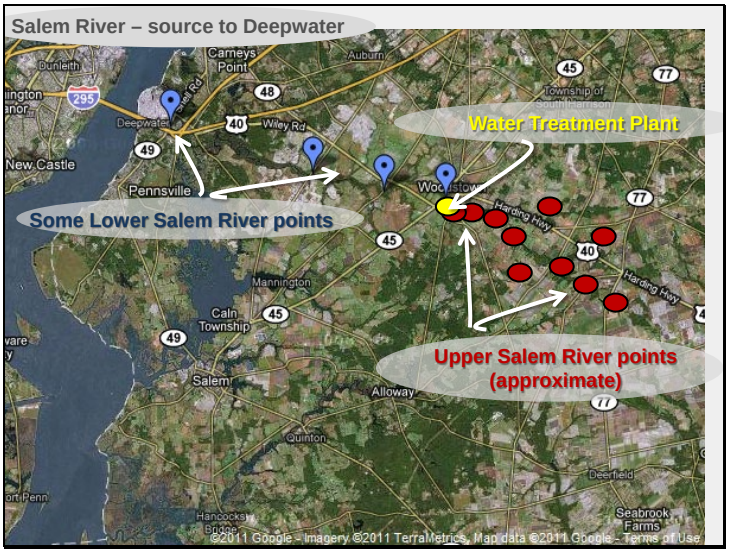
Slide 1

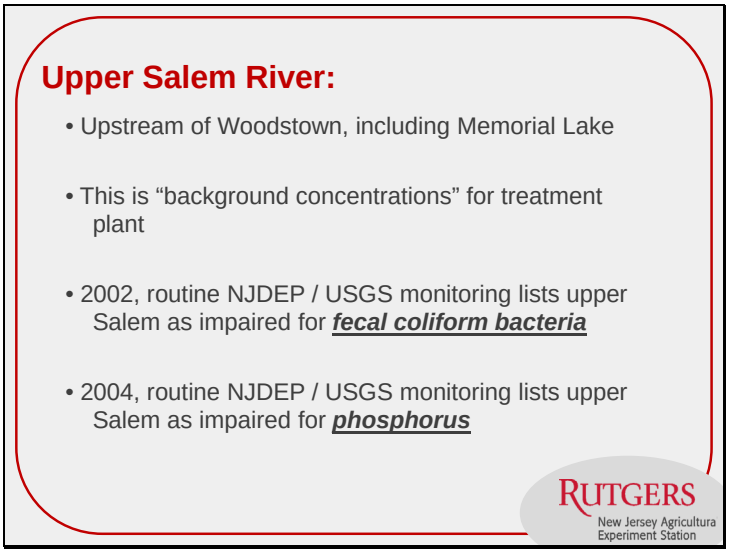
This presentation will review some information about Water Quality in the Salem River.

Slide 2



This is a map of water sampling locations along the Salem River. The red dots indicate the location of sampling spots in the Upper Salem River Watershed that were studied as part of an assessment by the Rutgers Cooperative Extension Water Resources Program from 2007 to 2009. This watershed is upstream (southeast) of Woodstown, and includes Memorial Lake. The yellow dot is the location of the wastewater treatment plant. The blue dots are the sampling locations where there is U.S. Geological Survey water quality data. These extend from Woodstown to the discharge to the Delaware River at Deepwater.

Slide 3



The Upper Salem River study area is upstream of the wastewater treatment plant, and therefore, when considering contributions of the plant to the water quality of the river, serves to indicate background concentrations of potential pollutants in the river. As a brief history of water quality concerns in the upper watershed, in 2002, routine testing led the state to list the upper watershed as impaired for fecal coliform bacteria. These bacteria are an indicator of fecal matter contamination from human or animal resources. In 2004, routine testing led the state to list the upper watershed as impaired for phosphorus.

