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### The Effect of the Middleboro Wastewater Treatment Plant on the Water Quality of the Nemasket River

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# The Effect of the Middleboro Wastewater Treatment Plant on the Water Quality of the Nemasket River

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2008 4 2



# Nemasket River

- Name means 'place of fish' in the Wampanoag language
- Discovered by Europeans in 1853
- Early settlers and Native Americans used the river for:
  - Food and water
  - Early industries: grist mills, saw mills, furnaces and forges.
  - Later industries: cotton mills and shovel works
- The Nemasket river begins at Lake Assawompsett (largest natural body of fresh water in MA) in Lakeville and flows through Middleboro into the Taunton River
- The river was also called the Canal River and the land, lowland, and swamps through which it flowed were called the Canal Swamps.



# Nemasket River

- Anadromous fish: Alewife, Blueback, American Shad, Gizzard Shad, Lamprey
- Supports largest coastal river herring population in MA, with more than 1 million fish/year
- Subbasin Area: 10.9 square miles
- Length: 11.2 miles
- Stream order: 3
- Confluence with the Taunton River
- The Middleboro Wastewater Treatment Plant discharges effluent into the river, and we thought it would be interesting to observe the effect it has on the river's quality.

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### Vaughn Street

- low traffic levels and low density housing
- little canopy with seasonal aquatic vegetative blooms
- Upstream from the Vaughn site is an expanse of wetlands.
- The wetland area impedes the flow of the water
- This is our reference site and runs under Vaughn Street.

### Route 105

- medium levels of traffic and surrounded by urban setting
- partial canopy covering and has vegetation on banks
- This site also has an auto-body shop located near the bank of the river and a house with a garden directly on the banks of the river.
- This is also reference site and is located beneath Route 105.

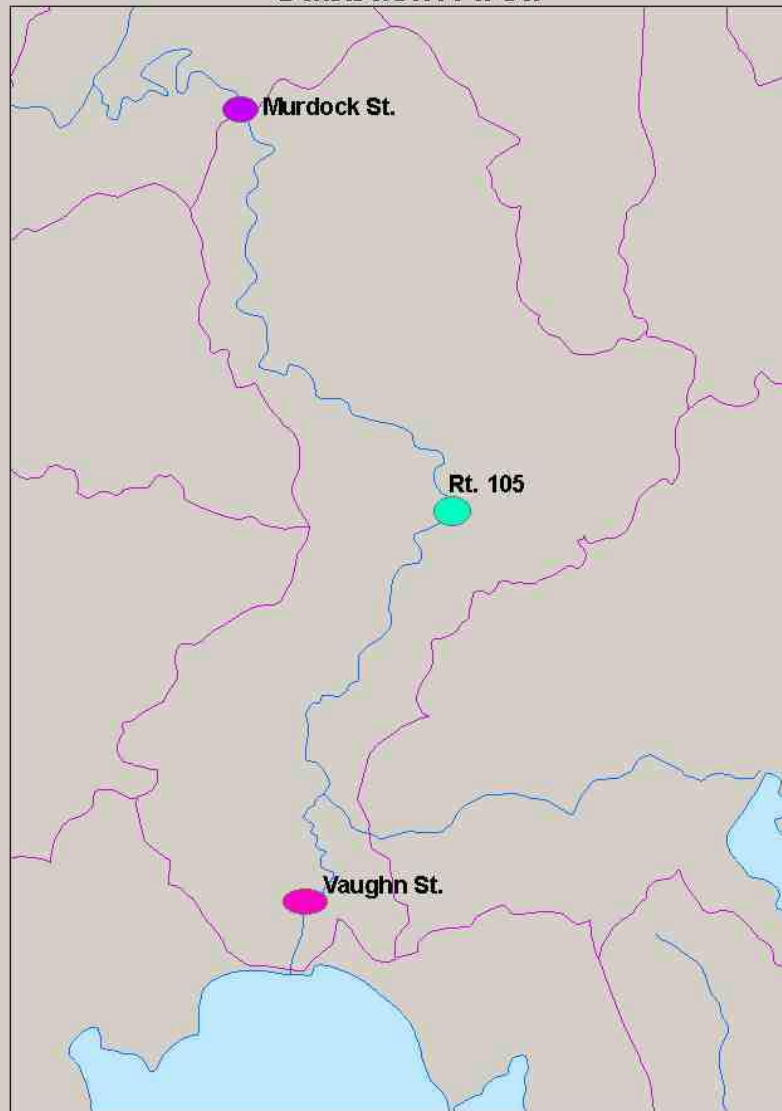
### Murdock Street

- low levels of traffic crossing it, and low housing density
- partial canopy, with vegetation growing on the banks
- This is our impact site, which flows underneath Murdock Street.

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## Nemasket River Subbasin Area



0 420 840 1,680 2,520 3,360 Meters





# Middleboro Wastewater Treatment Plant

- Built in 1950
- Building of advanced plant took three years (1974-1977)
- Cost: 5.6 million dollars (25 million dollars today)
- Processes about 1.3 million gallons of waste a day and is designed to hold up to 2.16 million gallons
- The treatment plant operates under a very strict NYPDES permit as it empties its effluent close to the NMK headwaters.



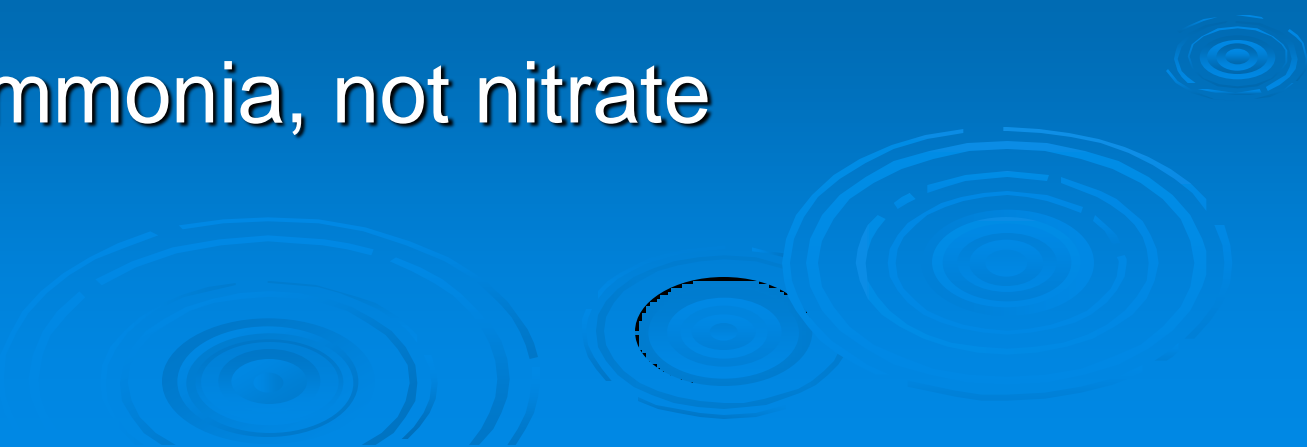
# Wastewater Treatment Plant Facts

- Plant's capacity: 2.3 million gallons/day
- Discharges effluent constantly throughout the day
- Uses 15% sodium hypochlorite (bleach) as disinfectant
- This creates a pH of 11, however, the plant does not adjust pH






# Wastewater Treatment Plant

- The plant does not process storm water
  - The plant does process Ocean Spray even though the plant was not originally designed to do so
  - Chlorine is removed with sodium bisulfate
  - Utilize ferric chloride to precipitate out the phosphate
  - Remove ammonia, not nitrate
- 

