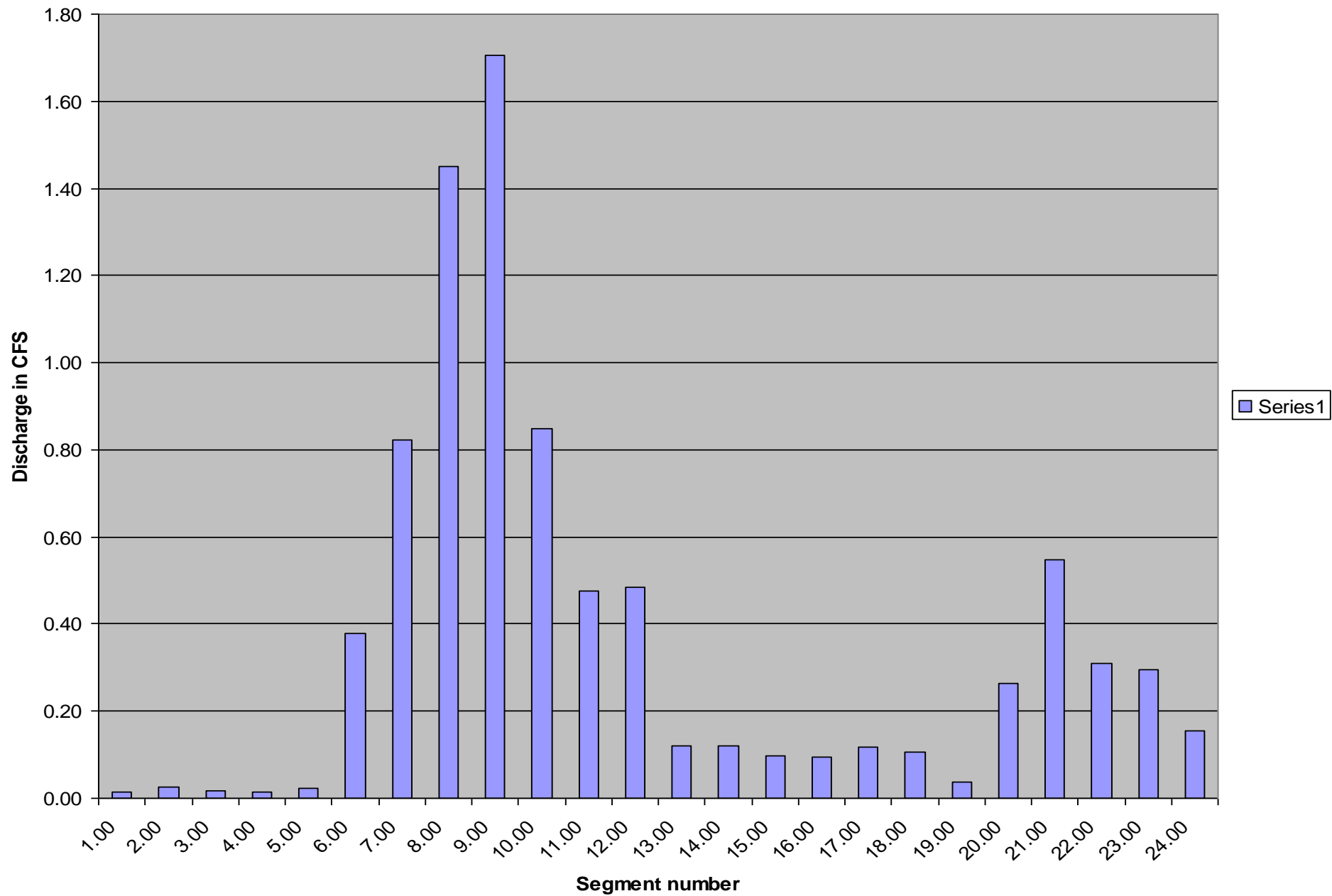




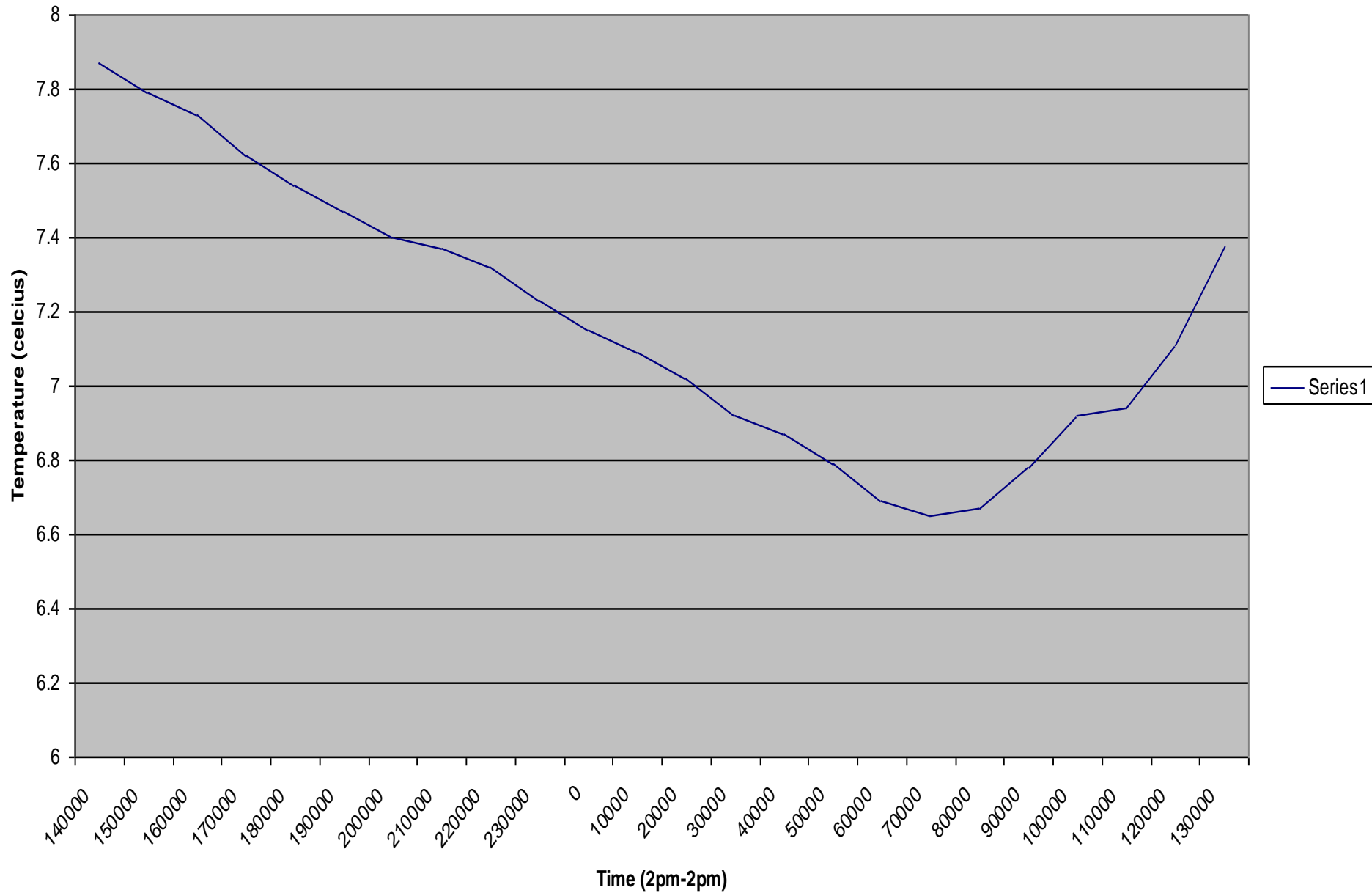
# Reed Street Bridge site



Discharge by segment-Reed st.