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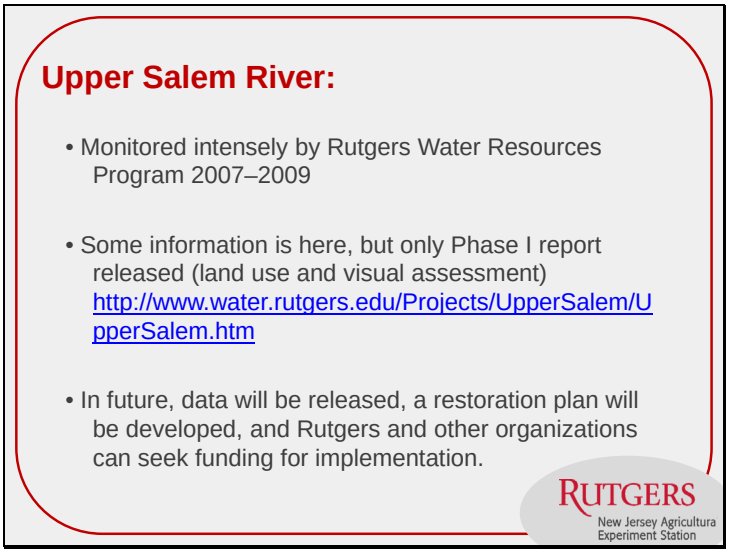

From 2007 to 2009, the upper watershed was studied more intensely by the Rutgers Water Resources Program to further determine the sources of pollutants to the river. Information about this study can be found in the project page of the water resources program. However, only the Phase I report has been released to date. This does not include the water quality monitoring data. In the future, the water quality monitoring data will be finalized and released, and a Restoration Plan will be developed. Having this plan is important, since its approval by the state Department of Environmental Protection will help support organizations seeking funding to implement its recommended projects. Maps are also available at that website.
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http://www.water.rutgers.edu/Projects/UpperSalem/UpperSalem.htm

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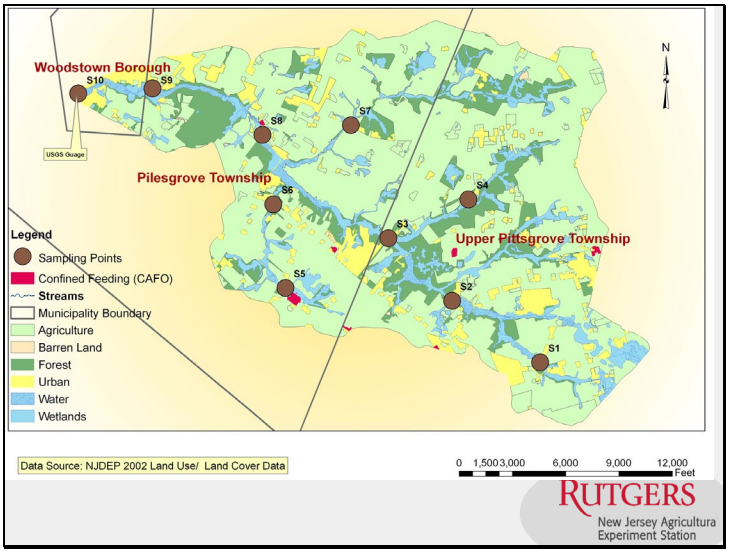

This is a map of the Upper Salem River study area. Sampling points are indicated by brown dots. The municipalities in this study area are Woodstown, Pilesgrove, and Upper Pittsgrove. This map also indicates land use. Light green is land devoted to agricultural production, and yellow is developed land. The darker green is forest. Note that some of the river and tributaries have forest along them.

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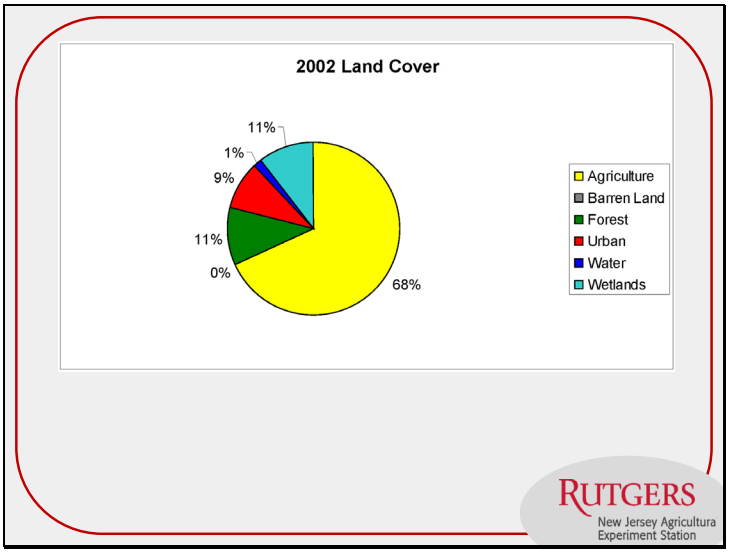