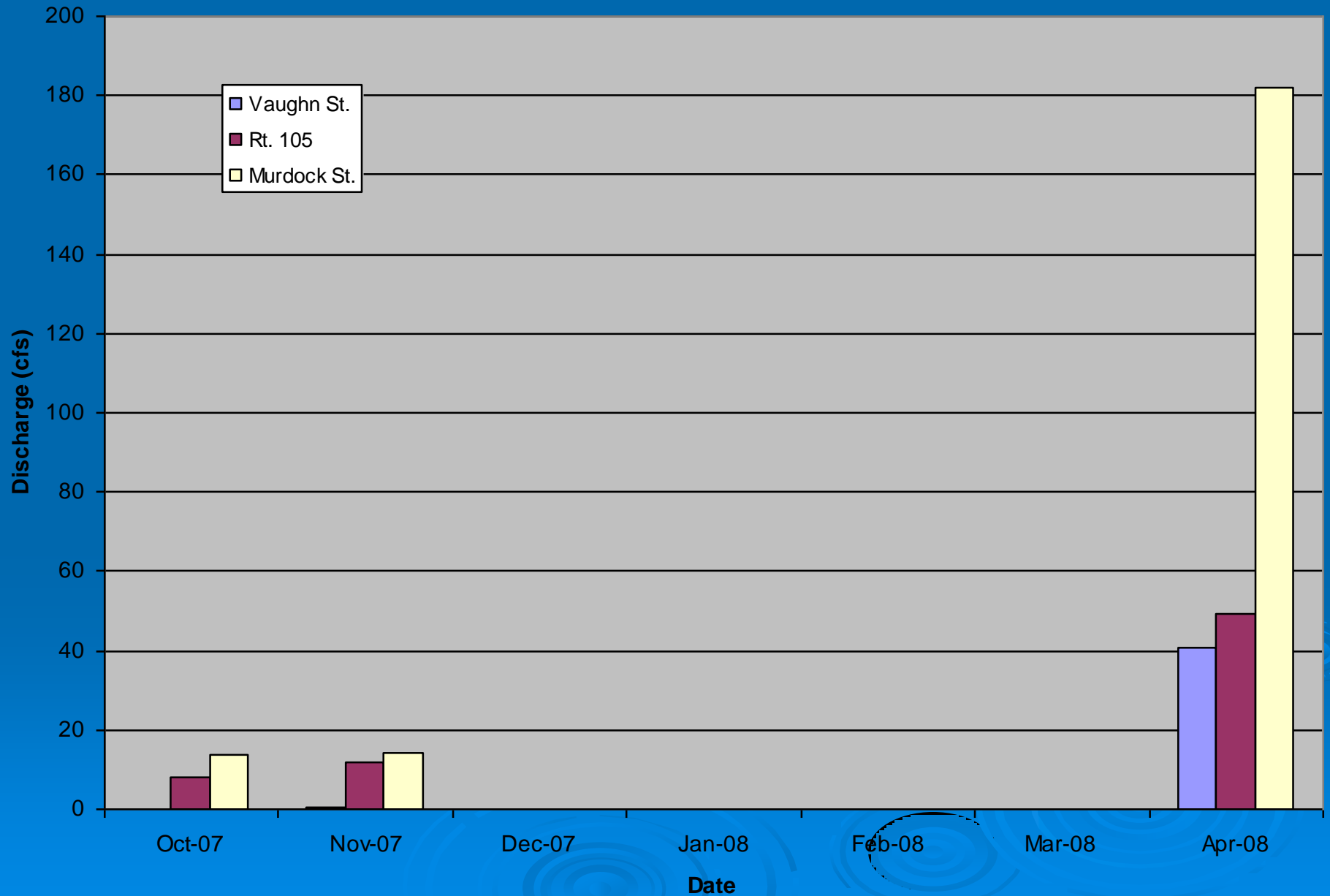


# Future of the Wastewater Treatment Plant

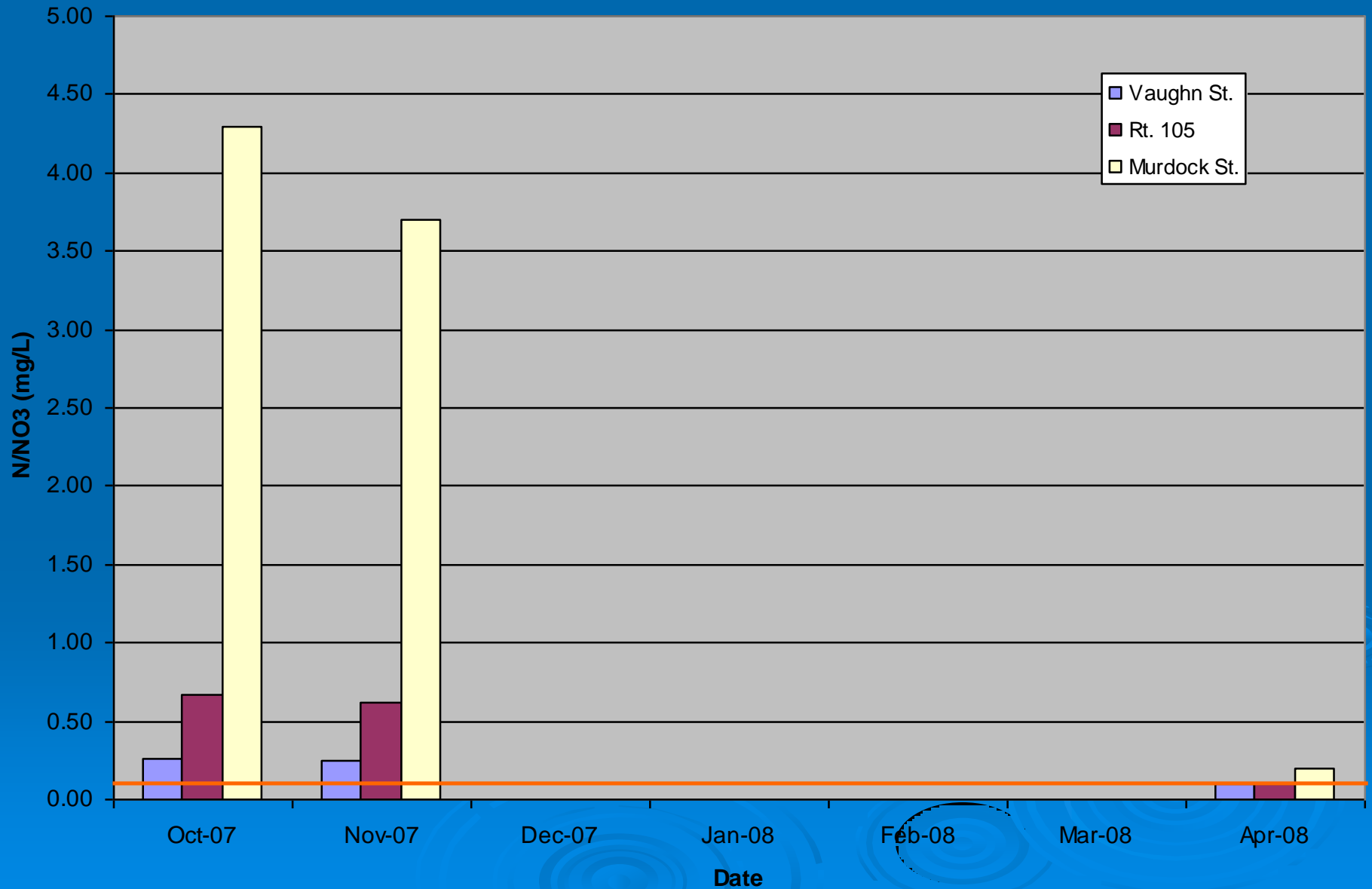
- The plant anticipates stricter changes in state regulations, such as adding regulations for the removal of nitrate
  - Will need to utilize denitrifying bacteria to convert nitrate into nitrogen gas by adding a carbon food source
  - Concerned about the proposed casino in Middleboro
  - This will significantly add to the plant's load and nutrient levels
- 
- The bottom of the slide features a decorative graphic of several concentric circles, resembling ripples on water, in a lighter shade of blue against the main background.



