Summary:
Beginning February 5th, we'll be collecting near-daily water quality measurements of Cuyahoga River water as it flows through Kent. Using the data we collect, we'll attempt to answer the following questions:

- How does water quality change as the river flows through an urban area?
- How does water quality vary with respect to discharge in the Cuyahoga River?

Each student will sign up for one weekday on the class calendar. On the assigned day, that student will be responsible for taking a suite of measurements at 2-4 locations. The measurements we will take are (1) turbidity, (2) specific conductance, and (3) temperature and we will also collect water samples for later analysis on the Picarro water isotope analyzer. Each student will be required to take one set of measurements at the base of the steps just upstream of Main Street and one set of measurements at the beach just downstream of Summit Street. Students with access to cars are also encouraged to take measurements at the River Bend Road boat launch (at Kent's upstream end) and at the Middlebury Road boat launch (at Kent's downstream end). Details of each measurement technique and each site are given below.

Hypotheses:
Based on your understanding of urban hydrology and the Cuyahoga River watershed, what do you think we will see in the data?

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Field Sites
Boat Launch on River Bend Road (optional)
Stairs to river immediately upstream of Main Street Bridge (required)
Beach downstream of Summit Street/Tannery Park (required)
Boat Launch on Middlebury Road (optional)

The Main Street and Summit Street sites are accessible on foot from campus and they capture a ~0.5 km river reach that represents Kent's most heavily urbanized area. The River Bend Road site is ~2.1 km upstream from Main Street and represents the approximate upstream extent of urban land use on the Cuyahoga River. This site is 2.3 km downstream of where the City of Akron withdraws its public water supply. Between River Bend and Main Street, urban land use adjacent to the river intensifies as you move downstream. The Middlebury Road site is ~3.1 km downstream from the Summit Street site, and while there are wide riparian woodlands on either side of the river, the City of Kent wastewater treatment plant also discharges into this reach.

Protocol:

1. On your assigned day, go to the Geology department office between 9 am and 5 pm to pick up the field gear. Make sure you leave enough time to get your work done and return the gear by 5 pm. If you don't get the gear back in time, you are responsible for notifying the next day's assigned person and arranging a mutually agreeable gear transfer. This gear is:
    a. bucket with string (for throwing into the river to retrieve water)
    b. pitcher for pouring water into the turbidity tube
    c. turbidity tube
    d. Vernier LabQuest data collector (NOT waterproof)
    e. Vernier LabQuest conductivity probe (only the lower part is waterproof)
    f. Vernier LabQuest temperature probe (only the lower part is waterproof)
    g. 2-4 labeled 20 ml vials for water sampling
    h. A data sheet from the binder
2. Press the silver power button on the upper left corner of the Vernier LabQuest to turn it on and to make sure its battery is charged. Turn it back off once you have checked the power. If the unit will not turn on, either plug it in and charge for a few hours before sampling (if you have time) or find Dr. Jefferson. Either way, record that you had a dead battery on your data sheet.
3. Head to your first field site. At a minimum you need to collect data for the Main Street and Summit Street sites. You are encouraged to also collect data for the River Bend and Middlebury sites.
4. When you arrive at the field site, note the time and any pertinent environmental conditions on the data sheet.
5. Rinse the bucket and pitcher in river water 2x (to remove contamination from previous sites). Collect a bucket of water, being careful not to include sediment from the bottom of the river. Use the pitcher as needed to transfer water to the turbidity tube, but make sure to rinse the pitcher 2x before use.
6. Turbidity measurements:
    a. Rinse the tube with the water that is going to be tested and pour it out.
    b. Vigorously stir or swirl the water sample until it is completely mixed, introducing as little air as possible.
    c. Fill the turbidity tube with river water to the 120 cm mark. Measurements should be taken in daylight, but not direct sunlight. Cast a shadow on the tube by placing yourself between the sun and the tube. Do not wear sunglasses when reading the tube.
    d. Place your head 10–20 cm directly over the tube so that you can see the viewing disc. If it is visible when the tube is full, record 120 cm on the data sheet.
    e. If the disk is not visible, use the valve at the bottom of the tube to slowly release water until the viewing disk becomes visible. Record the water level in cm on your data sheet.