Land use in the upper watershed is 68% agricultural land, 9% developed, and 11% forest cover. Wetlands also comprise 11% of the area.

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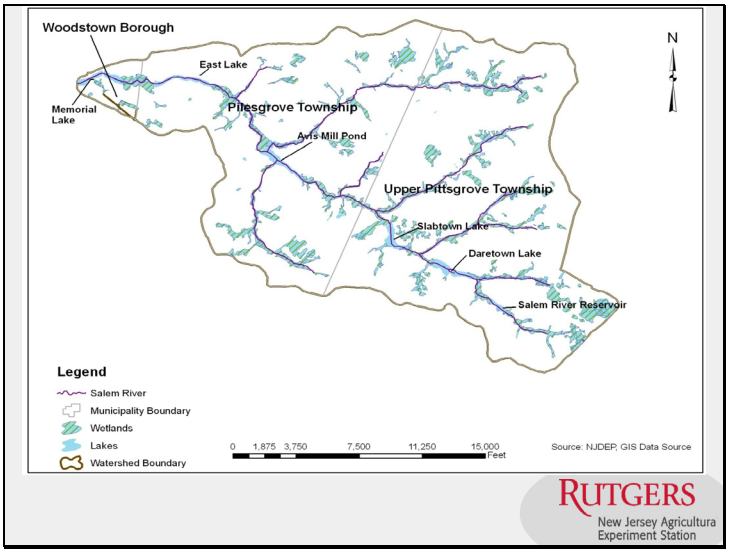

This is another map indicating the primary lakes and ponds in the watershed: Memorial Lake, East Lake, Avis Mill Pond, Slabtown Lake, Daretown Lake, and a small reservoir.

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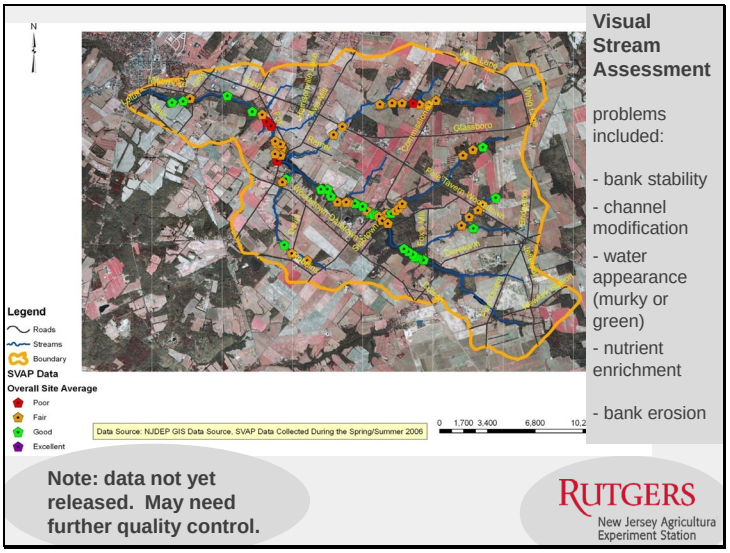

One type of assessment that was performed was a visual stream assessment. For this assessment, people go into, or near, the stream channel and perform a visual assessment according to a specific protocol. This figure shows the locations of the assessments, with green indicating a “good” result, orange “fair”, and red “poor.” Some problems at low-scoring locations included bank stability, for example from a lack of vegetation; channel modification; murky or green water color; nutrient enrichment of water; or bank erosion.