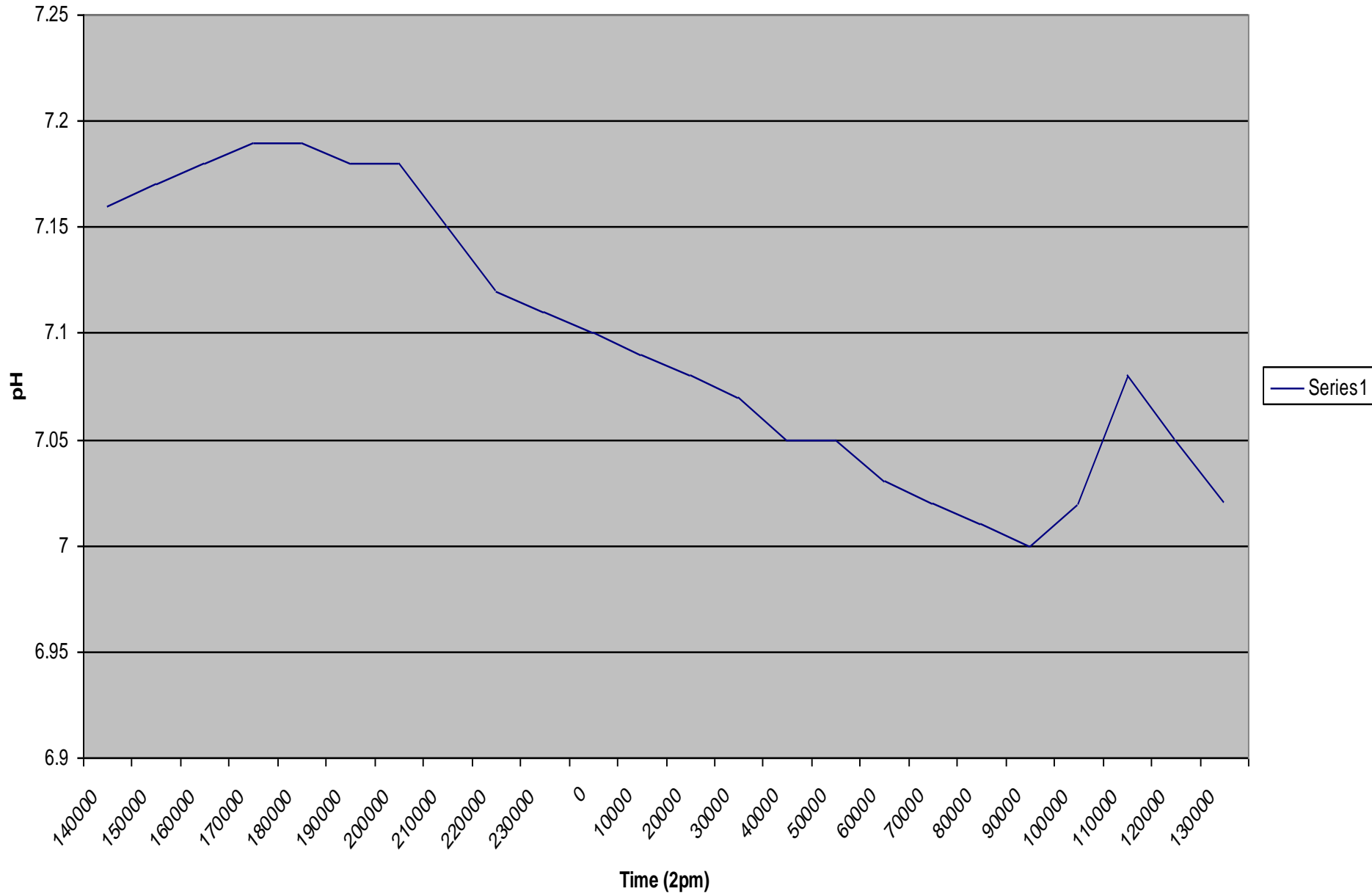


Reed Street Temperature vs. Time

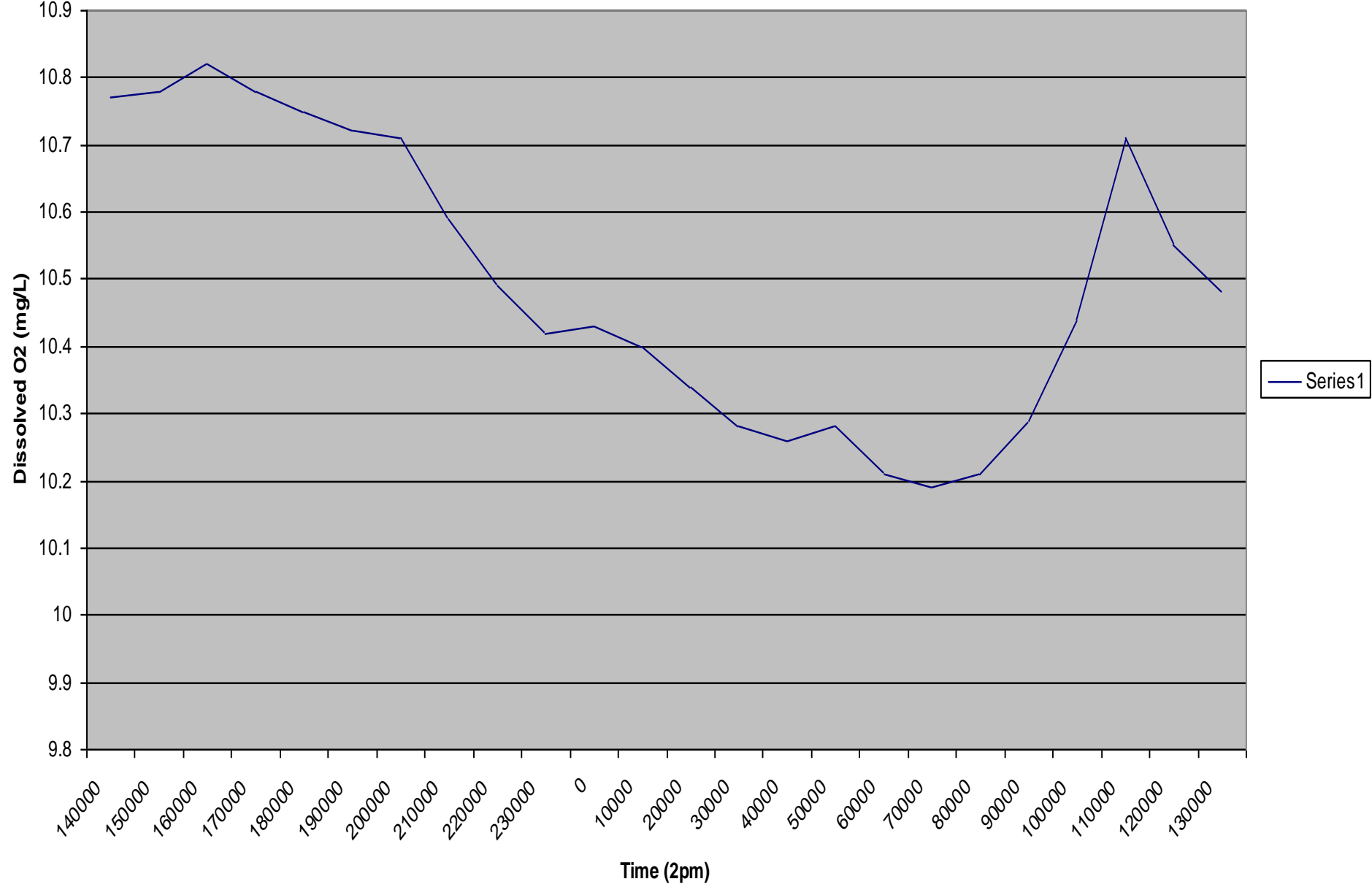




Reed Street: pH vs. Time



Reed Street: Dissolved O2 vs. Time



# Comparison of the 2 sites

- While the Wilmarth Bridge Road segment is one of many contributors to the overall Palmer River [as well as its downstream Reed Street counterpart], their significance may be partially inferred from the following:

<b><u>Primary Habitat Characteristics</u></b>	<b><u>Wilmarth Bridge Road</u></b>	<b><u>Reed Street</u></b>
<u>% Cobble</u>	20-34% (fair)	>50% (Excellent)
<u>Velocity</u>	<0.5 fps (poor)	Same (though other regimes were present within the immediate stretch of river)
<u>Embeddedness</u>	0-25% (excellent)	Same

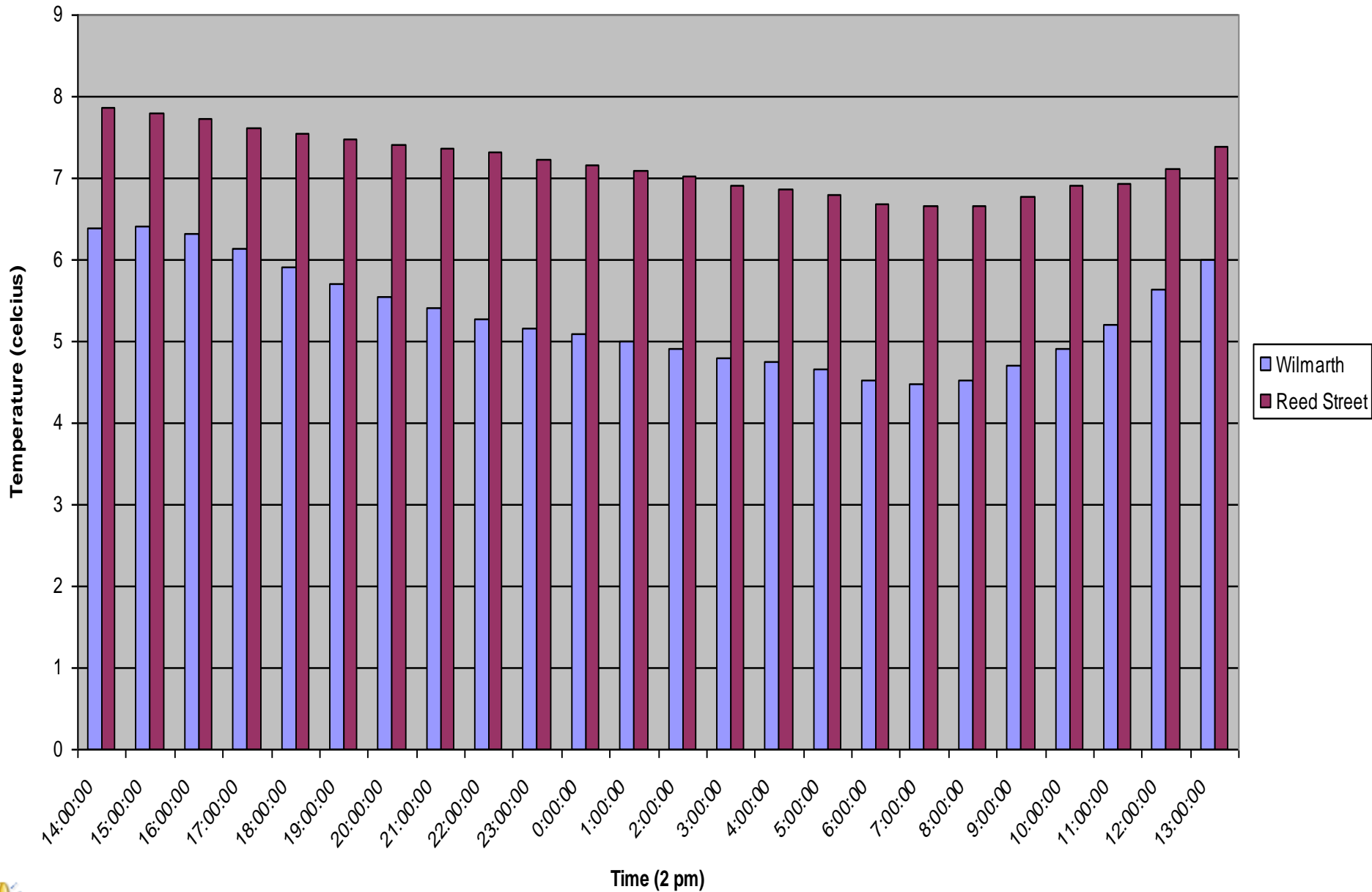
<b><u>Primary Habitat Characteristics</u></b>	<b><u>Significance of Characteristic</u></b>
<u>% Cobble</u>	Indicator of sediment deposition & load carried by river
<u>Velocity</u>	Figures into Discharge & acts as a selective force on the native Biota
<u>Embeddedness</u>	Indicator of microhabitats available for different types of biota. Ex: algae, scraper-insects



<b><u>Secondary Habitat Characteristics</u></b>	<b><u>Wilmarth Bridge Road</u></b>	<b><u>Reed Street</u></b>
Velocity/Depth Regimes	2 of 4 present, fast-shallow dominant (good-fair)	All 4 present (excellent)
Riffle Characteristics	40-60% of segment is riffle, riffle is as wide as the stream, but its length is <2x the stream width (good)	Same
Conditions of Banks (% eroding)	<10%, mostly healed (good)	Same
Bank Vegetation	> 90% (excellent)	Same
Overhead Canopy	> 75% (excellent)	50-75 % (good)

<b><u>Secondary Habitat Characteristics</u></b>	<b><u>Significance of Characteristic</u></b>
Velocity/Depth Regimes	Indicator of the # of microhabitats available → can indicate relative level of biodiversity possible & available base for local food chain
Riffle Characteristics	Indicator of relative saturation of dissolved gasses (O <sub>2</sub> , CO <sub>2</sub> )
Conditions of Banks (% eroding)	Indicates ability of Riparian plants to maintain root integrity as well as how local precipitation affects discharge levels
Bank Vegetation	Indicates soil fertility and overall health of Riparian buffer zone
Overhead Canopy	Indicates the relative degree of the temperature-mitigating properties of local Flora

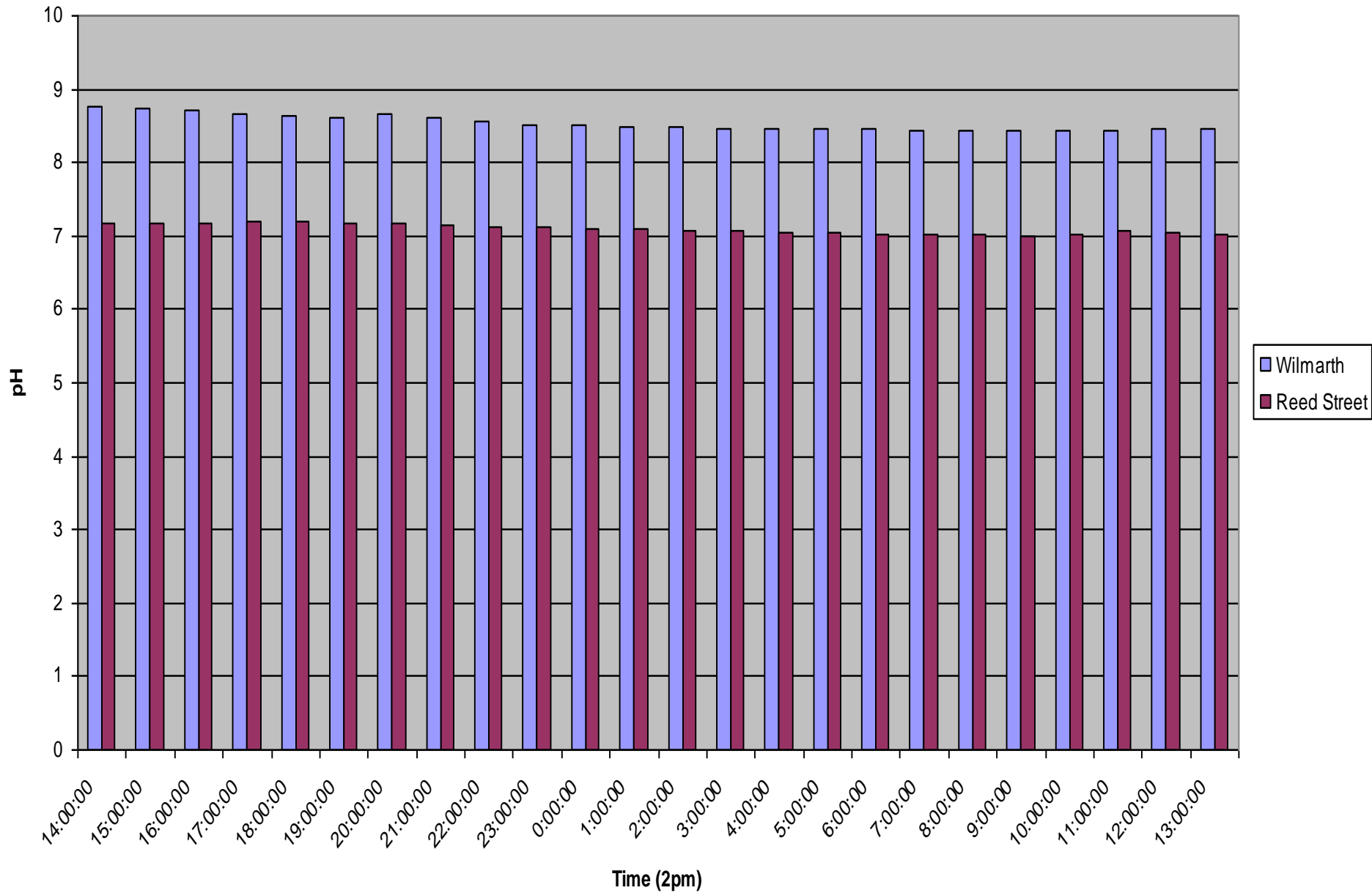
Temperature vs. Time - both sites



# Inferred significance I

- Observation: Reed Street maintained a higher Temperature than Wilmarth and exhibited fewer variations
- Hypothesis: This may be because of the higher discharge. The high *Specific Heat Capacity* of water combined with the shear *Volume* helped Reed street retain the heat & exhibit less day/night variation

pH vs. Time - both sites





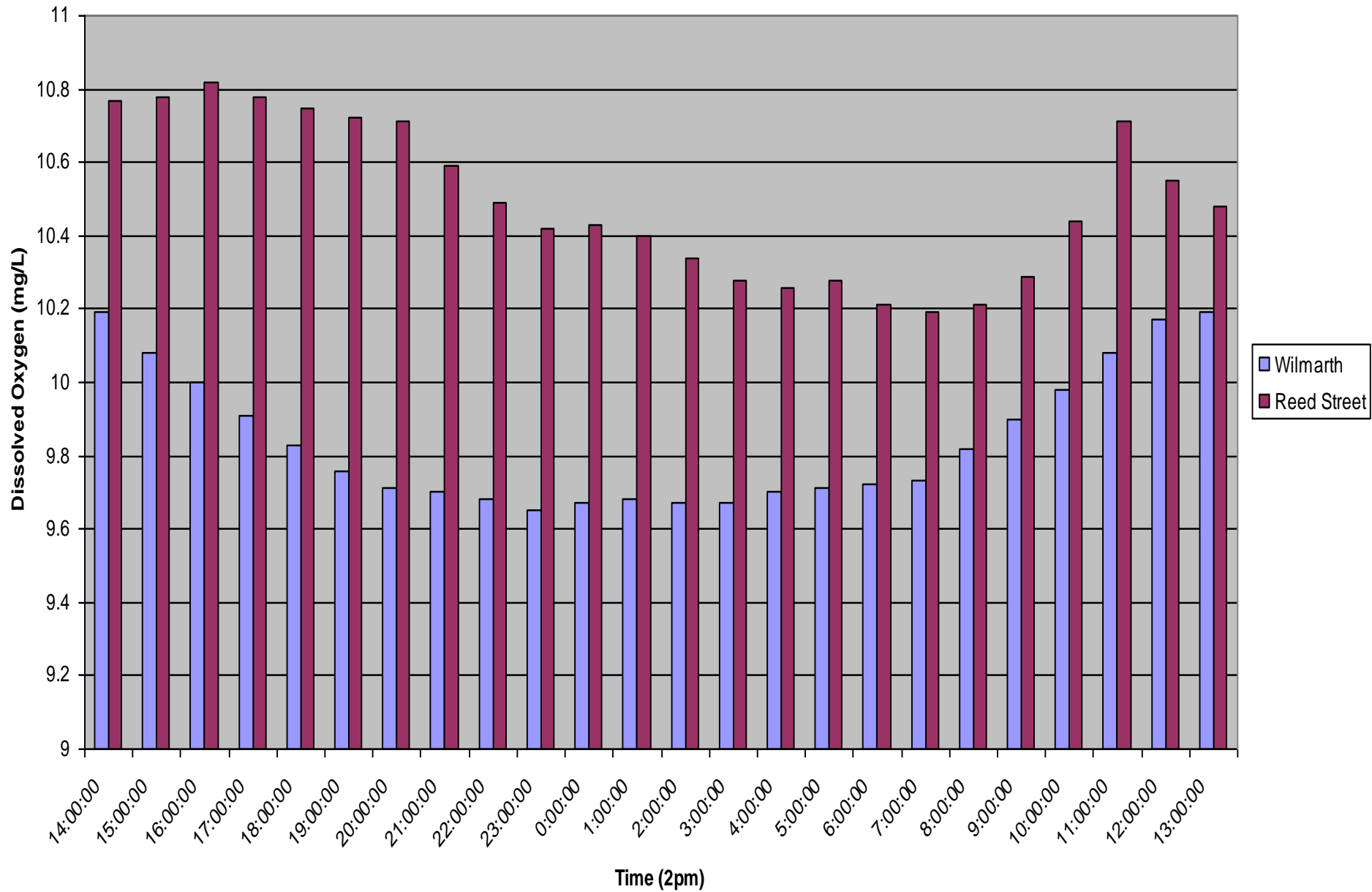
# Inferred significance II

- Observations:
  - 1. There was no significant overnight lowering of pH in either site.
  - 2. Wilmarth Bridge Road site exhibited more basic pH's than Reed Street

## Hypotheses:

1. Turbulent (rather than laminar) flow helped keep gas concentrations from being highly variable. This, in turn, kept CO<sub>2</sub> levels from contributing to acidity overnight (Carbonic acid)
2. There may be an underlying geological reason: perhaps the area surrounding this site contains Basic rock and/or weathered Bicarbonate (HCO<sub>3</sub><sup>-</sup>) ions; which can slow the effects of acidification by neutralizing contributors like acid rain and contaminated runoff.

Dissolved Oxygen vs. Time - both sites



# Inferred Significance III

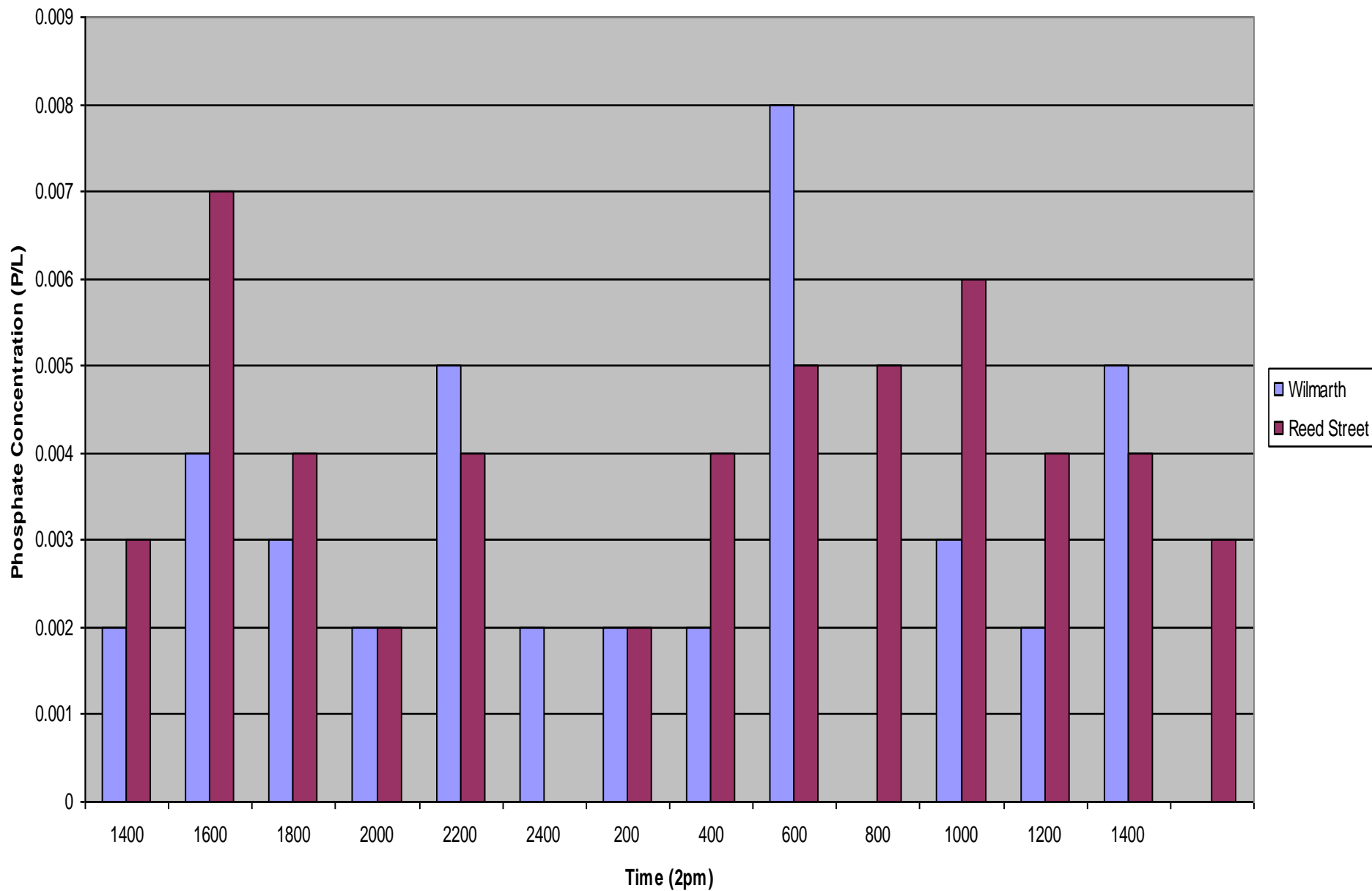
- Observations:

1. Both sites dO<sub>2</sub> levels drop off in the evening hours.
2. Wilmarth Bridge Road's drop-off seems to occur earlier.

Hypotheses:

1. Halted photosynthetic activity (sunset) coupled with continued respiration shifts a balance of gasses to an output of CO<sub>2</sub> (respiration) with **no O<sub>2</sub> input** (due to *halted photosynthesis*)
2. Perhaps the higher percent of *canopy cover* at this site provided significant shade to halt photosynthesis earlier in the evening than at Reed Street.

Phosphate levels vs. Time - Both Sites

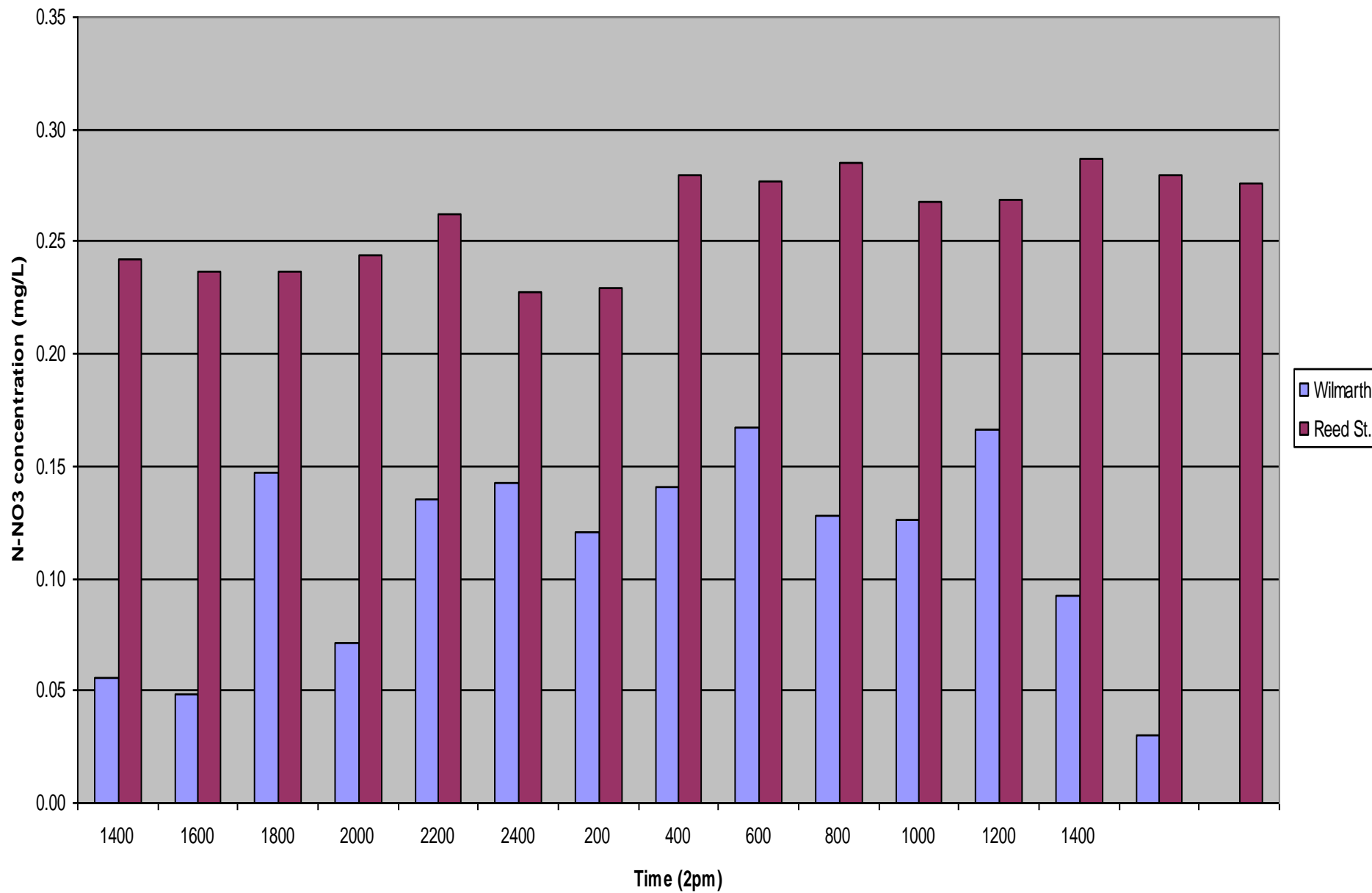




# Noted patterns & irregularities for Phosphate levels

- 1. No data was available for Wilmarth Bridge road at 8AM or at Reed St. at midnight.
  - The analysis registered an airspike for these samples
- 2. All values were **AT** or **BELOW** detection limits
  - This would suggest that phosphates are at a low enough level to be a limiting factor for both sites

N-NO3 concentration vs. Time - both sites



# Noted patterns & irregularities for Nitrate (NO<sub>3</sub>) levels

- 1. All levels were above detection limits of the analyzing device
  - This suggests that NO<sub>3</sub> is NOT a limiting factor for either site
- 2. Concentrations were higher at Reed Street.
  - With higher discharge, we would expect lower concentrations. So this tells us that between these 2 sites, there must have been a significant addition of NO<sub>3</sub> to the Palmer River
  - Between the 2 sites are farmland, wooded marshes, a golf course, and low-density residential areas