   f. Use the table or equation below to convert your water level measurement to turbidity units (NTU).
      i. Depth in Centimeters = 244.13 *(Turbidity in NTU)$^{-0.662}$
      ii. See Table 1 for conversion short cuts.
      iii. Record your turbidity measurement on the data sheet.
7. Water Sample Collection
   a. Uncap a 20 ml vial and submerse it in the bucket of water, filling the vial completely. Try to avoid getting a lot of sediment or other floating particulates into the vial.
   b. Cap the vial tightly and check to make sure there are no air bubbles. If there is lots of head space, please open it up and fill again.
   c. Record the vial number on the data sheet.
8. Temperature and Specific Conductance Measurements
   a. Press the silver power button in the top left corner to turn it on.
   b. Connect the temperature and conductivity probes to two of the slots at the top of the Vernier LabQuest.
   c. The LabQuest should now display data being collected by the two probes. If it doesn't, press the crescent shaped button with a triangle on it.
   d. Put the bottom few inches of the temperature and conductivity probes into the water sample (in the bucket or pitcher) and leave them there until their readings stabilize and become ~constant.
   e. Record those readings on the data sheet. Turn off the Lab Quest, wipe the probes dry and put it all back into the box.
9. Discard any remaining water and head to the next site.
10. Repeat steps 4-9 for the remaining field sites.
11. When you have finished sampling for the day, bring all gear back to McGilvrey 221.
   a. Rinse the turbidity tube, pitcher, and bucket in sink water and make sure Vernier LabQuest is dry and off.
   b. Plug in the LabQuest so that it can charge overnight.
   c. Put your data sheet into the binder and your filled sample vials into the container.
12. Make sure you budget your time so that you can get all gear back and properly cleaned and returned before 5 pm. If the office is closed when you get back, and it's before 5 pm, find a faculty member to let you in. If you get back after 5 pm, please contact the person who is supposed to sample the next day and make mutually agreeable arrangements to transfer the gear. You will still be responsible for returning water vials and the data sheet to McGilvrey ASAP.

Safety First!

a. If you feel uncomfortable sampling on your own, ask a classmate for help. If you can't find a classmate, ask a friend. If you can't find a friend, ask Dr. Jefferson!
b. Complete all sampling during daylight hours.
c. Do not go into the river or risk falling in. You can use the bucket and rope to collect water from the river without getting too close.

Your grade depends on:

1) Collecting your samples and measurements on the assigned day
2) Returning the gear, data, and samples in a timely fashion
3) Returning everything in working order.

If you are having trouble with one of these things (e.g. you forgot to sample), contact Dr. Jefferson ASAP.

Your grade does *not* depend on how many samples you collect or what the numbers are. But the more and better data we have, the more interesting scientific story we may be able to discover.

Class Data Analysis

Following the conclusion of data collection, we will compile and analyze all of the data during class. We will try to answer the questions posed at the beginning of the project and test any hypotheses you have generated.

Table 1: Conversion chart converting centimeters (cm) to turbidity units (NTU's). Table and equation 1 from Wyoming Stream Team, 2011.

Distance from bottom of tube (cm) NTU's	NTUs
<6.25	>240
6.25 to 7	240
7 to 8	185
8 to 9.5	150
9.5 to 10.5	120
10.5 to12	100
12 to 13.75	90
13.75 to 16.25	65
16.25 to 18.75	50
18.75 to 21.25	40
21.25 to 23.75	35
23.75 to 26.25	30
26.25 to 28.75	27
28.75 to 31.25	24
31.25 to 33.75	21
33.75 to 36.25	19
36.25 to 38.75	17
38.75 to 41.25	15
41.25 to 43.75	14
43.75 to 46.25	13
46.25 to 48.75	12
48.75 to 51.25	11
51.25 to 53.75	10
53.75 to 57.5	9
57.5 to 60	8
Over 60	<8

Directions

1. From Main Street Bridge to River Bend Road:
    a. Head north on Gougler Avenue (0.3 miles)
    b. Continue on North Mantua Street (0.8 miles)
    c. Turn right on River Bend Road (0.4 miles)
    d. Park in the parking lot just before the bridge and walk down the boat launch to the river.
2. From River Bend Road to Main Street Bridge:
    a. Head west on River Bend Road (0.4 miles)
    b. Turn left (south) onto North Mantua Street (1.2 miles)
    c. Turn left (east) onto Main Street (0.2 miles)
    d. Park in the proximity of the bridge and walk down the stairs, under the bridge to the upriver side of the bridge and walk down the final stairs to the river.
3. From Main Street Bridge to Summit Street / Tannery Park (by car)
    a. Head east on Main Street to Franklin Ave (1st right)
    b. Turn right on Franklin Ave (heading south) (0.3 miles)
    c. Turn right on Summit Street (heading west) and cross the bridge
    d. Take first left into parking lot and walk down to the river beach.
4. From Summit Street/Tannery Park to Middlebury Road
    a. Head NW on Summit Street and continue onto Stow Road (0.2 miles)
    b. Turn right onto Pearl Street
    c. Take 1st left onto OH-59 and head towards Stow (0.2 miles)
    d. Take 1st left onto Middlebury Road (1.4 miles)
    e. Turn into the boat launch parking area just before crossing the bridge.
5. Walking directions from Main street bridge to Summit Street/Tannery Park
    a. Follow the path downstream either on the pavement (higher up) or the dirt trail (lower down). Cross under Haymaker Parkway and emerge at Stow Street. Cross Stow Street and head to the river. Total distance 0.3 miles.
6. All sites are accessible from the Hike and Bike Trail, but it might be a little awkward to walk or bike with the gear for very far. However, if you want to do that and need help figuring out directions, just let me know.