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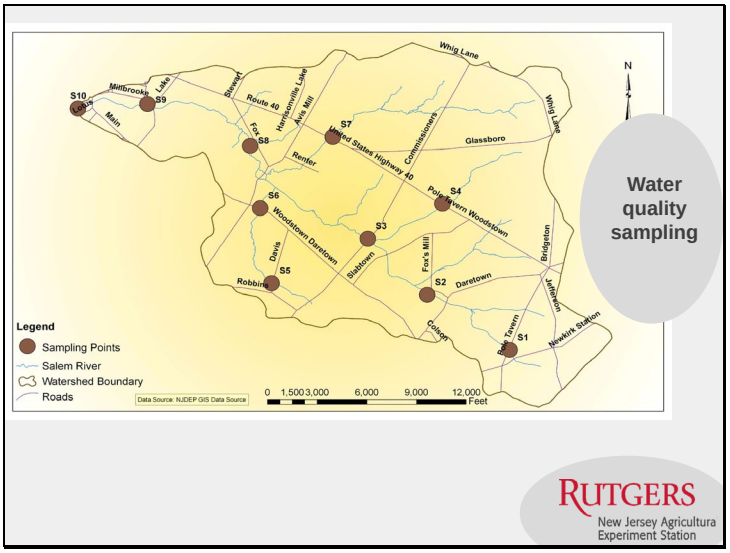
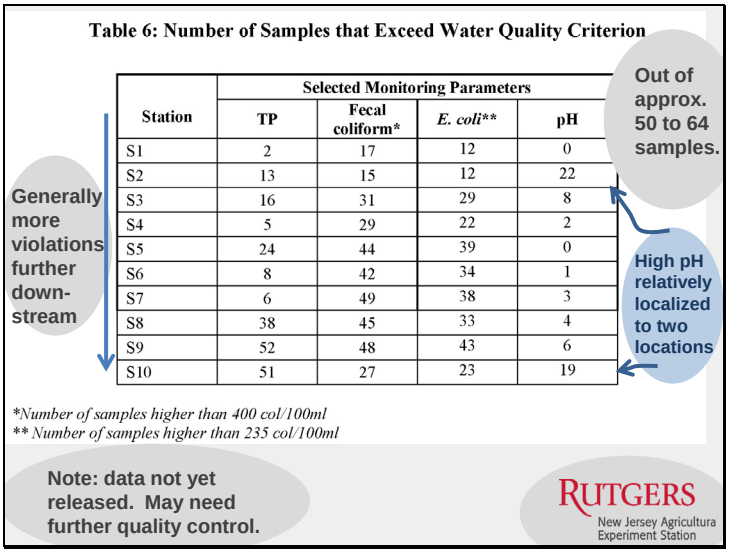
Please note that these data have not been released and are subject to revision during quality control procedures.

Slide 9



A map of the water sampling locations. Note that S10 is at the bottom (downstream, west) of the watershed, and the numbers increase (S2, S3, S4, etc.) more-or-less as one moves up the watershed and tributaries.

Slide 10



This is a table of how often water samples exceeded benchmark concentrations. Benchmark concentrations are the amount of a pollutant that is allowed in a given waterbody according to state standards. By "exceeded" we mean that the sample had a higher concentration of a pollutant than is allowed by the benchmark. The first column shows the sampling stations. Remember that S10 is at the bottom (downstream end) of the watershed. The numbers in the table are the number of exceedances of that pollutant at that station, out of about 50 to 64 samples per station. For total phosphorus (TP) some stations had more than 20 or 50 exceedances, or about one-third to most of the sampling occasions. Note also that there may be a general trend of more exceedances toward the bottom (downstream end) of the watershed. This might suggest that phosphorus builds up further down the river, from many small contributions from many sources along the way. For fecal coliform bacteria there were commonly more than 20 or more than 40 exceedances per station, or about 20% of samples, though some stations had exceedances more than 30% of the time. There also appears to be a possible trend of increasing exceedances as we move downstream, with the exception of the last station. The last station is after Memorial Lake, so perhaps the lake acts as a trap for those bacteria. *E. coli* is another bacterium that is used as an indicator of fecal matter contamination, and the data here basically mirror that for fecal coliform. Exceedances for pH weren't very common except at two stations. The cause for these exceedances in pH is not currently known.