Discharge (2007-2008)  
Nemasket River

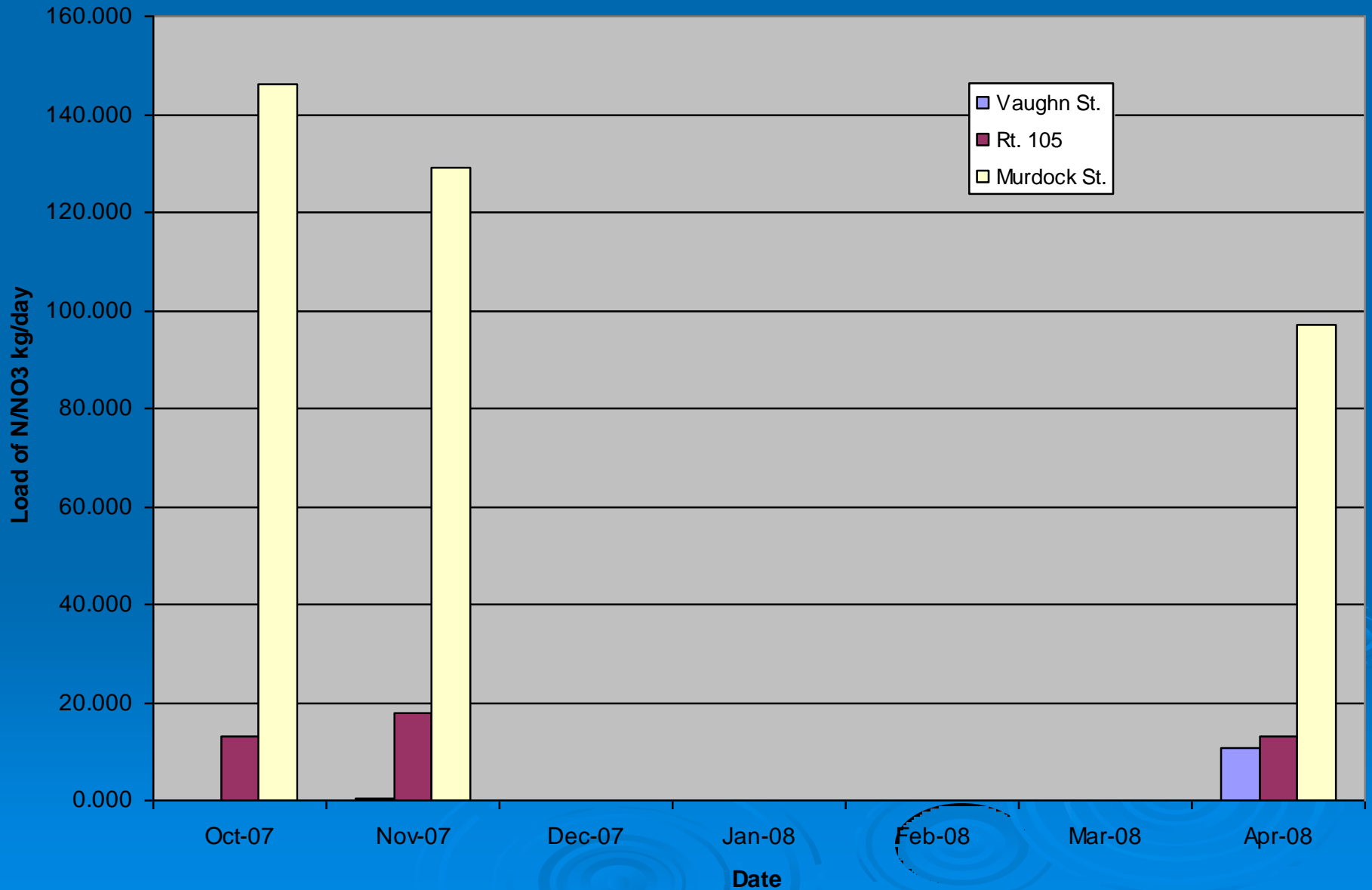


Concentration of Nitrogen as Nitrate (N/NO<sub>3</sub>) (mg/L)  
Nemasket River

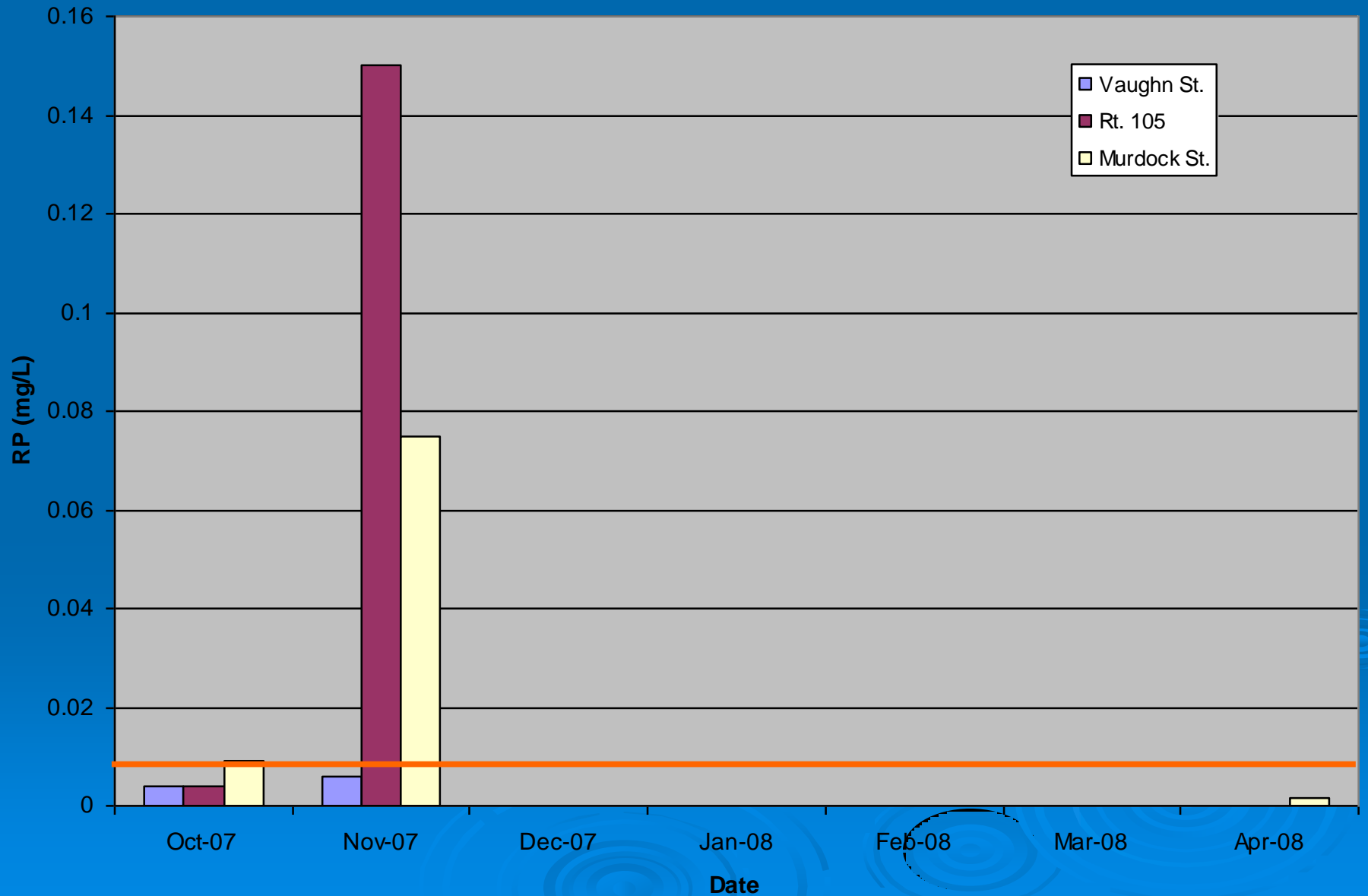