# Inferred Significance IV

Observation: Bent shape to Riparian Trees at both sites



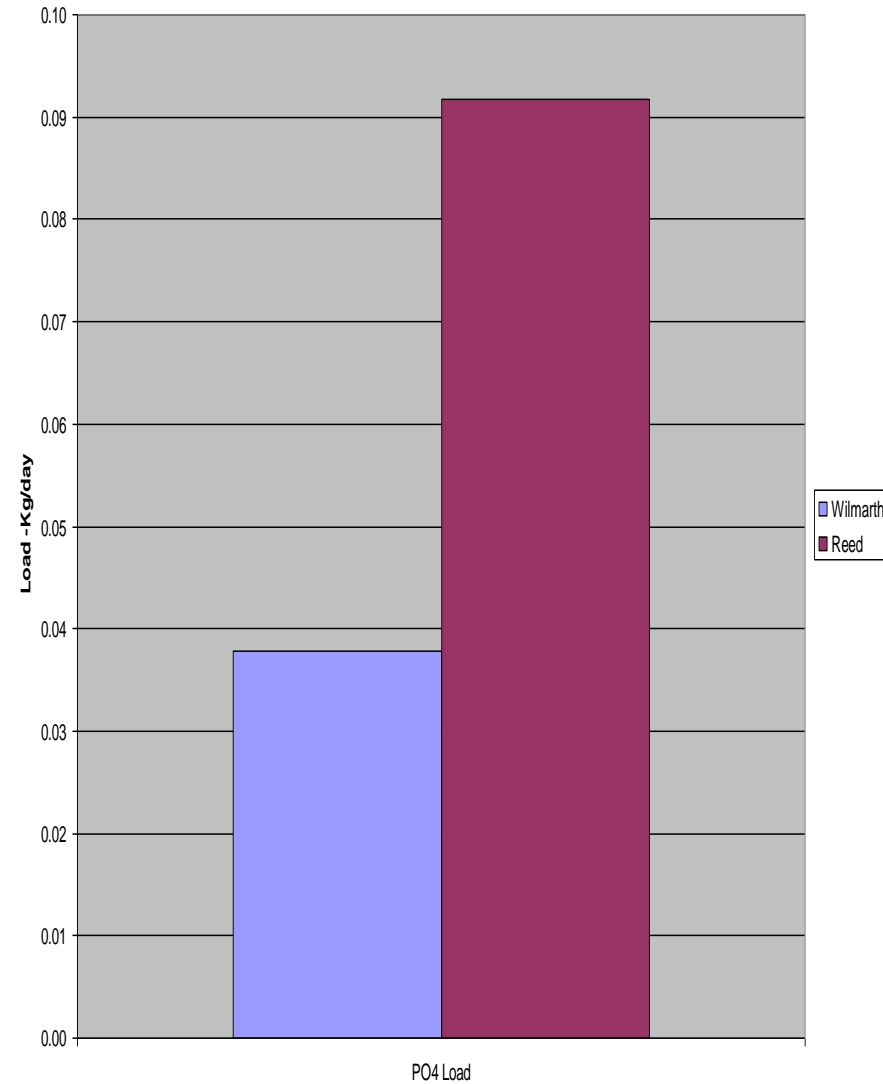
Hypothesis: Trees have corrected their growth toward the sun (phototropism) in response to erosion taking the soil around their roots away



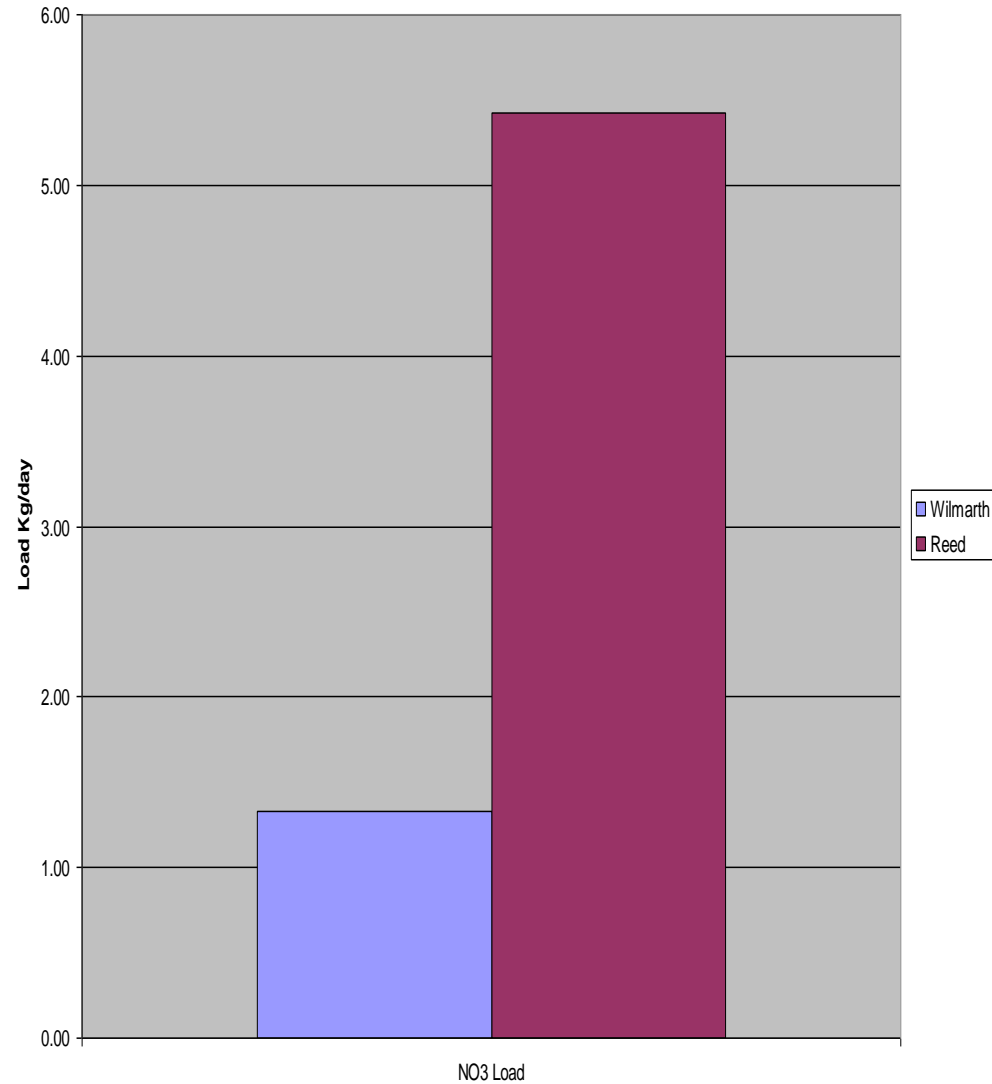


# Nutrient Load

PO4 Load - both sites



NO3 Load



# Significance of Load

- Load is higher at Reed street: This is at least partially (though not proportionally) due to the increased discharge  $\rightarrow Q=w*d*u$
- Lower amounts of  $PO_4$  suggest that this IS a limiting factor in the Palmer River.
- Increased amounts of  $NO_3$  *could be* attributable to runoff from nearby farms &/or the Golf course.
- These levels suggest a low-average level for **BOTH** nutrients examined

# The best parts of any Field Trip...



Pretending to be a troll under the bridge!



Pretending to have 'hand-feet'



Keeping warm & playing Hide n' seek!



Wondering if the Teacher Can be the first to get Wet!

# *AND OF COURSE.....*

Hot Dunkies' on a COLD morning!!!