Image of all four sites:

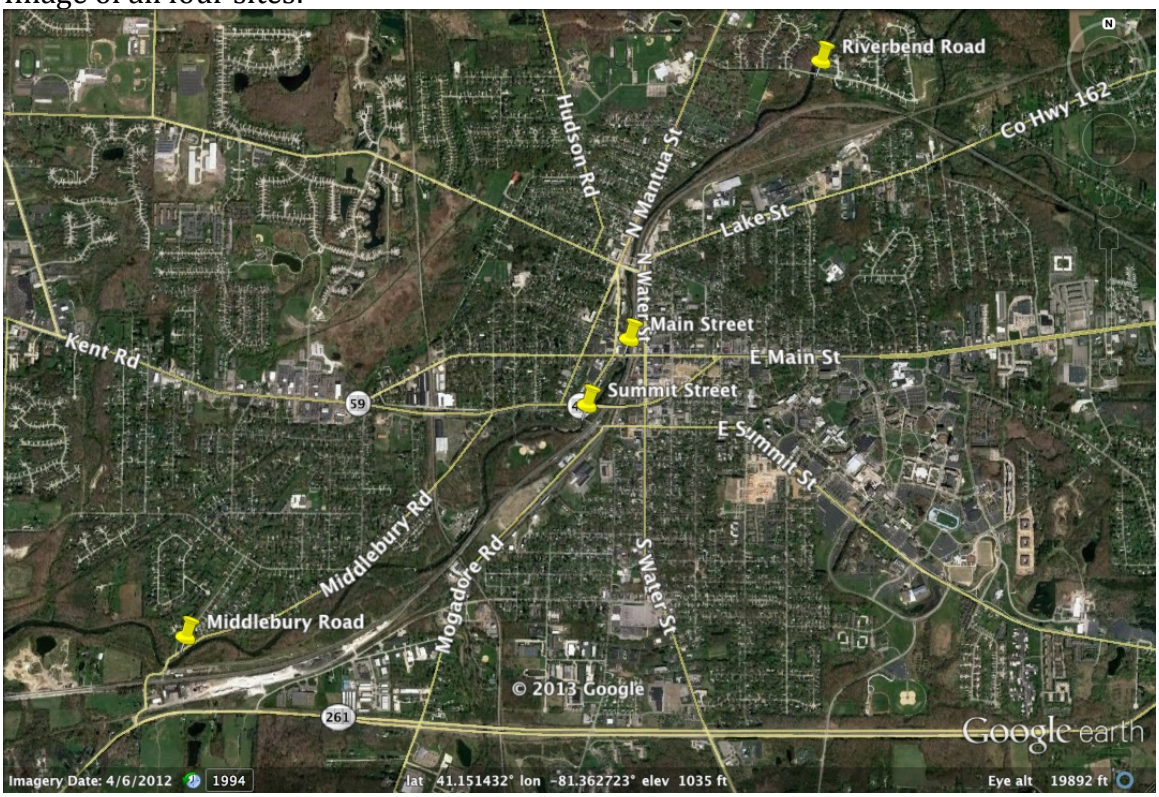

Image of the Main and Summit Street area:

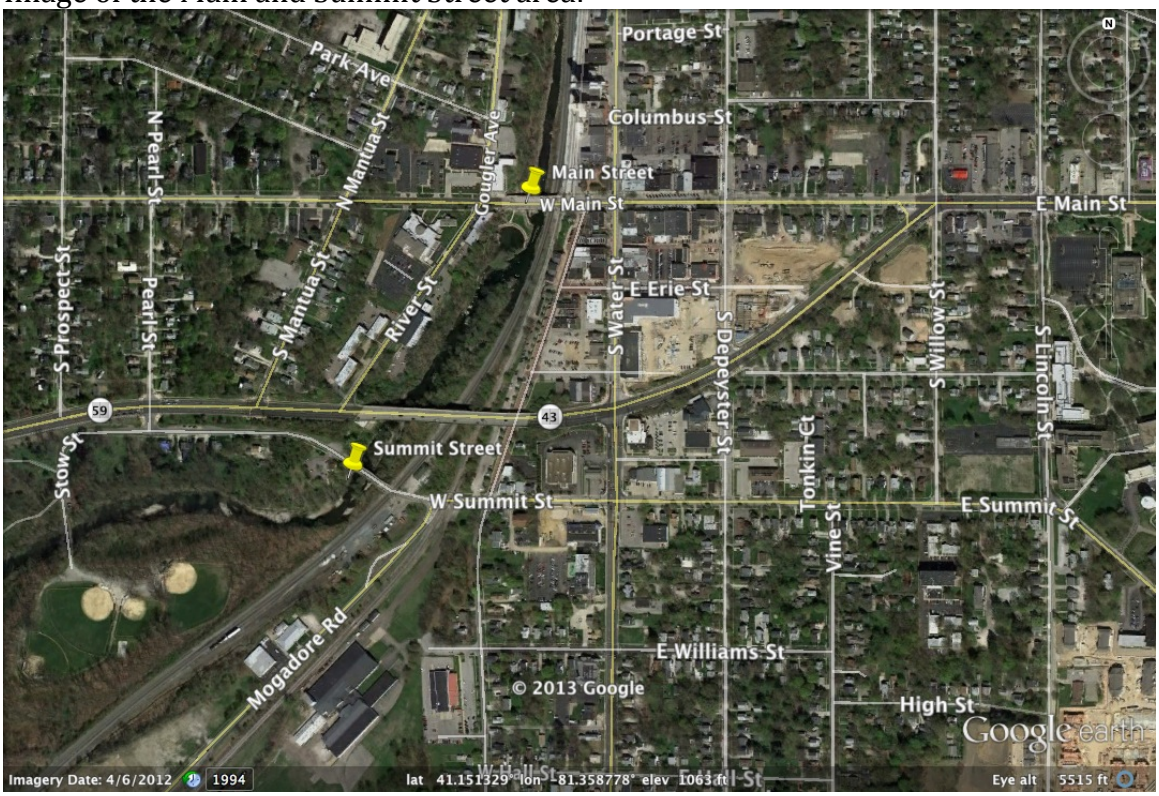

Image of the River Bend Area:

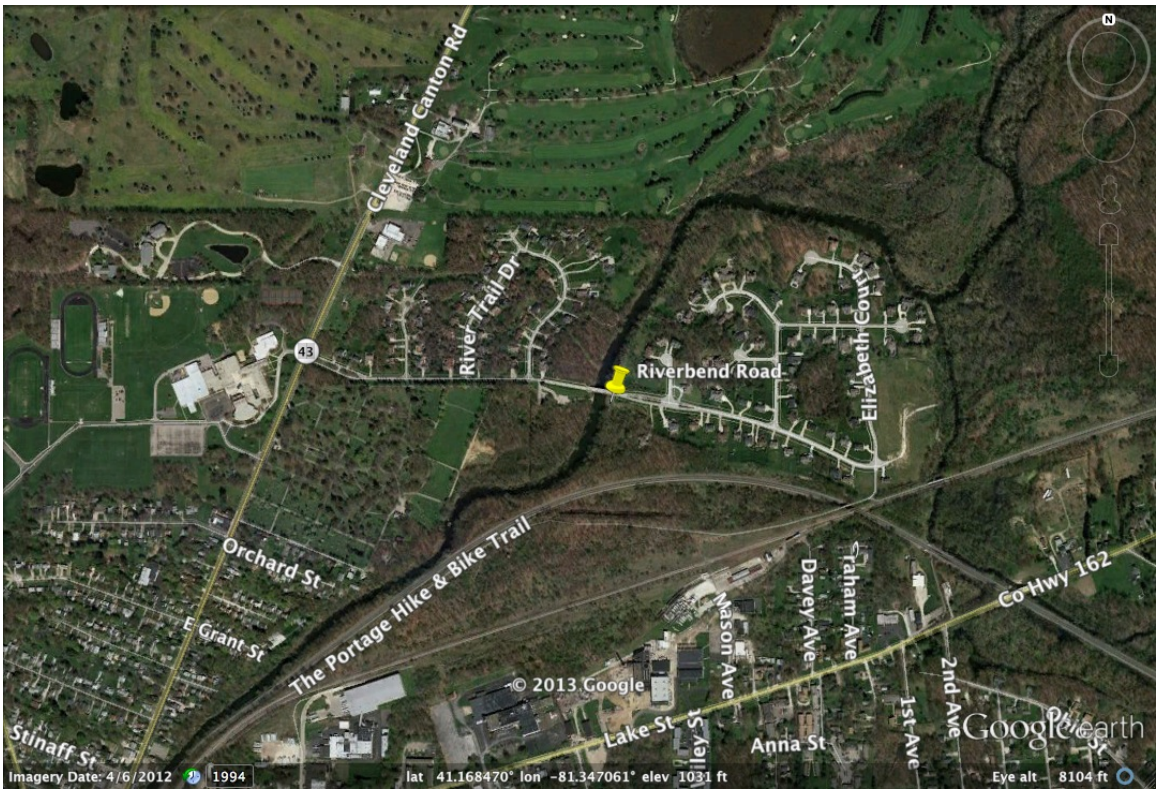

Image of the Middlebury Road area: