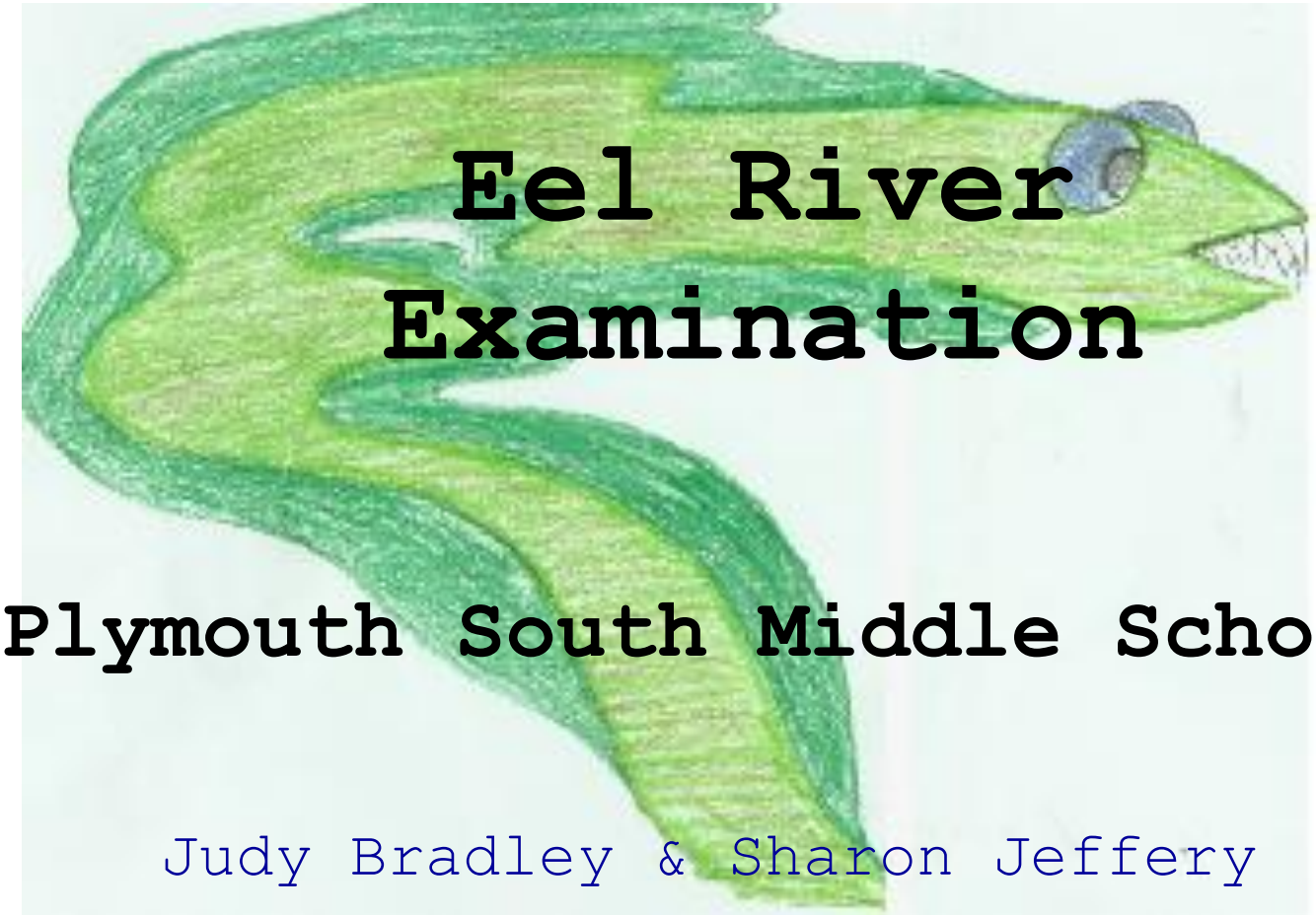
5-7-2004

Eel River Examination



Eel River Examination

Plymouth South Middle School

Judy Bradley & Sharon Jeffery

Overview

The purpose of our study was to measure and observe the changes in the profile, flow, and chemical composition of Plymouth's Eel River over the course of the school year from October 2003 to April 2004.

Who Participated?

- A group of 7th and 8th grade students from Plymouth South Middle School

Why the Eel River?

The Eel River is Plymouth's largest River. It had been the center of population and business growth until the 20th century. It has played an important role in history. The Pilgrims chose wisely to make their town on the banks of this river like the Native Americans who were already there.

The river is fed mostly by water seeping through coarse sand and gravel from kettle ponds that have no river connections. The Plymouth-Carver Aquifer, a "sole source" aquifer, is the water supply for the entire SE MA region. Plymouth alone withdrew 59.6 million gallons per day in 1985 and the population has increased significantly.

Why the Eel River?

The Eel river watershed has had cranberry bogs in it for decades. The chemicals used on the bogs filter through to the groundwater and then end up in the river. Some of these chemicals contain nitrogen and phosphorus.

There are currently 5 golf courses in the watershed. These impact the water with chemical pollution from maintaining the greens, but they also place large demands on our water supply, which shows up in lowered river water.

Why the Eel River?

The town's new wastewater treatment plant, which began operation in 2002, was constructed within the watershed. It was projected that the plant would introduce at least .75 million gallons of treated effluent every day into filtering beds. The water will then flow underground and seep into the Eel River. On occasion untreated effluent is released.

Since the Eel River gives us a visual idea of what is happening to our water supply we decided to study what it "looked" like this year.

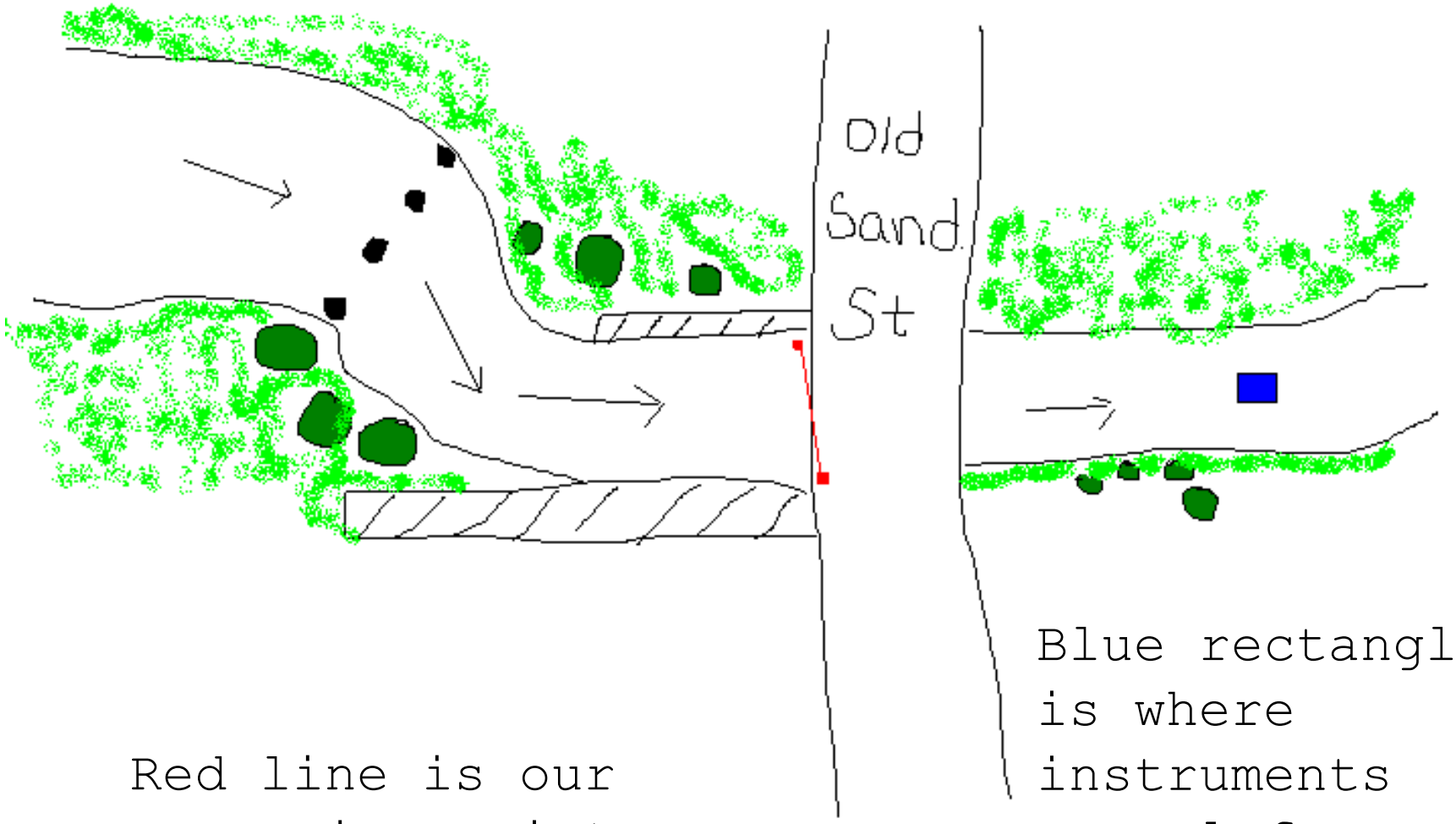
Where did we go?