Load of Nitrogen as Nitrate (N/NO<sub>3</sub>) (kg/day)  
Nemasket River

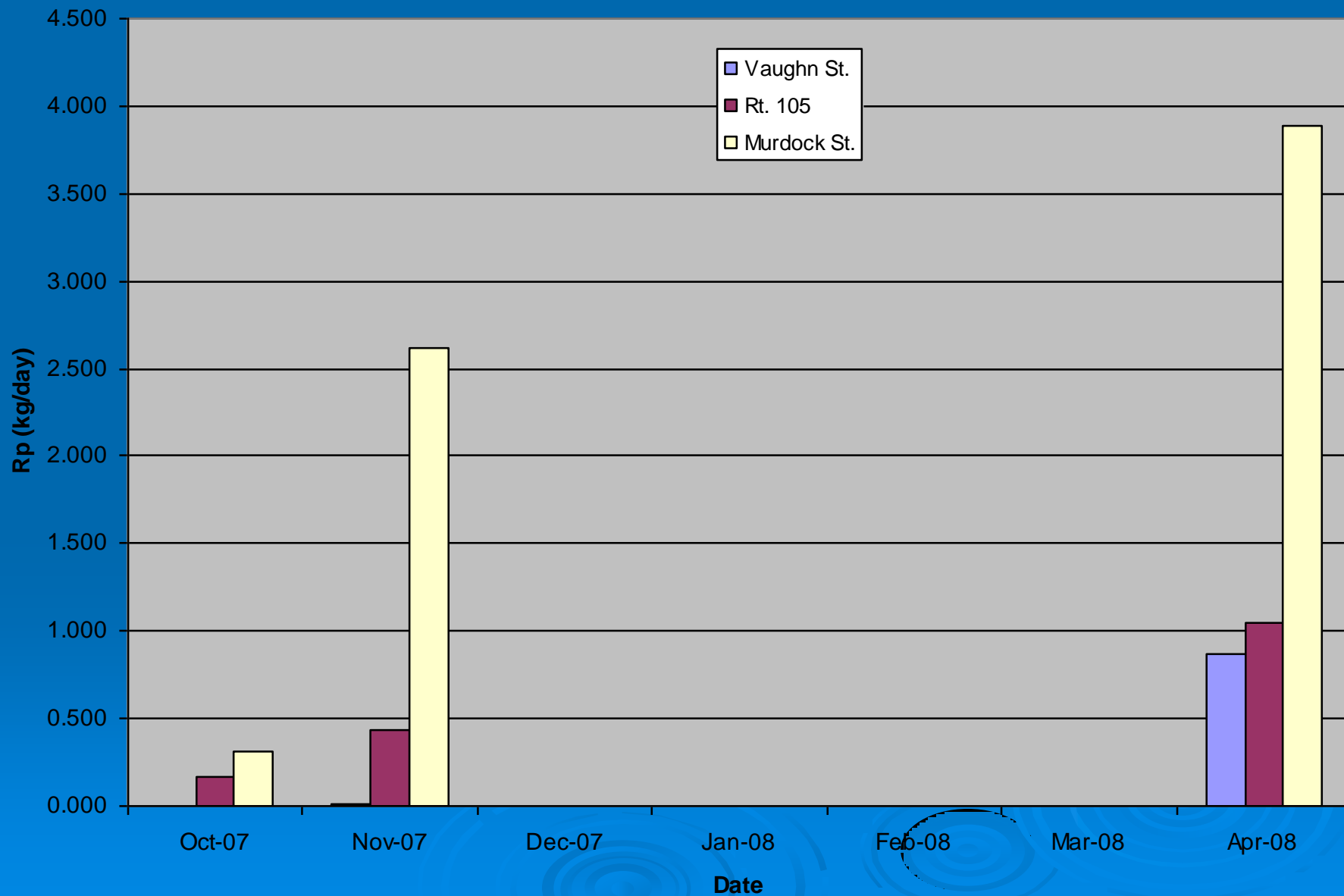


# Concentration of Reactive Phosphorous (mg/L) Nemasket River





# Load of Reactive Phosphorous (kg/day) Nemasket River



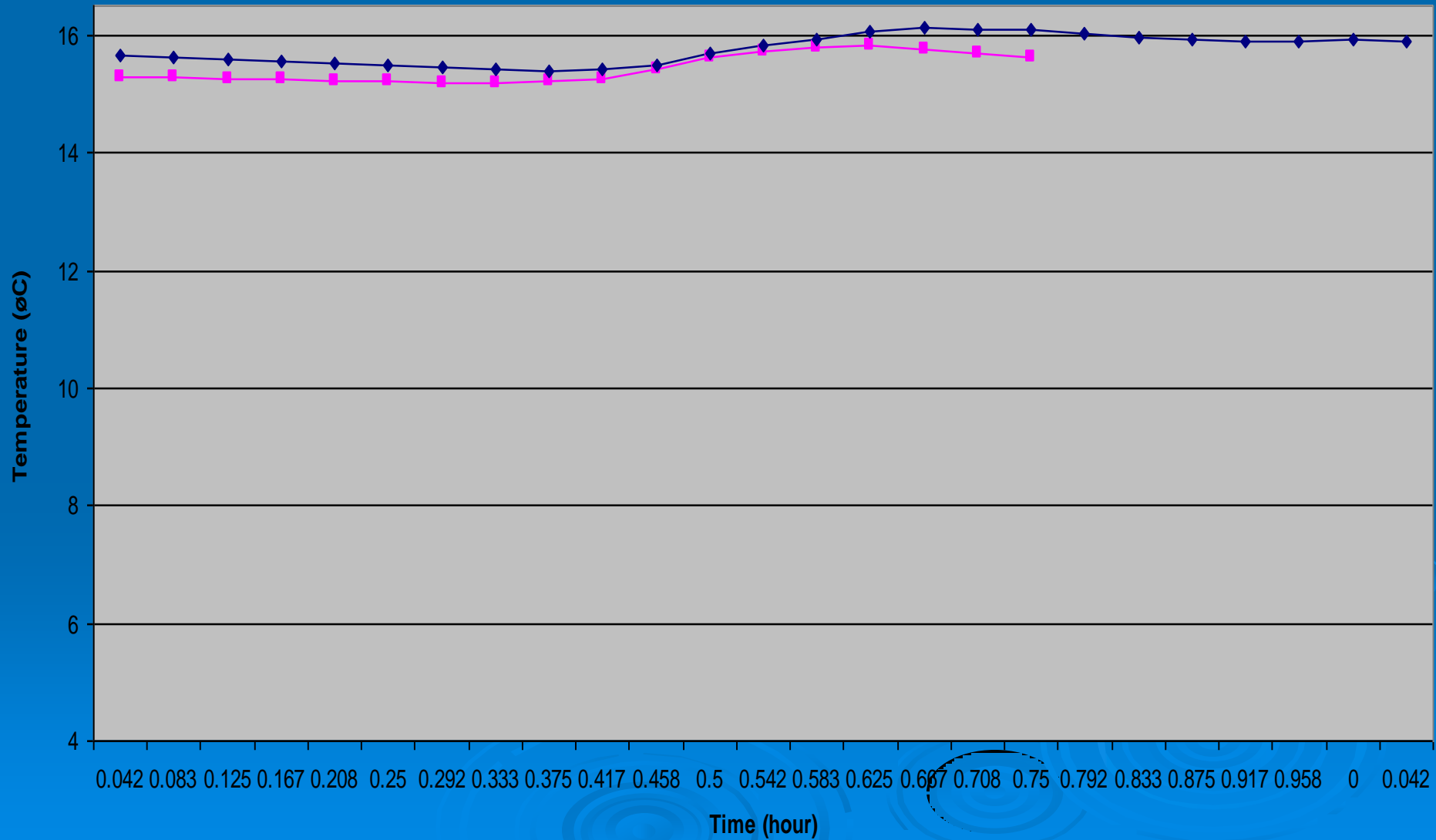
# Nemasket River

## Temperature vs Time

10/11-10/12

Rt. 105

Murdock

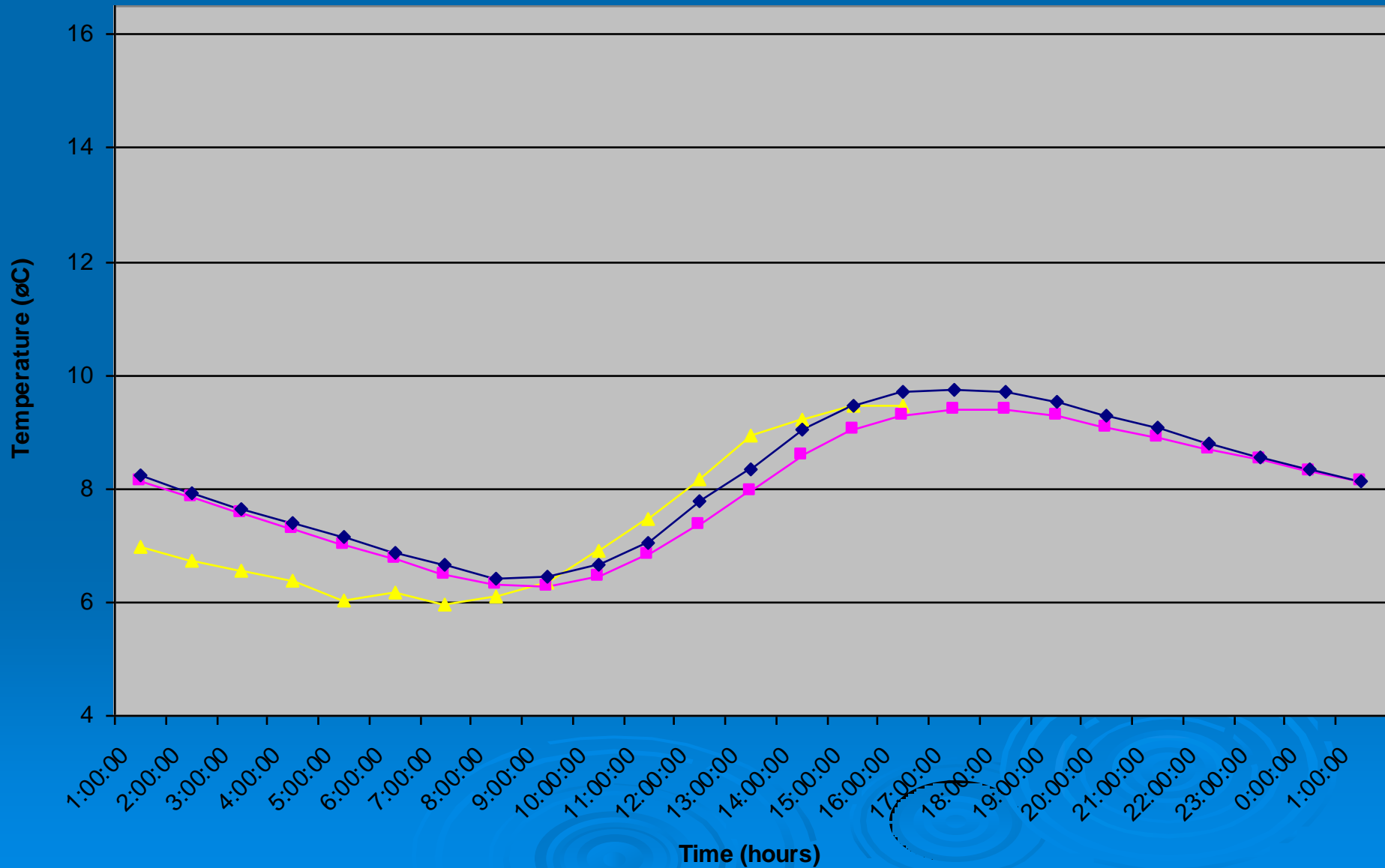
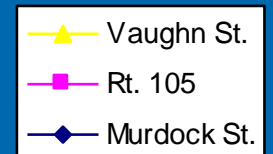




# Nemasket River

## Temperature vs. Time

### 4/3-4/4



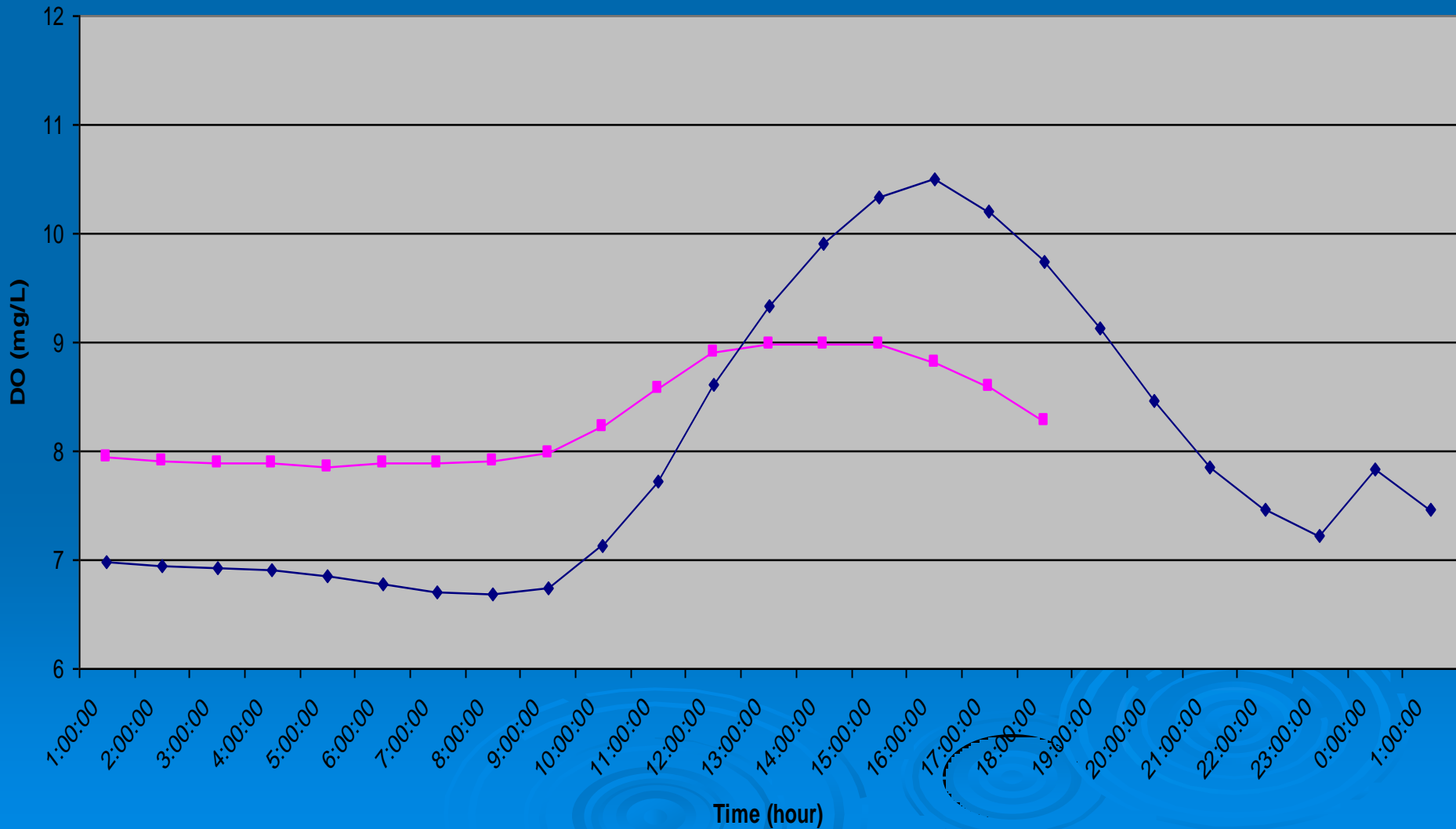
# Nemasket River

## Dissolved Oxygen vs. Time

### 10/11-10/12

Rt. 105

Murdock

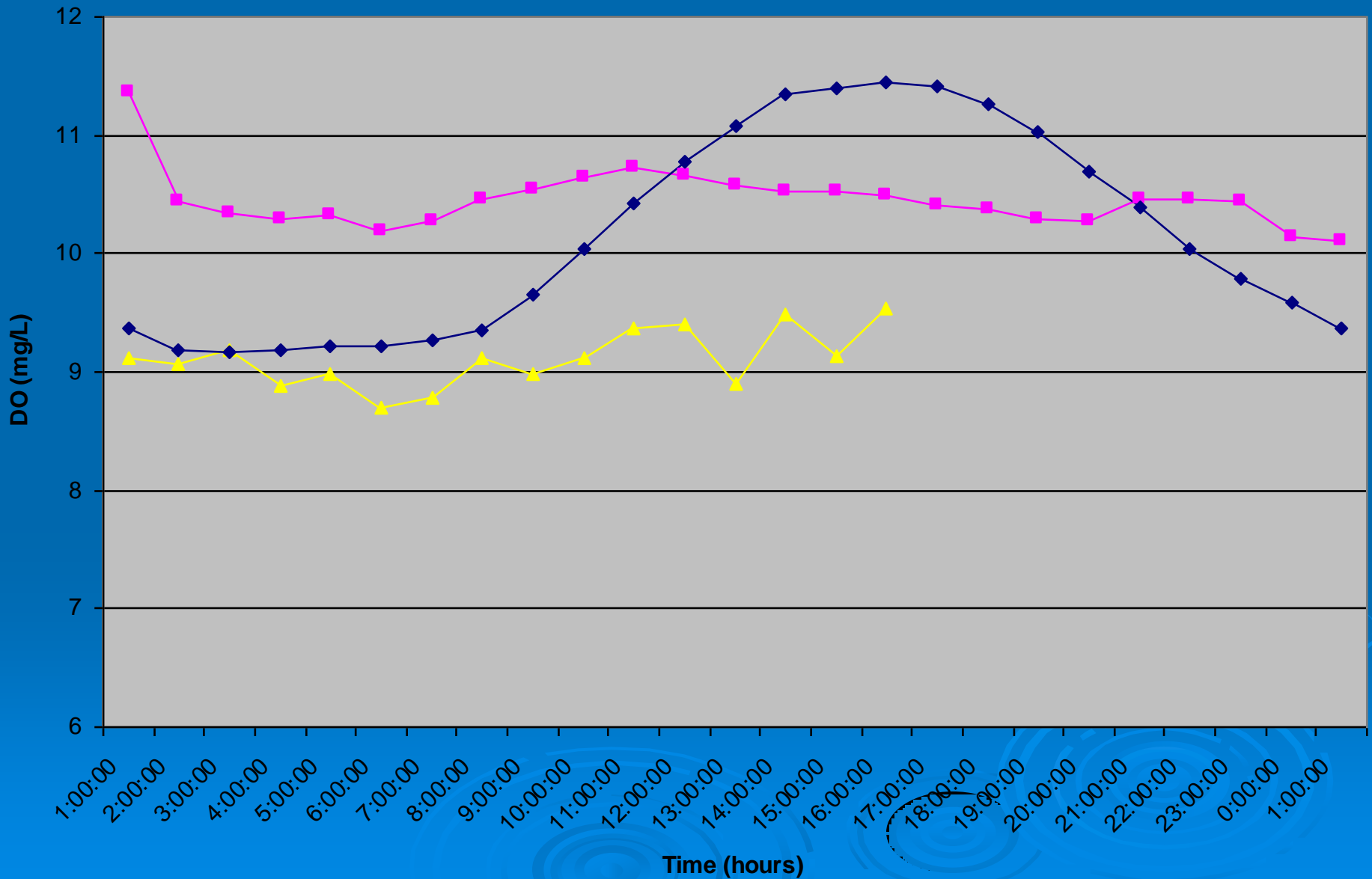
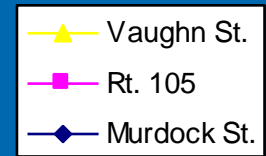




# Nemasket River

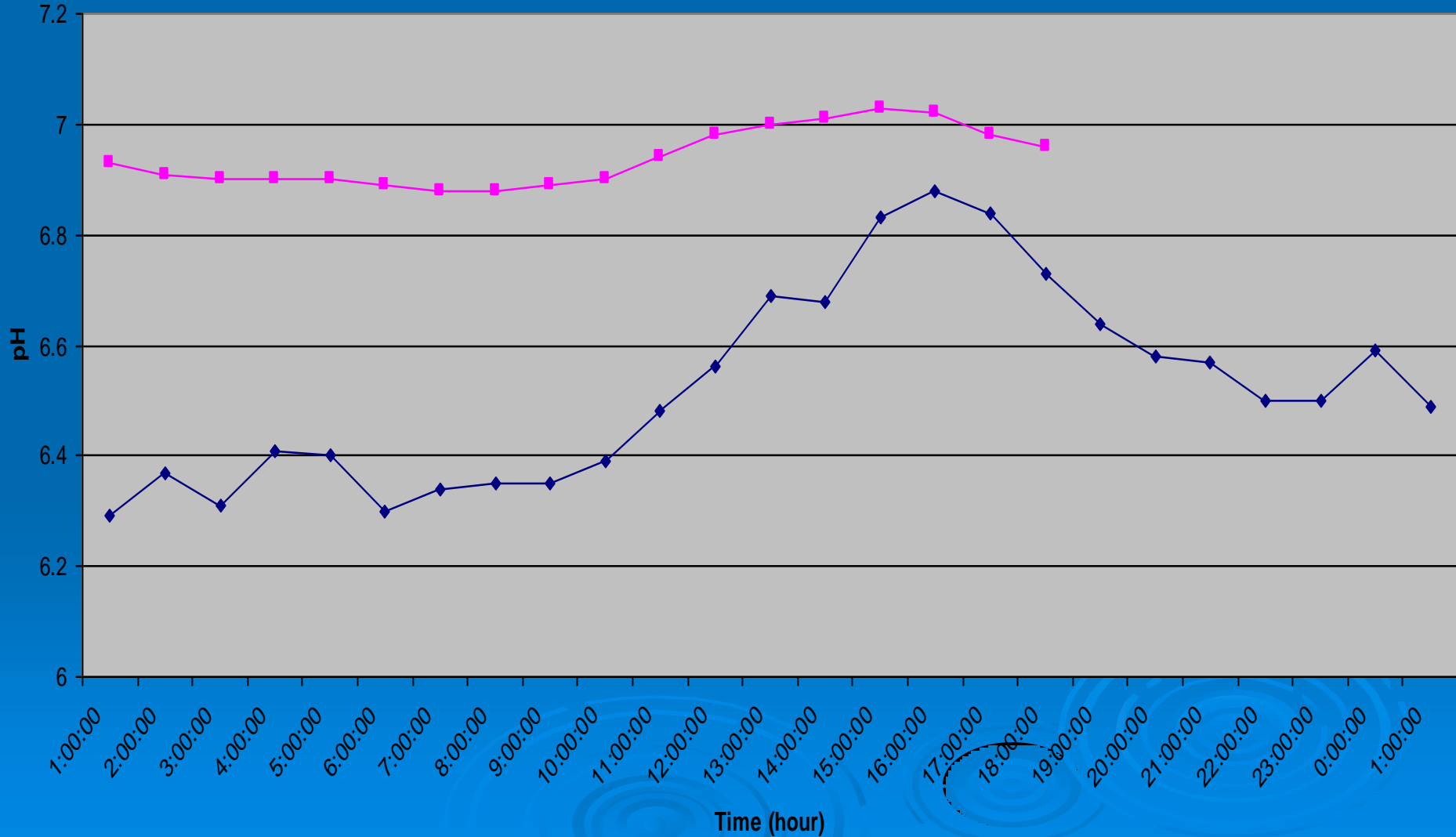
## Dissolved Oxygen vs. Time

### 4/3-4/4



**Nemasket River**  
**pH vs. Time**  
**10/11-10/12**

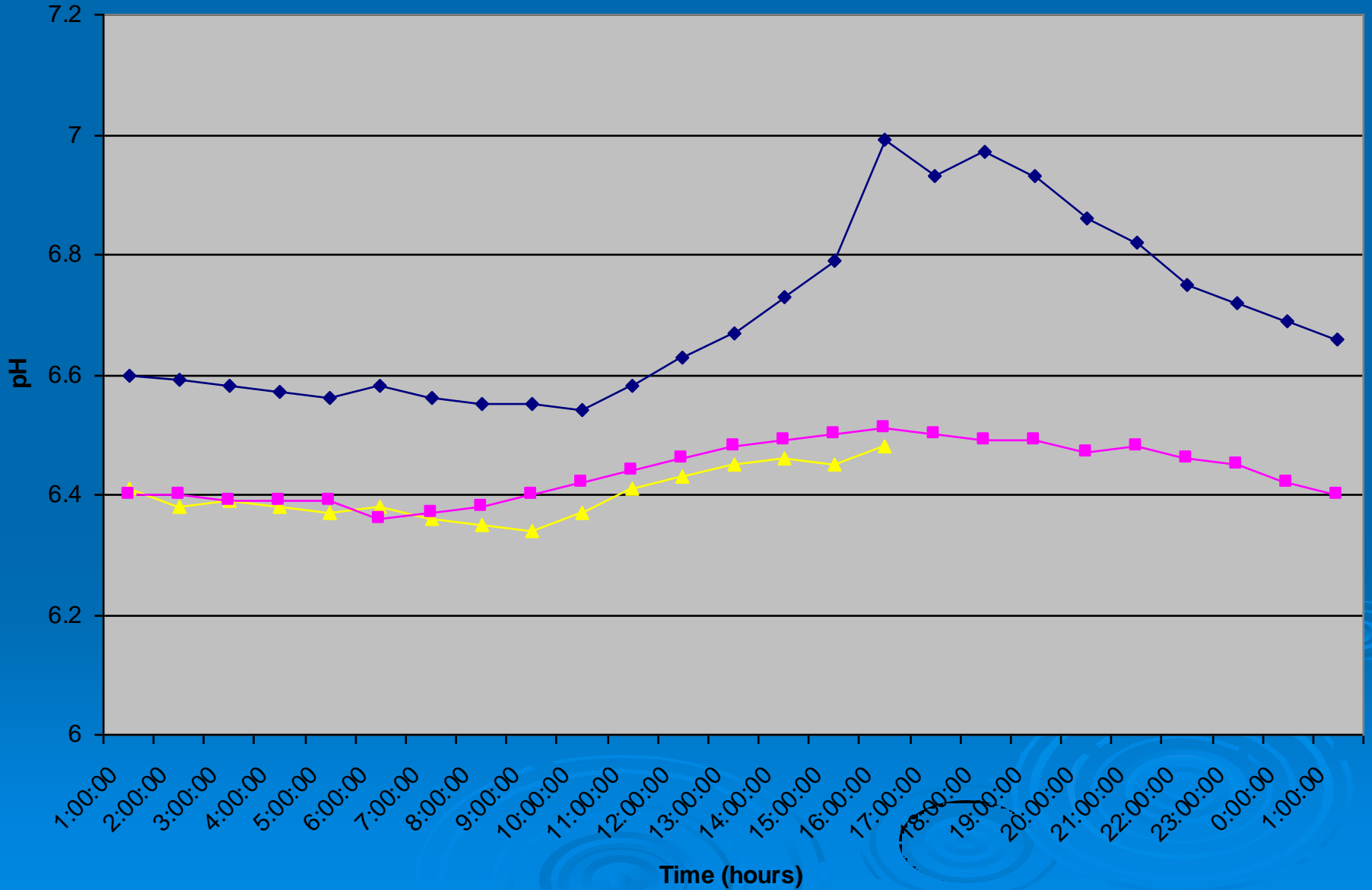
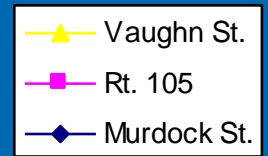
—■— Rt. 105  
—◆— Murdock



# Nemasket River

## pH vs. Time

### 4/3-4/4





# Macro invertebrates of Route 105

## AVERAGE COUNTS

Ephemeroptera baetidae 7  
Ephemeroptera heptageniidae 48  
Ephemeroptera tricorythidae 3  
Plecoptera perlidae 1  
Tricoptera glossosomatidae 1  
Tricoptera hydrosychidae 327  
Tricoptera odontoceridae 1  
  
Tricoptera philopotamidae 62  
Diptera chironomidae 1  
Diptera simuliidae 3  
Diptera tipulidae 1  
Odonata calopterygidae 1  
Coleptera elmidae 3  
Coleptera psephenidae 10  
Amphipoda 46  
Decapoda 1  
Gastropoda 3  
Pelecypoda 3  
Oligochaeta 1

**Total number of bugs: 523**

**Total number of tolerant bugs: 54**

**Percentage of tolerant bugs: 10.33%**

**Total number of intolerant bugs: 393**

**Percentage of intolerant bugs: 75.14%**

Route 105 had a total of 19 species of macro invertebrates.

Hilsenhoff Biotic (10-max) Index

(HBI): 4.5

Indicates Good water quality

# Macro invertebrates of Murdock Street

## AVERAGE COUNTS

Ephemeroptera baetidae 7  
Ephemeroptera heptageniidae 12  
Plecoptera perlidae 1  
Plecoptera perlodidae 2  
Plecoptera taeniopterygidae 4  
Tricoptera hydropsychidae 279  
Trichoptera odontoceridae 1  
Trichoptera philopotamidae 18  
Diptera chironomidae 4  
Diptera simuliidae 1  
Odonata calopterygidae 2  
Odonata lestidae 1  
Coleoptera elmidae 2  
Amphipoda 9  
Isopoda asellidae 1  
Decapoda 1  
Gastropoda physidae 18  
Gastropoda planorbidae 6  
Oligochaeta 1  
Hirudinea 2

**Total number of bugs: 372**

**Total number of tolerant bugs: 41**

**Percentage of tolerant bugs: 11.02%**

**Total number of intolerant bugs: 305**

**Percentage of intolerant bugs: 81.99%**

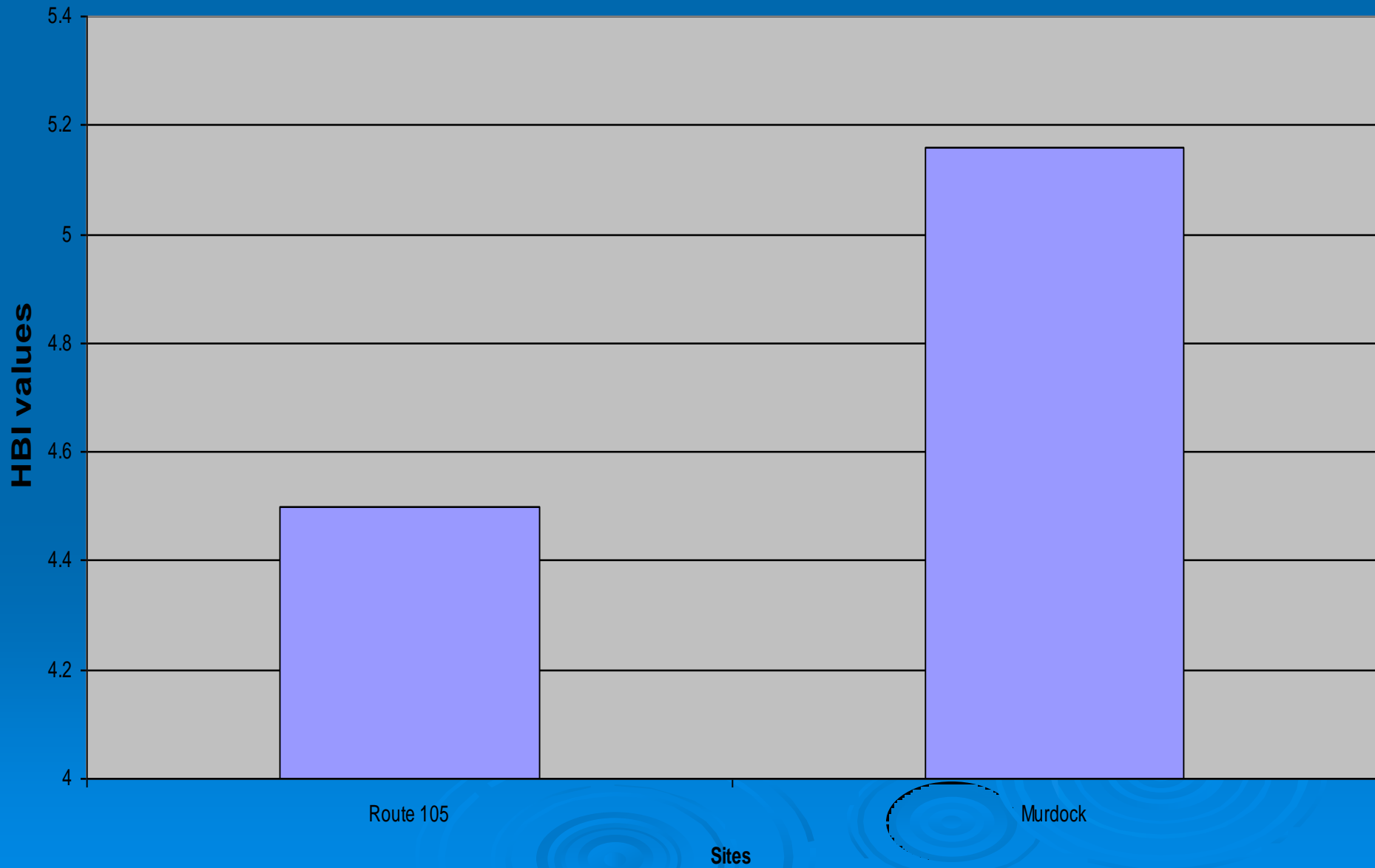
Murdock street had a total of 20 species of macro invertebrates.

Hilsenhoff Biotic (10-max) Index

(HBI): 5.16

Indicates Fair water quality

# HBI: Hilsenhoff Biotic Index





# Fecal Coliform

- Tested sites on Rte 105 and Murdock St.
- Fecal coliform is found in the intestines of animals and is expelled in their waste
- Grows best at 44.5 °C
- May be present due to effluent in the river from wastewater treatment plant
- We tested using MFC Broth method

2008 4 2



# Fecal Coliform Results

Rte 105:

100 mL

- 54 colonies
- 57 colonies

10 mL

- 8 colonies (80/100 mL)
- 7 colonies (70/100 mL)

Murdock St:

100 mL

- 15 colonies
- 9 colonies

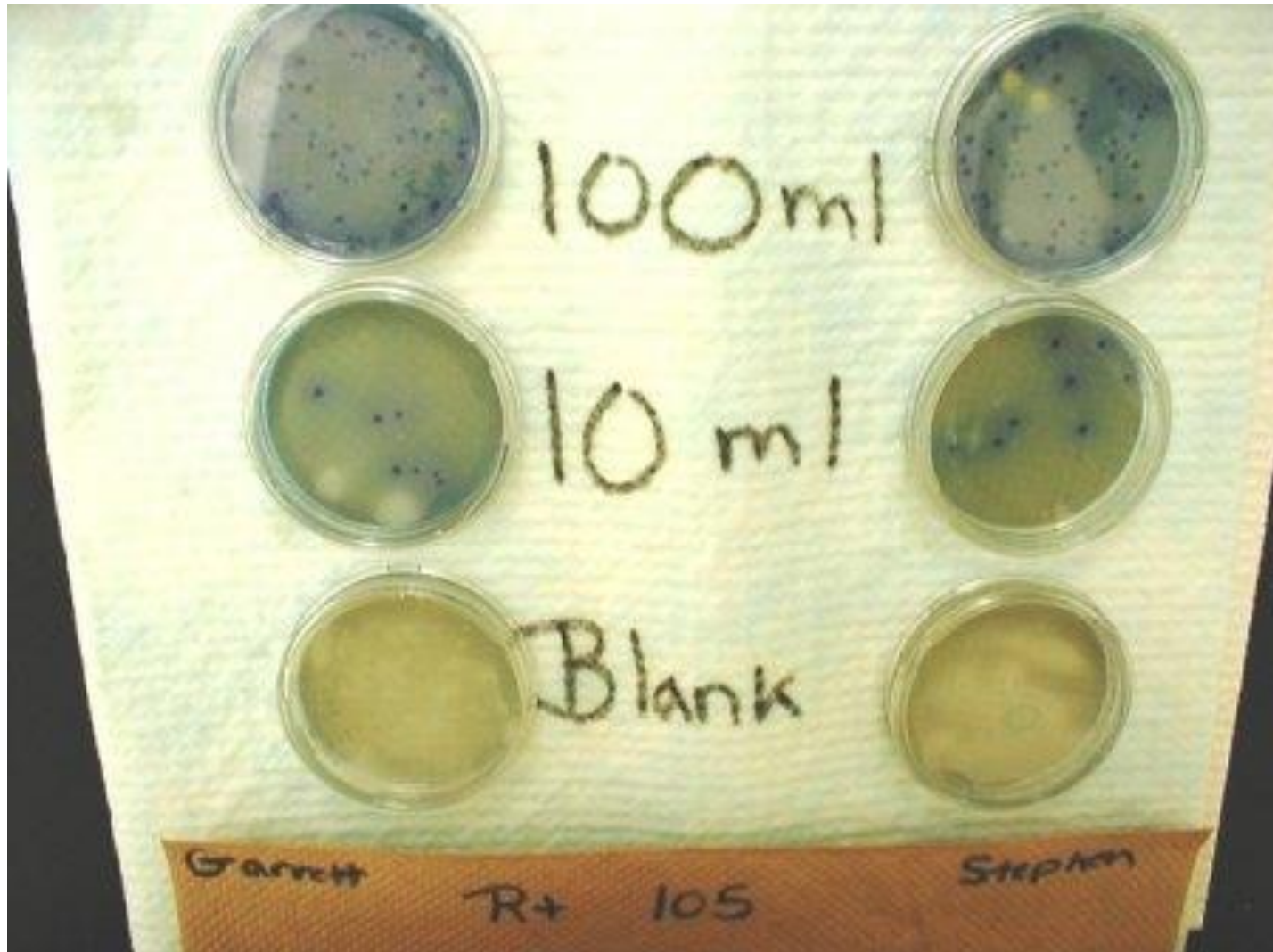
10 mL

- 1 colonies (10/100 mL)
- 0 colonies

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# Rte 105 Fecal Coliform Colonies





# Murdock St. Fecal Coliform Colonies





# Conclusion

- Indeed the Wastewater Treatment Plant has an effect on the Nemasket River
- The plant successfully removes fecal coliform bacteria
- The plant does not, however, completely remove nitrates and phosphorus
- Macro invertebrates are affected downstream from the plant at Murdock St.
  - 5.16 HBI compared to 4.5 HBI at Rte 105





# Documentations

- Behar, Sharon. *Testing the Waters*. River Watch Network: Portland, Oregon, 1997.

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# Accreditations

## A Special Thanks to:

- Kim McCoy for her much appreciated help in the field and with the fecal coliform testing.
- Mr. Joseph Ciaglo for his informative tour of the Middleboro Wastewater Treatment Plant.

2008 4 2



# The End

*Thanks for watching!*

