

7th Grade State Standards

MEET, GREET, WELCOME, AND INTRODUCTION

- I. **Meet teachers/students/chaperones on bus at parking lot or at door.**
 - a. Greet teacher.
 - b. Secretary collects permission slips and payment.
 - c. Welcome students, preferably at the door and explain that they will quietly go through the lobby to the auditorium with all their belongings.

- I. **Welcome and introduction.**
 - a. What is ACLEC?
 - i. Mission, history, location.
 - ii. Mention volunteering opportunities and programs.
 - iii. What is an estuary?
 - iv. What is a watershed? The concept connects all of us to the Chesapeake Bay estuary.
 - b. Chesapeake Bay Watershed: What is it? (Can use Fieldscope.us)
 - i. Have students look at watershed map.
 - ii. Where is the Chesapeake Bay?
 - iii. What is a watershed? A geographic area that stores surface/ground water that will drain into a common waterway, such as a stream, lake, estuary, wetland, or even the ocean.
 - iv. The Chesapeake Bay watershed is 64,000 square miles encompassing 6 states (DE, MD, VA, WVA, PA, NY).
 - v. It is the largest estuary in the US/ second in the world. (Russia has the largest.)
 - vi. What is an estuary? Brackish water – where fresh water meets the ocean. Large diversity of wildlife- plants and animals.
 - vii. Ex: If someone in Cooperstown, NY (Baseball Hall of Fame), decided that they didn't want Chem. X anymore and flushed it down the sink, where will it go? Whether it happens here or somewhere else in the watershed, it will wind up in the Bay.
 - c. Satellite Image of Chesapeake Bay
 - i. This is a satellite image of the Bay and it was taken after a bad rainstorm.
 - ii. Identify where the Bay is on the image.
 - iii. Locate OPC on picture.
 - iv. Locate Baltimore and DC. The large cities are the light blue areas
 - v. Why are certain rivers (Potomac River, James River) brown in color? Run-off from heavy rainstorm.
 - vi. What causes this? Hard surface in the cities, such as sidewalk, parking lots, roads. Unprotected land, no/few vegetation (the light brown areas indicating farmland).
 - vii. What might be in the runoff from these surfaces? Brake fibers which contains zinc, asbestos, copper, rubber; brake fluid, oil, dirt, trash, acid rain, fecal matter, pesticides, herbicides, fertilizer, etc.

- viii. Domino effect: How much can the system handle?
- ix. How come in other places, the rivers are not brown? The red areas are wetlands. They slow down the movement of water and the sediment is allowed to settle and the excess nutrients are taken up by plant materials.
- x. Importance of wetlands:
 1. Environment – water quality maintenance, aquatic production, climate regulator, flood control, shoreline erosion control, groundwater recharge.
 2. Socioeconomic – Water supply, harvestable products (timber, peat, fish, shellfish), hunting, recreation, aesthetics, education, scientific research.
 3. Wildlife – habitats, food, diversity, breeding grounds, migratory stopovers

d. Bush River watershed map.

- i. The Bush River watershed is a subwatershed of the CB watershed.
- ii. The southern half of Harford County drains into Winters Run, which carries the water to Otter Point Creek. It is one waterway, but the name changes when the river becomes tidal. OPC drains into the Bush River.
- iii. Most of the shoreline around Harford County is owned by the Army (Aberdeen Proving Grounds), about 75%. That means less than 25% can be used by Harford County citizens to access the water.
- iv. What are some positive outcomes if we do expand the marina? Enjoyment, recreation, revenue, conservation, etc.

e. Why are students here?

- i. Topic of field trip: New marina project and students will be scientists collecting data and determining water quality. Afterwards, scientists will use the information collected to make reasoned recommendations. Cumulative data from all schools will be used to determine overall water quality and health of OPC. Today, students will be the scientists to collect and provide information to help make a conclusive decision.

f. Itinerary

- ii. 9:45--Class split into Group A (Lab) and Group B (Boat)
 1. Group A might need jackets if cold and windy out. Loan student jacket/sweatshirt/hat from extra clothing box. They will stand up and follow field instructor to get life jackets and go to the van (or walk), leaving lunches and backpacks in auditorium.
 2. Group B will leave everything in auditorium and will wait until Group A has left the room.

Science I.A.1

- iii. 9:45-11:15—Group A in Lab and Group B on Boat
- iv. 11:15-11:45—Lunch for everyone in auditorium or outside
- v. 11:45-1:15—Group A on Boat and Group B in Lab
- vi. 1:15-1:30—Wrap up and departure.

OTTER POINT CREEK ENVIRONMENTAL SURVEY (OPCES)

TRAINING NOTES PART I—ON THE BOAT

CHECK LIST FOR PONTOON BOAT SUPPLIES

1. Rescue ring—in hallway
2. Boat key—from key rack in Manager's office
3. Radio and depth finder—in hallway in blue buckets
4. Blue buckets (2)—in hallway
5. 4 test tubs—In OPCES labeled cabinet. Inventory each kit to make sure all necessary supplies, in adequate quantities, are present.
 1. Water Filter
 2. Dissolved Oxygen (with 2 empty sample bottles)
 3. pH and temperature kit
 4. phosphate and nitrate kits
6. Large supply tub containing: hallway
 1. secchi disk
 2. soil sieves
 3. plankton net with 2 sample containers, lid
 4. water sampler
 5. data sheet with pencil
 6. air temp and wind speed tool
7. Metal or wooden meter stick—in Kriste's office at the door in map box
8. 2 small black tubs for mud sampling—in hallway or in greenhouse
9. waste container for chemical test water—in lab cabinet labeled OPCES
10. GPS Unit (one of old ones has the test location as a waypoint)—on desk in manager's office
11. satellite map of Chesapeake Bay—in hallway
12. mud sample container for taking back to classroom--in lab drawer in OPCES Corner
13. ½ gallon jug to collect water sample—in OPCES cabinet
14. Check to make sure 1 PVC pipe with depth markings is on the boat

After introduction, size each student for a safety vest, then load students into the 15-passenger van and drive to the marina, or walk.

Along the way, point out Otter Point Creek Marina, which is proposing the expansion project that student scientists are evaluating. Also have them note the land uses along the way.

Students are to walk the long way to the boat, and load from the side or the end without climbing over any chains.

Introduce the captain, and have everyone sit down to listen to the safety rules. (given by the captain).

As boat leaves dock, explain what we will be doing in the field today. We will be doing tests and collecting quantitative and qualitative data to analyze later in the lab and back in the classroom.

Students must understand the concept of watersheds to make sense of the field trip. Review the definition of a watershed. Use the satellite image of the Chesapeake Bay to help the students find our location in the Bay watershed, and to pick out some visible effects of land use on water quality of the Bay. Use the local watershed/sub-watershed map to help them determine which portion of Harford County is drained by Winters Run.

Looking at the overall health of the Creek includes collecting both qualitative and quantitative data.

Qualitative data—general impressions, observations, trends

- animal diversity
- Current impacts on the Creek
- Are there water treatment plants dumping in the Creek?
- Are there septic tanks in the area?
- Is there trash floating in the water?
- Do you see a lot of wildlife?
- Is there a healthy plankton community?
- How quickly does water flush out of the area?
- mud sampling

Quantitative data—numeric, measurable

- pH
- temperature, wind speed
- nitrate and phosphate levels
- dissolved oxygen measure
- water depth, clarity

Good science means collecting data with accuracy and precision. Therefore, always do each test more than once and average the test results. Consistency of data is also why we go to the same sample site each time. (Can the water vary in health from site to site?)

Would the water be as healthy near a sewage treatment plant as it would miles away?) Results are then comparable from date to date. Consistency of methods and sites makes the data more usable.

Location of sample site is recorded in GPS unit. Have one or two students help the captain steer the boat to the correct location using the GPS unit.