Our studies were conducted near the bridge on Sandwich Rd.

The instruments for chemical analysis were deployed on the ocean side of the bridge.

Our physical and flow measurements were taken on the other side of the bridge. We used 2 posts previously imbedded in the sand under the bridge as our measuring spot.

Surroundings are grasses, low bushes and a number of large trees (dark green)



Red line is our measuring point.

Blue rectangle is where instruments were left.

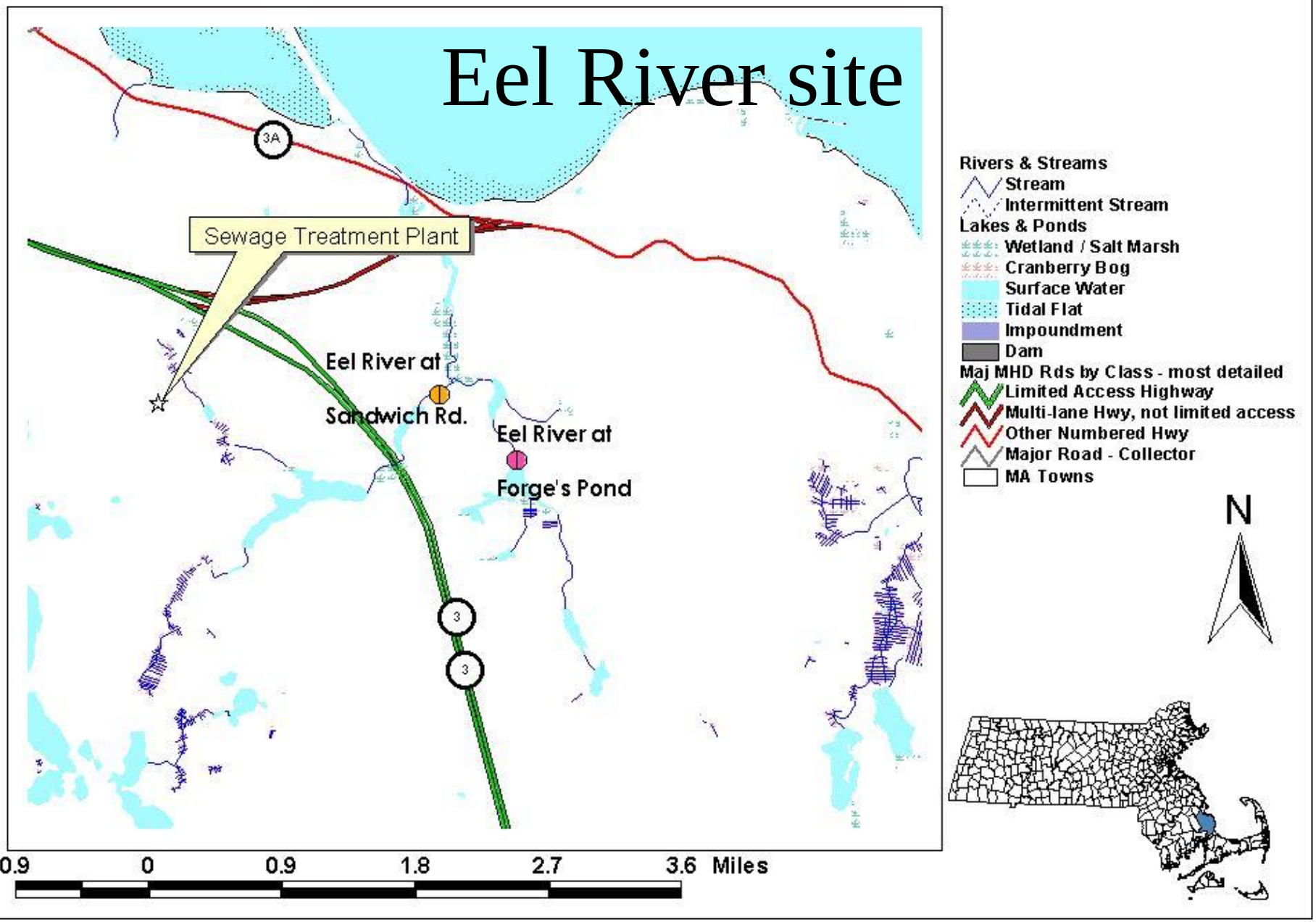
Eel River Bridge

On the inland side on Sandwich Rd.

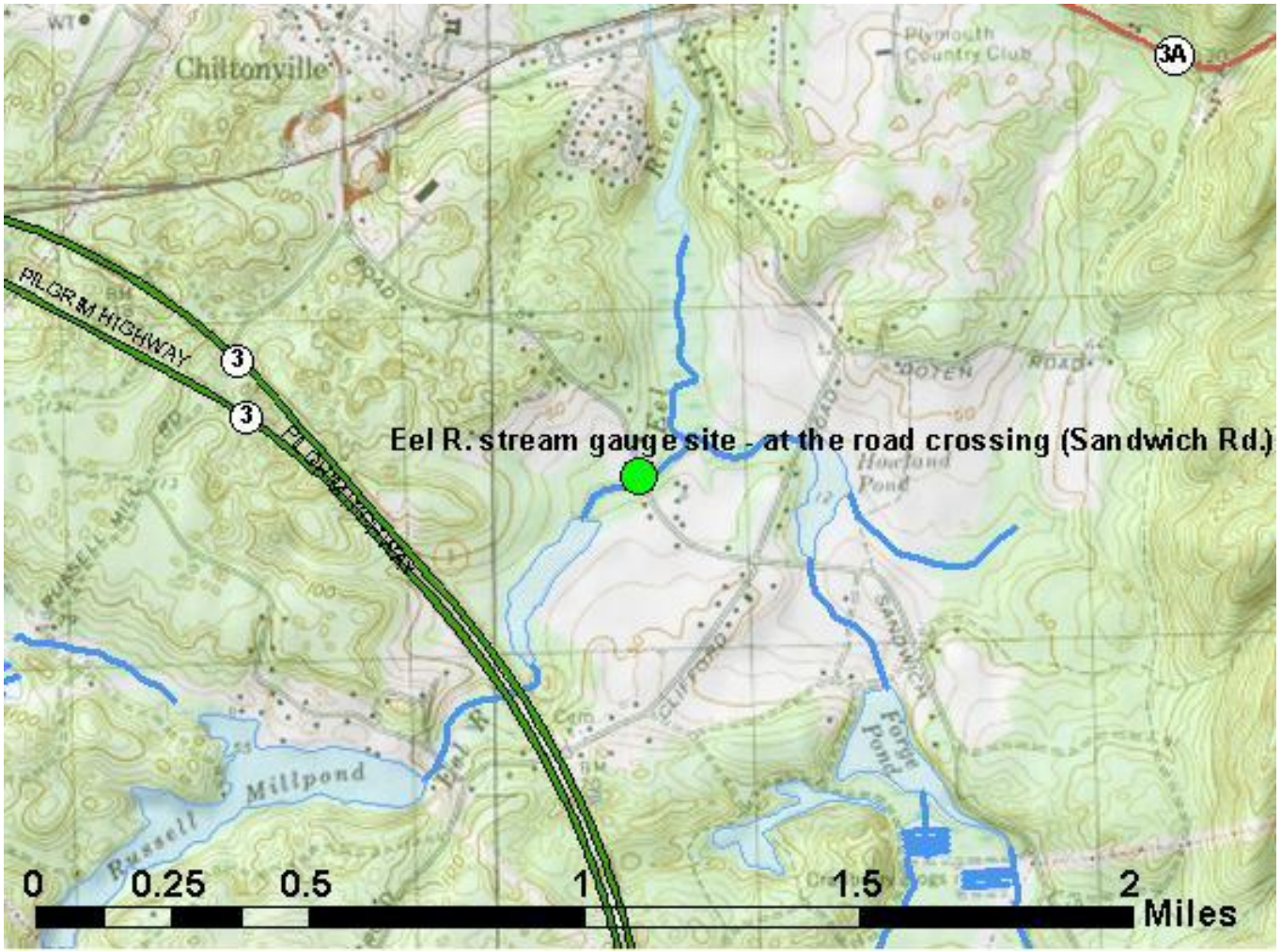
Upstream

There are 3 piling for an old dam.