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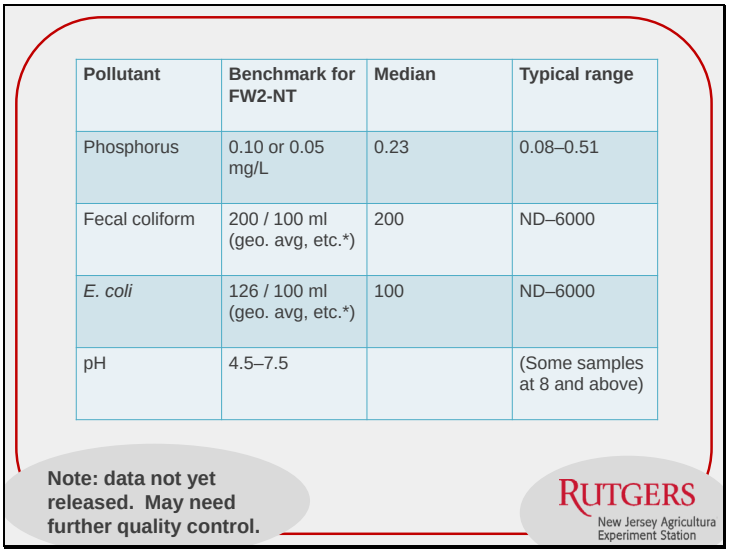
Slide 11



Pollutant	Benchmark for FW2-NT	Median	Typical range
Phosphorus	0.10 or 0.05 mg/L	0.23	0.08–0.51
Fecal coliform	200 / 100 ml (geo. avg, etc.*)	200	ND–6000
E. coli	126 / 100 ml (geo. avg, etc.*)	100	ND–6000
pH	4.5–7.5		(Some samples at 8 and above)

To look at this data another way, this table presents the state benchmark for each pollutant---which is how much of a pollutant is allowed in water---, the median values across all samples, and the typical range in the samples. The benchmark for total phosphorus in freshwater bodies that are classified as FW2--- as the upper Salem River is--- is 0.10 milligrams per liter for rivers (mg/L, or parts per million), and 0.05 milligrams per liter for lakes. The median value for phosphorus in water samples was 0.23 milligrams per liter, which isn't exceptionally high, but is high enough to cause eutrophication, plant blooms, and low oxygen conditions in lakes, and is at least twice the benchmark value. "Median" means that half the samples were above this value and half the samples were below. The typical range in samples was 0.08 to 0.51 milligrams per liter for total phosphorus. The benchmark values for fecal coliform bacteria and *E. coli* are somewhat complex, but essentially are a (geometric) average of 200 colonies per 100 milliliters (ml) of water for fecal coliform, and 126 colonies per 100 milliliters for *E. coli*. The median values for these were at or below the benchmark, suggesting that half of the samples met the benchmark and half didn't. The ranges in values, however were quite wide, from non-detectable (ND) to 6000 colonies per 100 milliliters. This indicates that the bacteria values vary greatly from one sampling time to another. Some water samples had pH values over 8, which is rather alkaline for rivers here.

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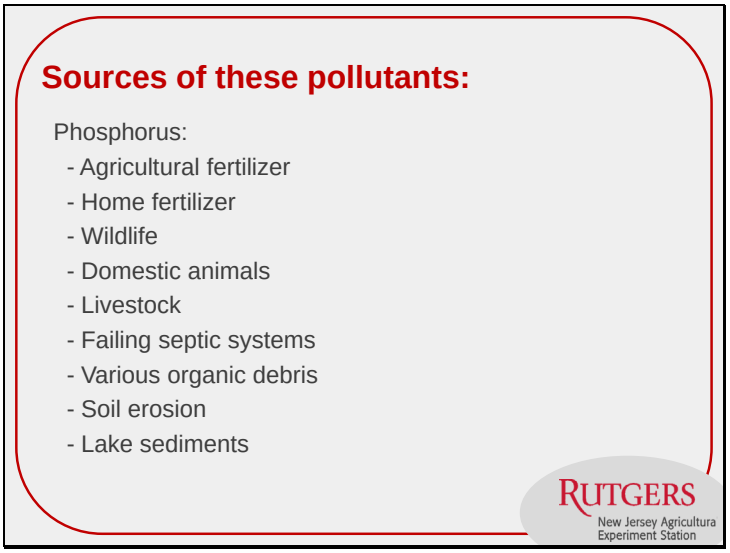
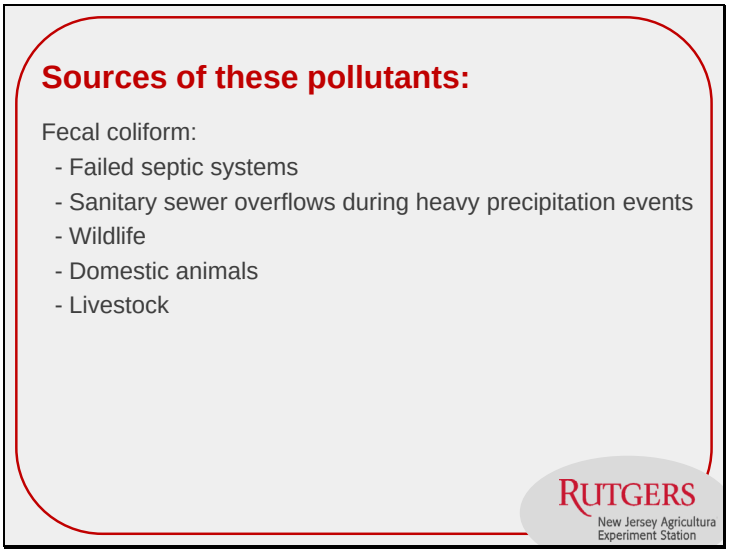
Slide 12



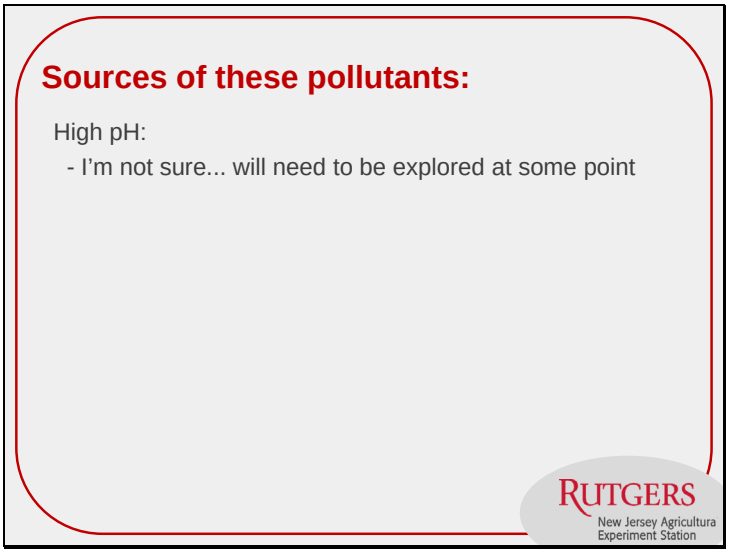
The two pollutants found to be impacting water quality the most in this study--- phosphorus and fecal matter--- come from a wide range of sources. Phosphorus is found in all living things and so is nearly ubiquitous in the environment, though in small concentrations. Sources of phosphorus that could be impacting the river include fertilizers for farms, lawns, or gardens; feces from wildlife, pets, or livestock; effluent from failed septic systems; and organic debris like yard clippings. Soil erosion is important source of phosphorus since phosphorus often chemically adheres to soil particles. If eroded soil particles that are carried with stormwater to lakes and rivers can release their held phosphorus there. Lake sediments, too, hold phosphorus, and can release it over time to the overlying water.

Slide 13



Fecal contamination is a concern because it can carry disease-causing pathogens of various types, such as bacteria, viruses, and protozoans (like Cryptosporidium). Any animal waste carries the bacteria that are used to indicate fecal contamination (fecal coliform bacteria or *E. coli*). Common sources of fecal contamination are failed septic systems and sanitary sewer overflows during heavy precipitation events; and feces from wildlife, livestock, and pets.

Slide 14



The sources of high pH water in this watershed are not known at this time. There are some natural high-pH marl deposits in the area. Alternatively, the pH of water could be affected by industrial or household effluent, or perhaps some other chemicals, but specific sources of any of these have not been identified.

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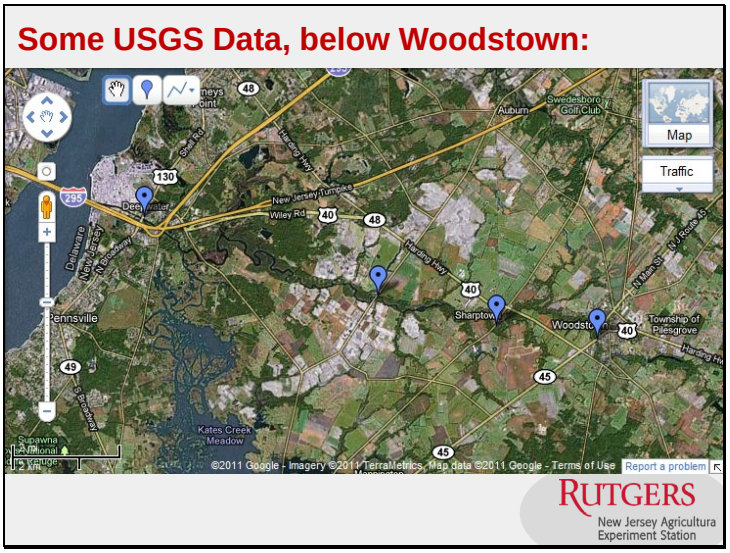
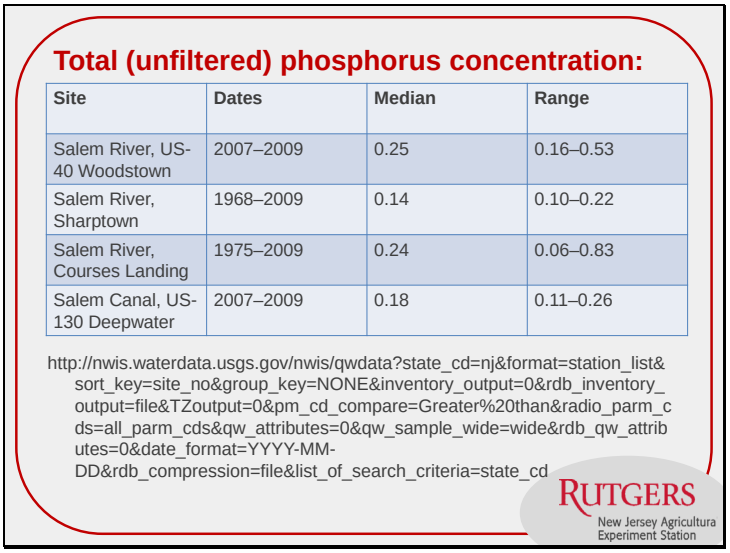


This map shows sampling stations where the state and U.S. Geological Survey have historically collected water samples. These samples are often collected intermittently, but give a general idea of the concentrations of water pollutants during the time period. The stations examined for this presentation, and shown on the map, are only those along the Salem River from Woodstown to its discharge to the Delaware River at Deepwater.

Slide 16



This table presents the median and range data for total phosphorus for these different sampling stations. In general, the median values here--- from 0.14 to 0.25 milligrams per liter--- are similar to that presented for the upper watershed in the previous table, which was 0.23 milligrams per liter. Similarly the ranges here are similar to that presented for the upper watershed, which was 0.08 to 0.51 milligrams per liter. This suggests that phosphorus concentrations don't differ much from above Woodstown to below in the Salem River.

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http://nwis.waterdata.usgs.gov/nwis/qwdata?state_cd=nj&format=station_list&sort_key=site_no&group_key=NONE&inventory_output=0&rdb_inventory_output=file&TZoutput=0&pm_cd_compare=Greater%20than&radio_parm_cds=all_parm_cds&qw_attributes=0&qw_sample_wide=wide&rdb_qw_attributes=0&date_format=YYYY-MM-DD&rdb_compression=file&list_of_search_criteria=state_cd

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http://salem.rutgers.edu/nre