Eel River Sites Judy Bradley & Sharon Jeffery

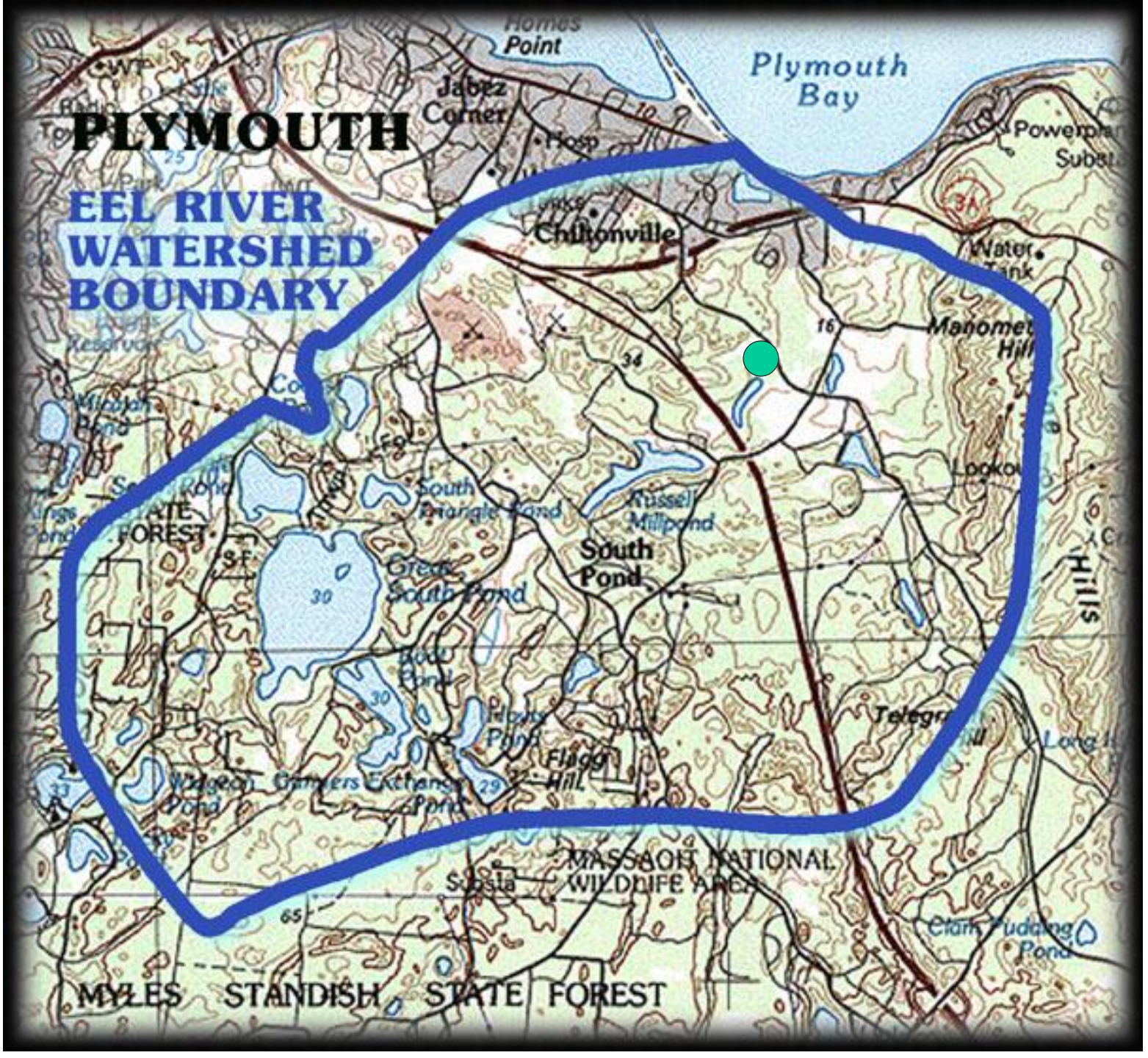


USGS Topographic Map



Ortho Map


Eel R. stream gauge site - at the road crossing (Sandwich Rd.)
0
500
1,000
2,000
Feet


PLYMOUTH
EEL RIVER
WATERSHED
BOUNDARY
Plymouth
Bay
Jabez
Corner
Chiltonville
South
Pond
Russell
Millpond
Great
South Pond
South
Triangle Pond
Flagg
Hill
MASSASOIT NATIONAL
WILDLIFE AREA
MYLES STANDISH STATE FOREST

About the Watershed:

The Eel River watershed contains 78% undeveloped forest. The rest is residential dwellings and cranberry bogs.

Housing growth in the last decade has increased the number of septic systems and the amount of impervious land.

New golf courses too!

About the Watershed:

The Eel River is a biologically rich ecosystem. It is home to many wild animal and plant species, some of which are endangered.

Some examples of the animals are eagles, mink,eels, herring, trout, painted and red-bellied turtles, kingfishers, osprey, and many more.

Oh yeah, and Ghengis Swan!

What we did at the Eel River

Measured the width of the river at the bridge

Measured the depth of the river at 2 foot intervals

Measured the flow of the river using a Marsh-McBirney Flo-Mate

What we did at Eel River

We left a programmed Sigma 900 Sampler to draw samples of water every hour for 24 hours.

The next day we removed and filtered the water and bottled it. The samples were frozen and sent to the WAL lab to be analyzed.

What we did at Eel River

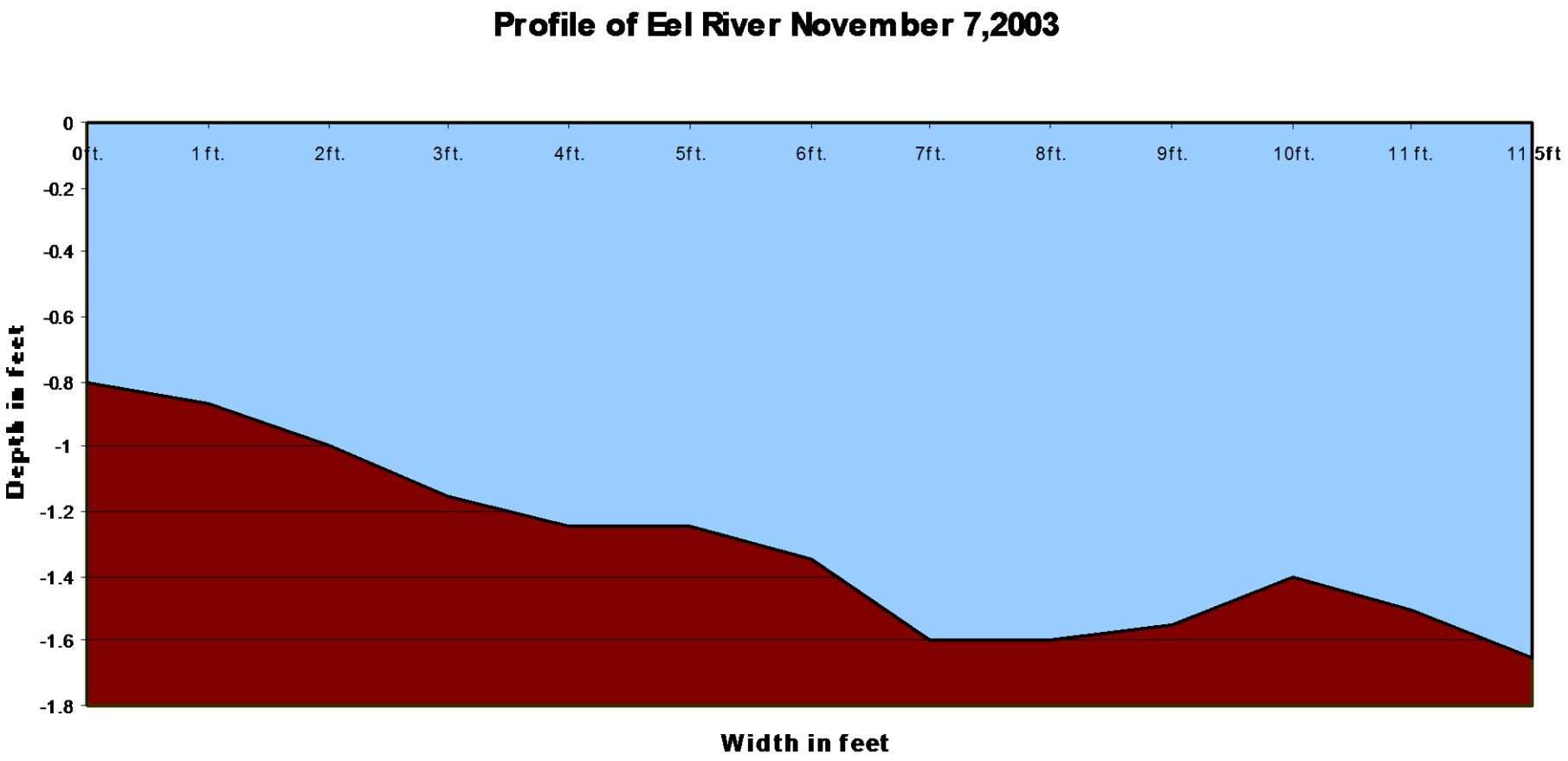
A Mini-Sonde device with probes was left floating in the river. Temperature, pH, and dissolved oxygen were measured every hour for 24 hours.

The readings are retrieved with a computer at the WAL.

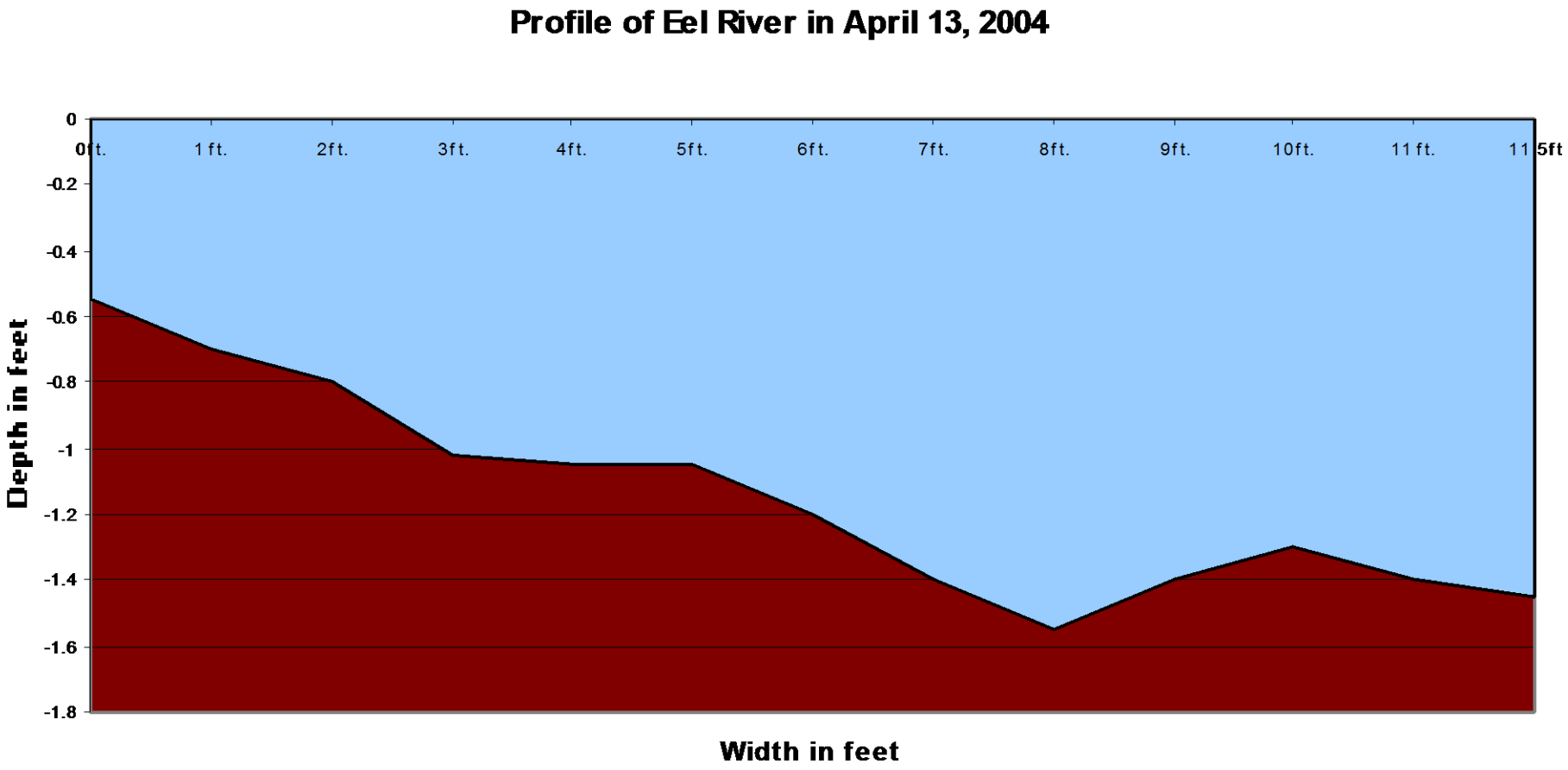
What we did at Eel River

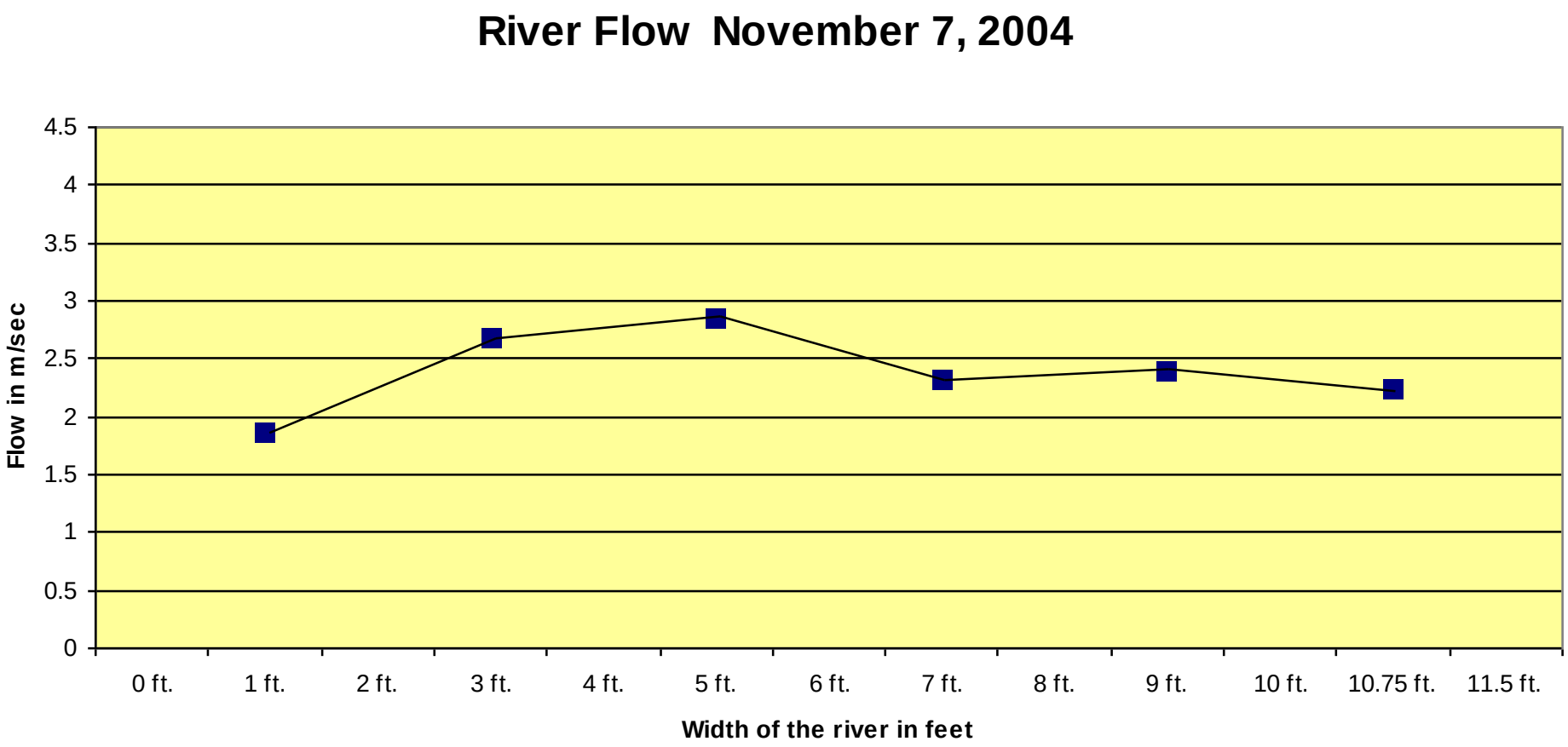
On her way to school on January 13, 2004 Mrs. Bradley got a grab sample of water from the river. At the BSC WALab we conducted Fecal Coliform tests on the water.

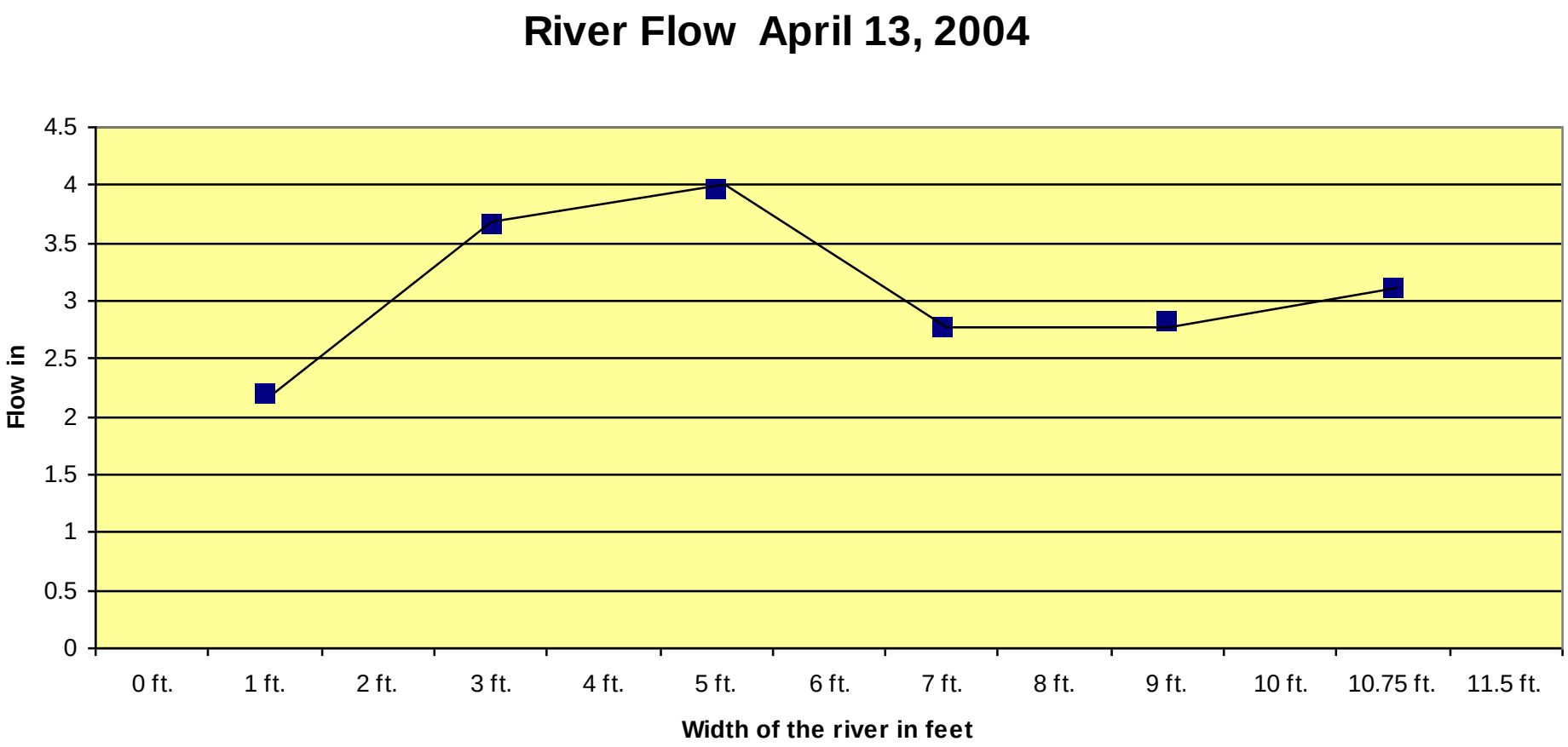
November River Profile



April River Profile




River Flow November 7, 2004
Flow in m/sec
4.5
4
3.5
3
2.5
2
1.5
1
0.5
0
0 ft.
1 ft.
2 ft.
3 ft.
4 ft.
5 ft.
6 ft.
7 ft.
8 ft.
9 ft.
10 ft.
10.75 ft.
11.5 ft.
Width of the river in feet


River Flow April 13, 2004
Flow in
4.5
4
3.5
3
2.5
2
1.5
1
0.5
0
0 ft.
1 ft.
2 ft.
3 ft.
4 ft.
5 ft.
6 ft.
7 ft.
8 ft.
9 ft.
10 ft.
10.75 ft.
11.5 ft.
Width of the river in feet

Environmental Dangers

The major fear of the town officials is eutrophication. This occurs when there is the introduction of nitrogen and phosphorus compounds. These chemicals act as fertilizers for algae and other plants. The plants flourish and bloom and choke out light and use up oxygen leading to the death of the animals in the water body.

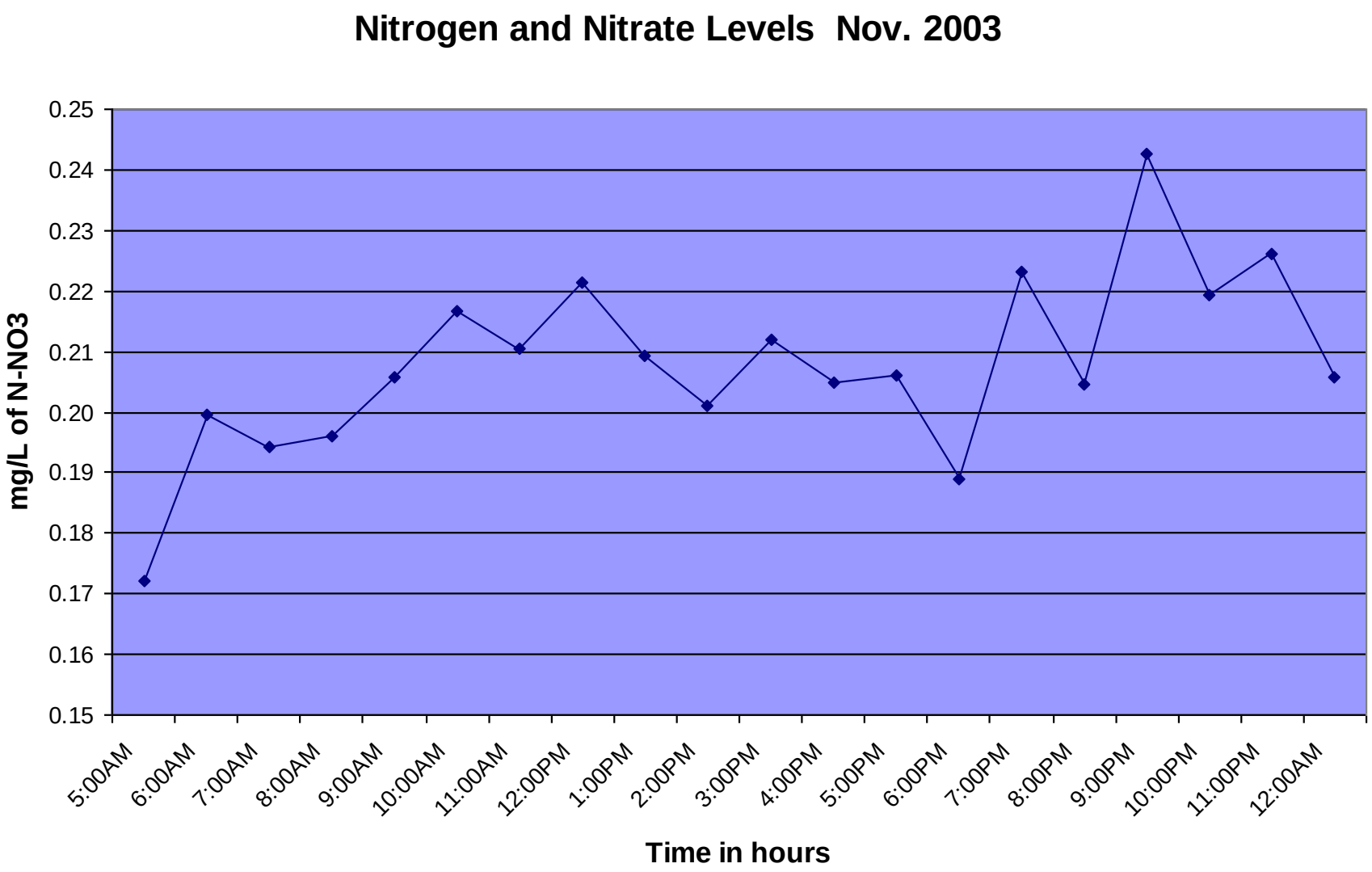
It has been classified as a Nitrogen Limited river. Town Engineers fear that even 1 mg/L will lead to uncontrolled growth of algae and eventual death of the river.

How Do Nitrates Get Into the River?

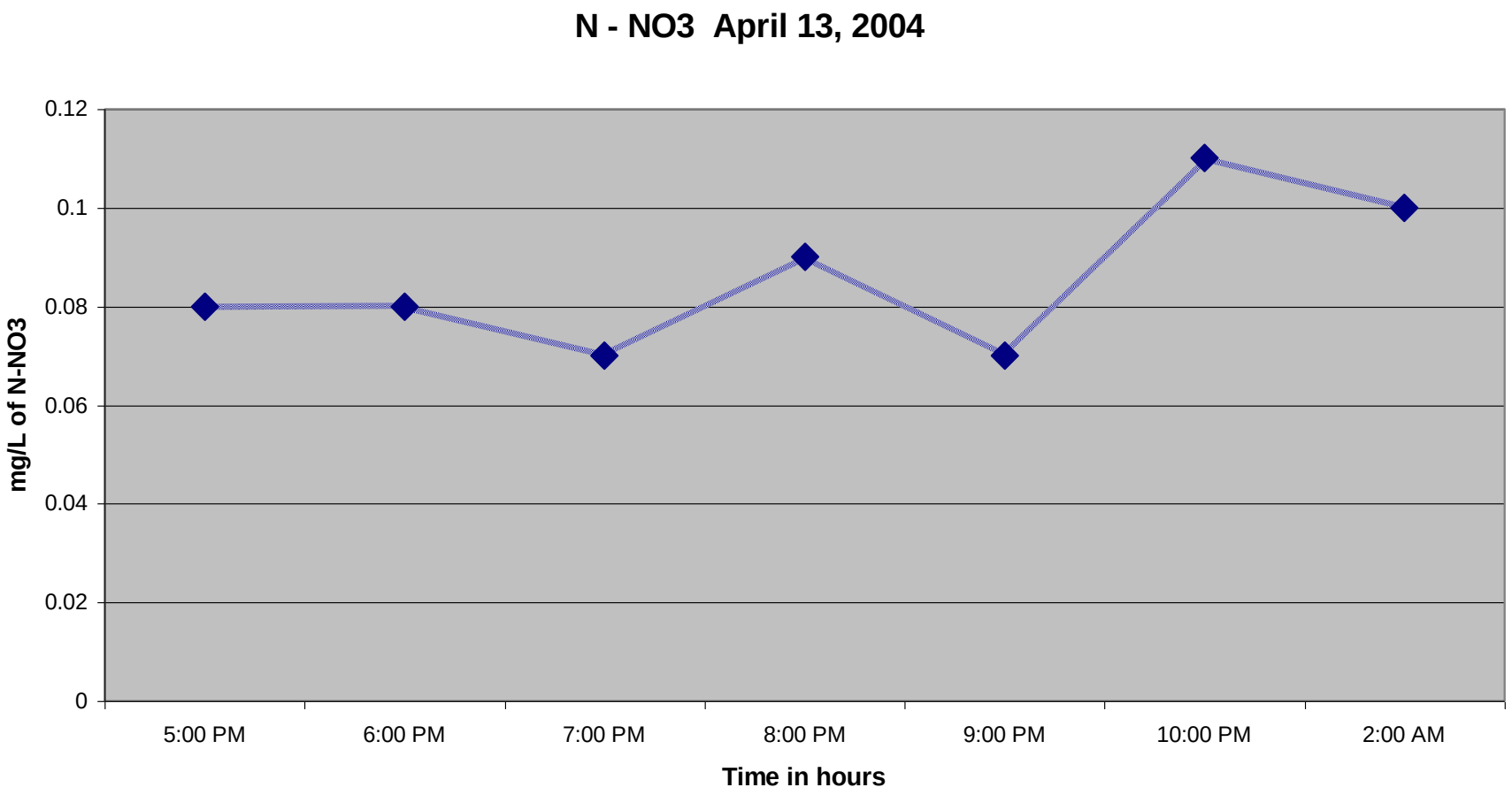
- Fertilizers- from golf courses, bogs, and lawns
- Failing Septic Systems
- Animal waste- from farms
- Untreated human waste from treatment plants

How Does Phosphorus Get Into the River?

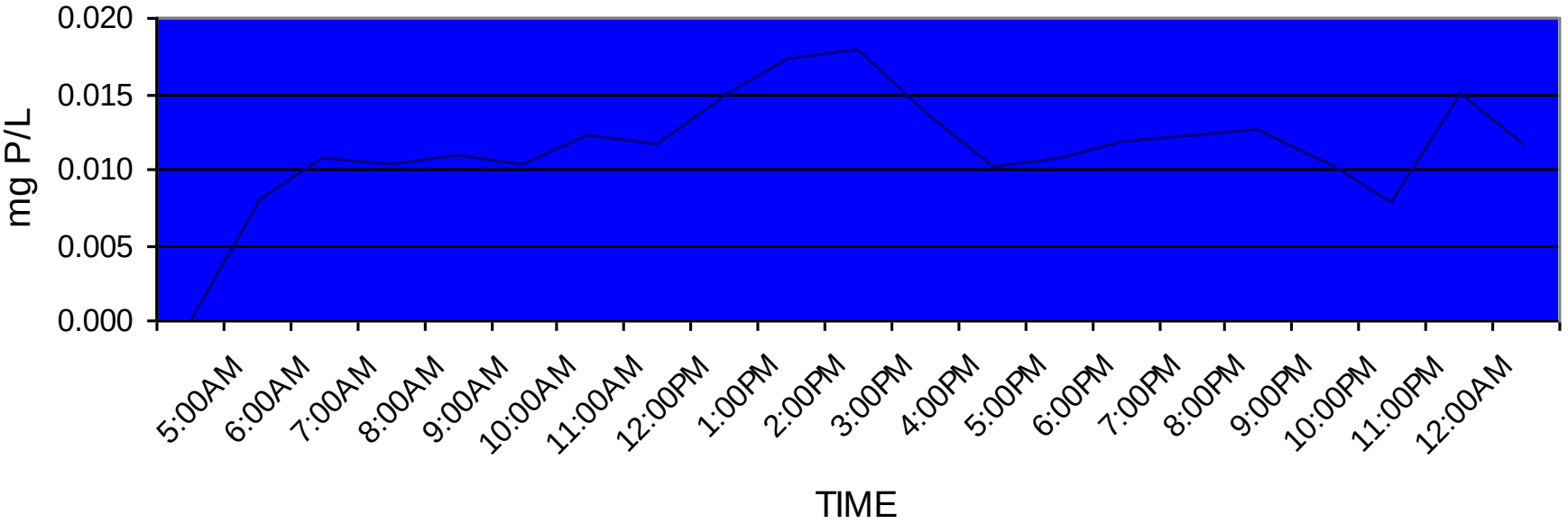
- Fertilizers- from golf courses, lawns and bogs
- Detergents – from leaking septic systems
- Animal waste – from farms


Nitrogen and Nitrate Levels Nov. 2003
mg/L of N-NO3
0.25
0.24
0.23
0.22
0.21
0.20
0.19
0.18
0.17
0.16
0.15
5:00AM
6:00AM
7:00AM
8:00AM
9:00AM
10:00AM
11:00AM
12:00PM
1:00PM
2:00PM
3:00PM
4:00PM
5:00PM
6:00PM
7:00PM
8:00PM
9:00PM
10:00PM
11:00PM
12:00AM
Time in hours

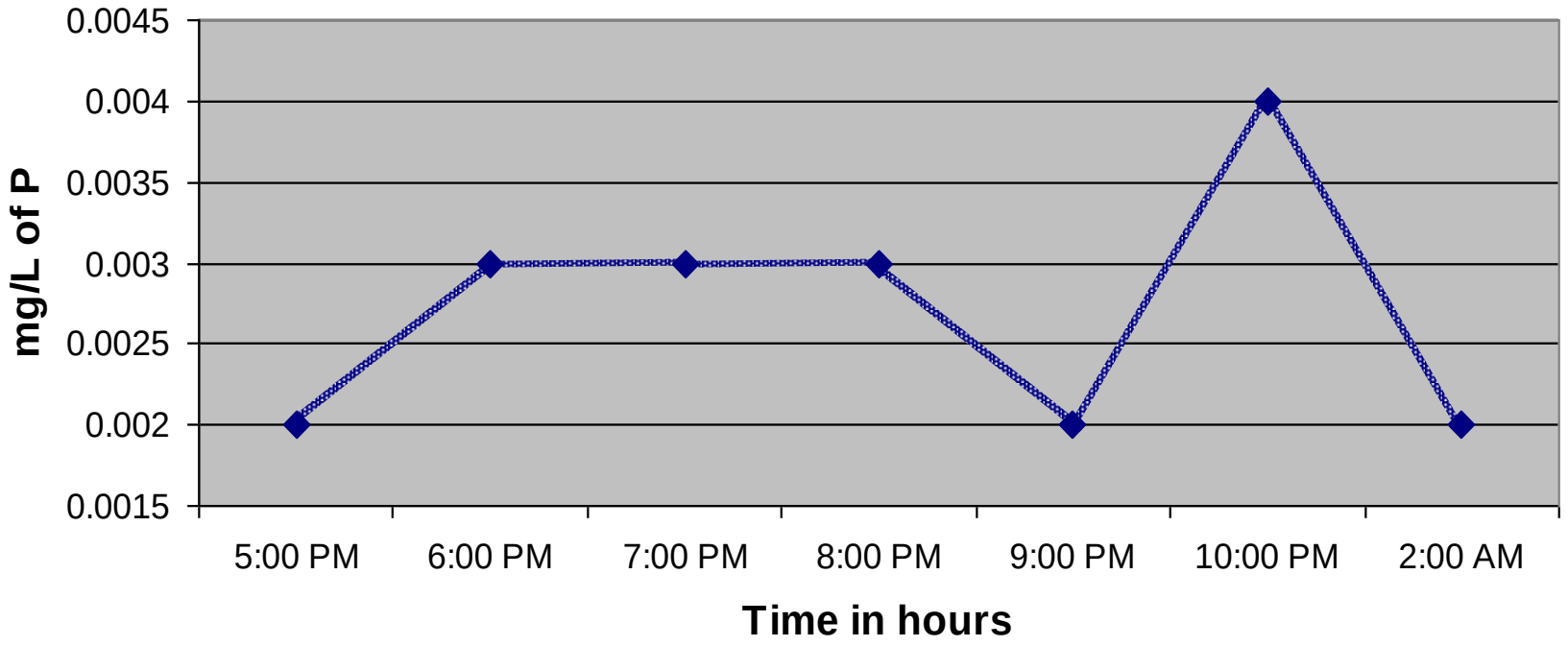
N-NO3 Levels April 13,2004



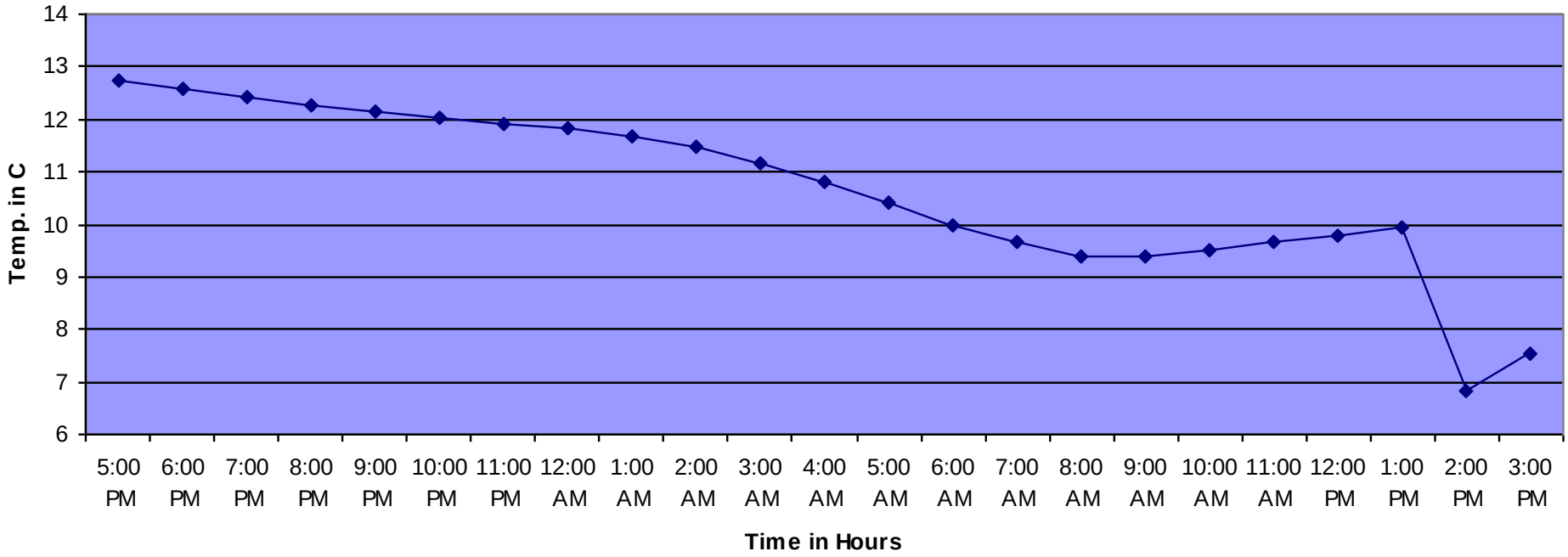
Phosphorus in mg/L Nov. 2003



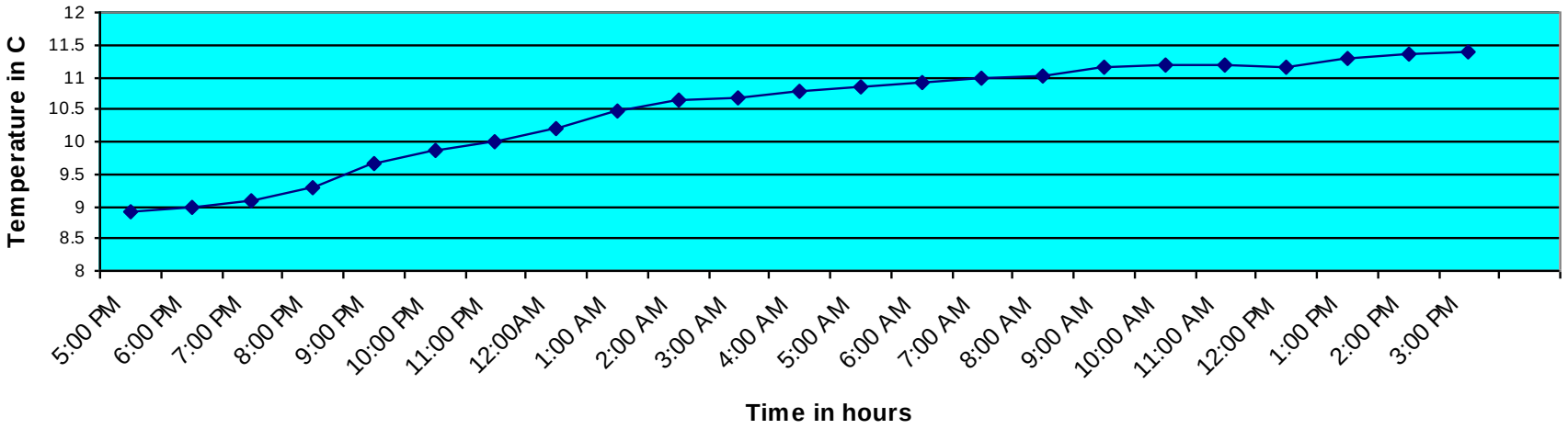
Phorphorus April 13, 2004



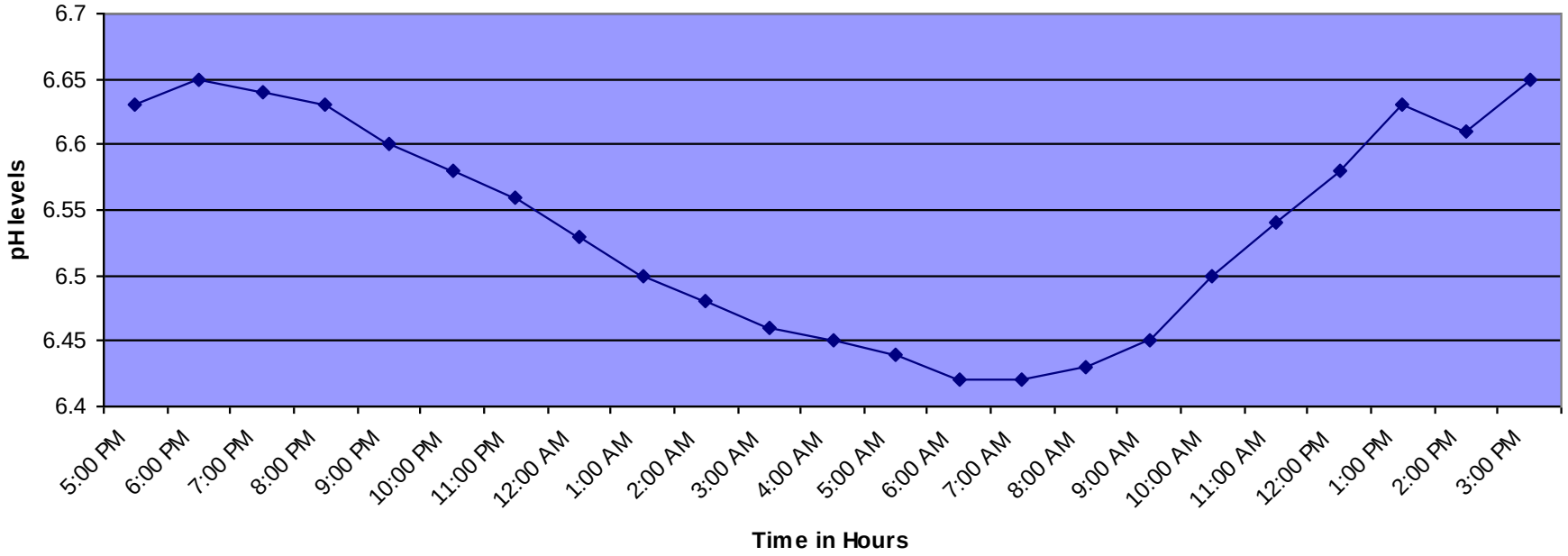
Temperature November 7, 2003



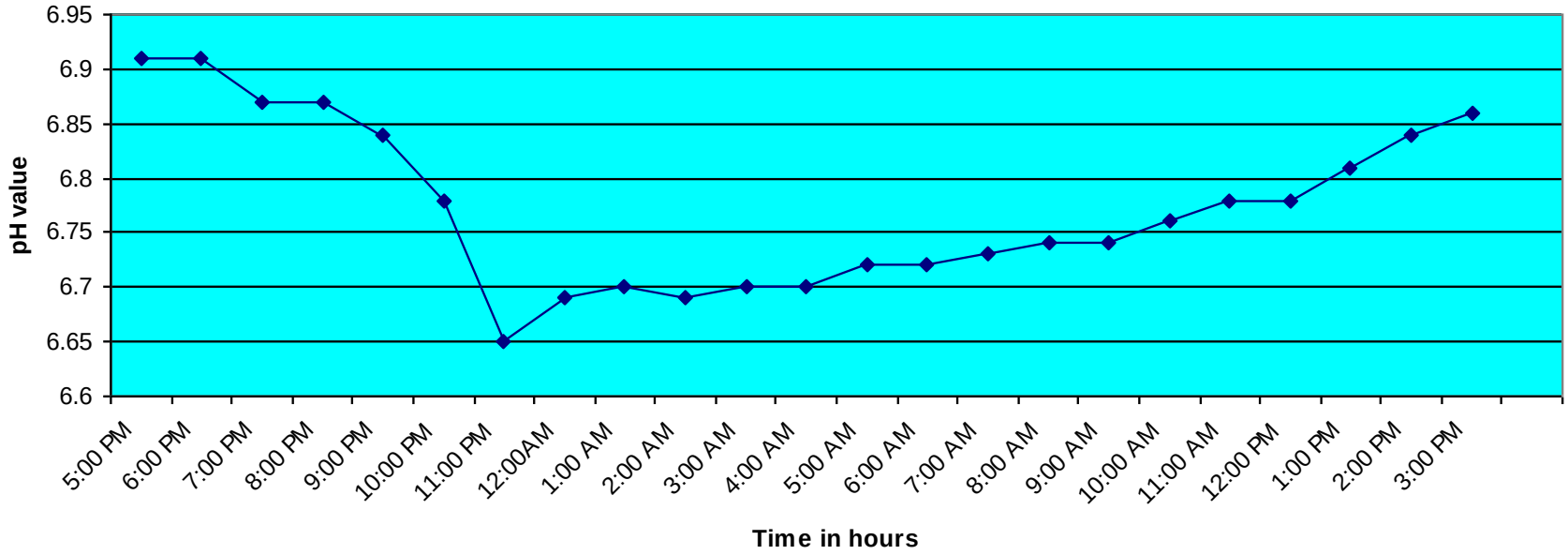
Temperature April 13, 2004



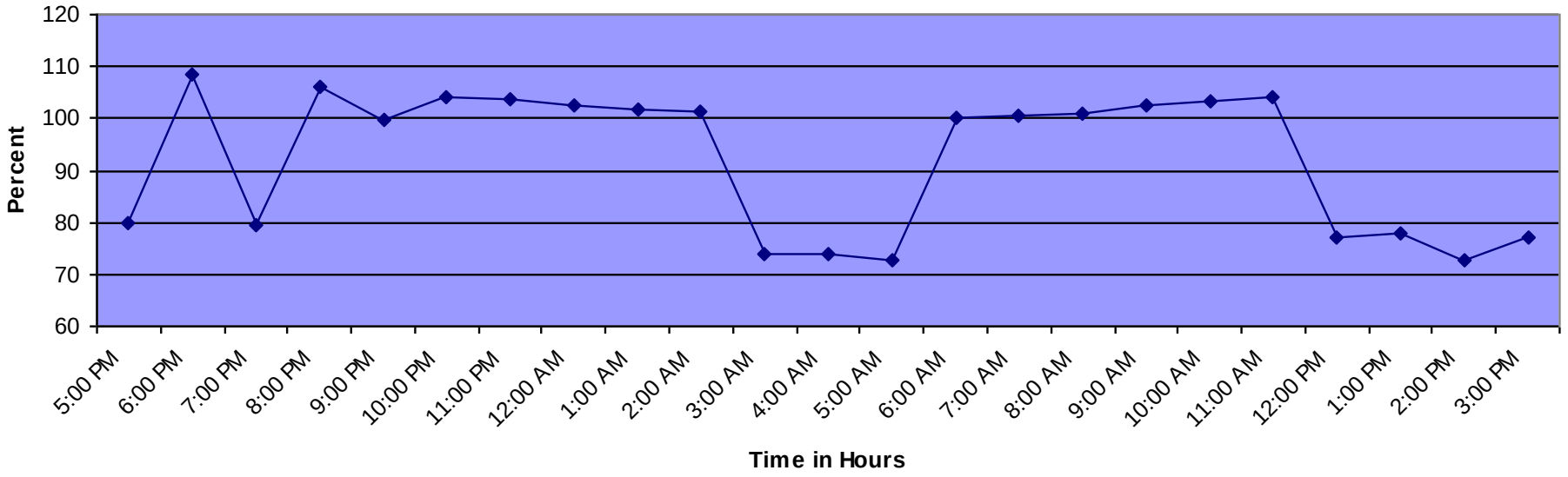
pH Levels November 7, 2003



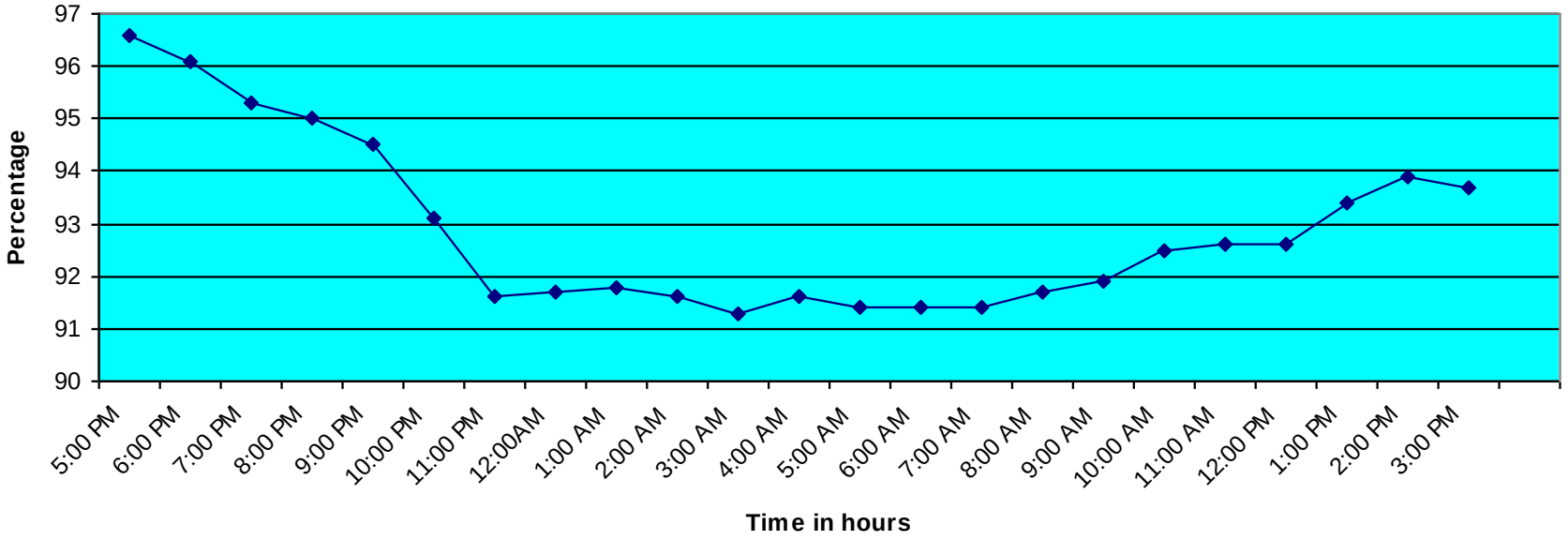
pH April 13, 2004



Percent of Dissolved Oxygen November 7, 2003



% of Dissolved O April 13, 2004



Eserichia coli

This bacteria, also known as fecal coliform, is commonly found in the solid waste of humans and animals.When ingested by humans disease can result.

The common sources are untreated effluent from wastewater treatment plants, failing septic systems, and large farms.

Preparing the Samples

Our water samples were filtered through sterile membranes and placed in Petri dishes with mFC broth.

After 24 hours in an incubator the dishes were viewed under a microscope and a colony count was taken.


THE WATER
FROM LAB SINKS
IS NOT
HUM
CONS
PLUM

Fecal Coliform Results

Bibliography

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http://www.state.ma.us/dfwele/RIVER/rifls
/Sites/EelRiver222/RIFLS_Site_Page.html

The Eel River Watershed Study Proposal,
MIT Eel River Investigation Team,
December 7, 2001

TEAM

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