Upon reaching the sample site, put down the anchor and begin testing. Designate one student as the recorder. The recorder can measure and record wind speed using the green anemometer from the large blue bin, and also measure the air temp.

1. Using the long PVC poles, have 2 students measure the depth of the water on each side of the boat. Average the two measurements, and then determine the half way point. That is the depth from which water will be sampled.
2. Demonstrate the use of the water sampler. Have 2 students work together to collect about $\frac{3}{4}$'s of a bucket of water. (Determine how far to lower the line (determined in step 1), set the wires on the pins, lower the sampler to desired depth, drop the trip weight, lift sampler, open one side to empty into bucket, repeat as many times as needed.)
3. Discuss the water clarity. Qualitative observations. Why is penetration of light into the water column important? We measure it quantitatively with a secchi disk. Have 2 students work together to measure turbidity. One student lowers the disk while they both determine when they can no longer see it. One student reaches down to pinch the string at the water's surface to mark the water level when the disk disappears. That student lifts the disk, and the meter stick is used to measure from the top of the disk to the measure on the string. Repeat the procedure on the opposite side of the boat, and give both results to the recorder for averaging and recording.
4. OPTIONAL- Have two students filter 250 ml of the water sample. Use the water filter from the blue tub. One student measures the water into a beaker, while the other sets up the filter with a filter disk, etc. Pour the water into the top, and then one student pumps while the other holds their thumb over the side spout. This will take a while to filter all 250 ml. When complete, disassemble the filter, being careful to remove the filter whole, and discuss this very visual display of sediment in the water. Wrap the filter up in foil to save for later.
5. Follow directions for the Hach colorimeter test for phosphates. Give the recorder the results of the test.
6. Have 2 students conduct the nitrate test. Collect water sample from the bucket. Follow the instructions, which include a 12 minute wait time, so they'll need a watch. Or, follow directions for the Hach colorimeter test for nitrates. Give results to the recorder.
7. Have 2 students conduct the pH test and measure water temperature. Use the appropriate tub, and collect a water sample in a 250 ml beaker from the blue water sample bucket. Insert the thermometer for at least one minute, then read and

record the temp. Meanwhile, conduct the pH test following the kit instructions. Give results to the recorder.

8. Have 2 students fix dissolved oxygen samples using the kit in the DO tub. They will work from the blue water sample bucket so that the 2 sample bottles can be properly submerged as per the instructions. Follow the instructions carefully so as not to introduce air into the sample. The chemical bottles are numbered on their lids in order of use. Students must use rubber gloves when they measure sulfuric acid into the sample bottle.
9. Note that we no longer measure salinity. Even during drought periods, Otter Point Creek salinity is way below 5 ppt, and is considered fresh water.

Before tossing remaining water in bucket, fill the ½ gallon jug with sample water to take back to the lab.

Be sure to dispose of all used test water in the labeled waste container.

After the tests are finished, discuss what we are measuring and why it is important.

Nitrates and Phosphates are nutrients essential for a healthy ecosystem, but excess nutrients can cause algal blooms. Too much algae increases turbidity, and when the algae dies, it consumes dissolved oxygen in the water.

Dissolved oxygen is required for animal life. Studies on the Bush River show that fish begin to die off at 3 ppm, and that 5 ppm and higher is optimal. The temperature of the water affects the quantity of oxygen the water is able to hold. Cooler water holds more oxygen than warmer water. Stated differently, dissolved oxygen decreases as water temperature increases.

pH—review the pH scale. pH is a measure of concentration of hydrogen ions in a substance, on a scale of 0-14. 7 is neutral, below 7 is acid (high hydrogen ions), and above 7 is basic (alkaline or low hydrogen ions). Humans and aquatic organisms are dependent on water with pH levels within a range near neutral. Most natural waters have a range between 5 and 9. Stomach acid is 1-3, cola 2.6, acid rain 4-5.5, rain 5.6-6.2, sea water 7-8.3, ammonia 11.9. Water with a low pH increases the solubility of nutrients like phosphates and nitrates, making these nutrients more available to aquatic plants and algae. This can promote harmful algal blooms, and corrode pipes and release lead, cadmium, copper, and zinc into water.

As a group, before pulling up anchor, conduct the mud sampling. Demonstrate the use of the PVC pole as a straw to suction up the mud sample. Put black bin into position at the front of the boat, and have a team of 2 students doing the actual collecting. (Tightly cover the high end of the tube with palm so no air gets in. Insert pole into mud about 12-18 inches. Pull pole up carefully, maintaining the air seal. Put end of pole over the tub, and remove hand from other end of pole. Mud should slide out. If not, tap the pole a few times in the tub.) Ask the students to do a sensory evaluation of the mud—note color, smell it, and feel it. Have students describe color, texture, and smell, and discuss with

Science
3.E.1.F

them the significance of each. Use the soil sieves to try to determine the actual size of the soil particles—start pressing a mud sample through the largest sieve first, on down to the smallest. Particles can be so small that they never settle out, or are easily resuspended in the water column. What does this mean for turbidity? Collect a mud sample and put it in the blue capped container to take back to the school classroom.

After the mud sampling is cleaned up, pull up the anchor and start back to the marina. Along the way, collect a plankton sample with 2 students, using the plankton net and a pole to keep the net just under the surface of the water. Drag the net for a minute or two, then pull it in and cap the sample to take back to the lab.

Remember to note qualitative measures of overall health of the Creek as you drive to and from the sample site. Note wildlife, human activity, new development, pier activity, location of sewage treatment plant, tides, turbidity, SAV presence or absence, land uses and relative percentages, location of sewer lines, proximity of route 40, location of Winters Run inflow, etc. Remind them of how they will be using the data—all types—to make a recommendation on the marina project.

Be sure everyone is seated for the docking, disembark, and return to the Center via van or on foot, with the samples.

Phosphates-- SAFETY GOGGLES AND GLOVES MUST BE WORN DURING THIS PROCEDURE.

1. Rinse sample bottles with the sample water.
2. Press the PRGM button, then press 79, then press ENTER
3. Fill each bottle to the 10ml line with the sample water (the line is labeled on the bottle).
4. Carefully add the contents of 1 PhosVer 3 powder packet to the sample bottle. The packets are in the ziplock bag labeled PhosVer 3.
5. Shake the sample for 15 seconds.
6. Press TIMER, then ENTER, and a two minute reaction period will count down.
7. After the two minute timer period, wipe the outside of the blank (the sample without the reagent), and place it into the colorimeter with the white diamond facing the key pad.
8. Cover the bottle with the black lid, making sure that no light can reach the bottle. Press ZERO and wait for display to read 0.0.
9. Remove the blank and place the prepared sample into the colorimeter, after wiping the outside of the sample bottle. Cover the bottle with the lid again and press READ.
10. Record the results in mg/L phosphates.
11. CLEAN UP—Place all treated samples in the waste container and rinse out the sample bottles (making sure to put rinse water in the waste container also.) Return all the equipment to bin.

Nitrates—SAFETY GOGGLES AND GLOVES MUST BE WORN DURING THIS PROCEDURE

1. Rinse samples bottles with the sample water.
2. Press the PRGM button, then press 51, then ENTER.
3. Fill each bottle to the 10 ml line with the sample water. (The line is labeled on the bottle.)
4. Carefully add the contents of one NitraVer powder packet to the sample bottle. (The packets are in the ziplock bag labeled NitraVer.)
5. Press TIMER, then ENTER, and shake the sample vigorously until the timer beeps (one minute).
6. After the timer beeps, stop shaking the sample and press ENTER again to start the second timer (five minutes).
7. While the timer is running, wipe the outside of the blank sample bottle clean, and place the blank sample (the one without the reagent) into the colorimeter with the white diamond facing the key pad. Cover the bottle with the black lid, making sure that no light can reach the bottle.
8. When the timer beeps, press ZERO and wait for display to read 0.0.
9. Remove the blank and replace it with the treated sample. Cover the bottle with the lid again and press READ.
10. Record the results in mg/L nitrates.
11. CLEAN UP-- Place all treated samples in the special waste container for cadmium laced waste and rinse out the sample bottles (making sure to put rinse water in the waste container also.) Return all the equipment to bin.

1 OPCES: Lab Portion

Outline

I. Prep before school arrives.

- a. Fill BOD flasks with OPC water 5 days before, place in dark cupboard .
- b. Get 15-passenger van (optional).
- c. Go to marina with 2 dissolved oxygen (D.O.) bottles, 1 D.O. kit, 2-liter bottle, plankton tow, and thermometer.
 - i. Fill a bucket with creek water. Submerge and fill both D.O. bottles in the bucket, according to directions. Then fix DO in each bottle:
 1. Add 8 drops of manganous sulfate-labeled #1
 2. Add 8 drops of alkaline potassium iodide azide solution-labeled #2
 3. Cap. Invert several times to mix. Let precipitate settle below shoulder of bottle.
 4. Add 8 drops sulfuric acid (H_2SO_4)
 5. Cap. Invert several times to mix.
 - ii. Fill 2-liter bottle 2/3rds full of OPC water if do not have already.
 - iii. Measure temperature of OPC water in bucket with aquatic thermometer, degrees Centigrade.
 - iv. Pull plankton tow along dock and pilings and collect plankton/microorganisms. Cap.
 - v. Return to Estuary Center with all samples.

d. Set up lab:

- i. Set up 5 work stations around the counter with a paper towel, one DO kit with pipette, one microscope. (Plug scopes in but push to rear of countertop).
- ii. Set up TV with instructor's microscope.
 1. Plug in microscope, VCR, and TV into power strip on cart. Plug in cart to wall outlet in phone corner.
 2. Plug in camera to wall outlet, connecting black from plug to black lead from microscope, yellow connector goes into back of VCR (video in).
 3. VCR (set to ch1) connects to TV (set to channel 3)
 4. Check that antenna from TV goes into VCR (antenna out)
 5. Power on first with VCR, then TV.
 6. Attach camera to microscope with collar.
- iii. Instructor's cart:
 1. Put plankton tow sample into a beaker or shallow bowl.
 2. Glass slides-with wells
 3. Plastic pipettes

4. Proto-slo
5. Get instructor's slide ready with something interesting from that morning's tow. Turn off microscope to prevent from heating and drying up sample on slide.
6. Fixed DO sample bottles (2)
7. DO kit

iv. Total suspended solids (TSS) station:

1. Hot plate
2. Heat resistant pad, cloth hot pads
3. 2 quart water sample jug
4. 100 ml. Graduated Cylinder
5. 250 ml. Beaker
6. Plastic pipette
7. Latex gloves
8. Scale
9. Scale and measuring equipment will go on rear center lab counter. Hot plate and heat pad will be on lab counter in left rear corner.

e. Set up meeting room:

- i. U-shaped format of tables
- ii. Chairs around the outside
- iii. Set up maps on one easel and data graphs on second easel
- iv. Packets of Q-value graphs and rulers.

f. Paperwork for field trip:

- i. Two clipboards, each with a pencil and double sided worksheets.
- ii. Leave one in lab, put one in container for boat or in auditorium.

INTRO TO WHAT WILL BE HAPPENING IN THE LAB

- 1) Lab instructor will discuss what we will be doing in the lab. Qualitative vs. Quantitative measurements, water quality parameters that we are studying.
 - a) Dissolved Oxygen (DO) – volume of oxygen contained in water, from:
 - i) Photosynthesis of aquatic biota (SAV)
 - ii) Transfer of oxygen from air/water interface
 - iii) Depends on temperature (high when cold), salinity (low when salty), and pressure (high when pressure is up and altitude is low)
 - b) Biological Oxygen Demand (BOD) – volume of oxygen that is made and used from all biological organisms in the water. Shows how healthy the system is.
 - c) Total Suspended Solids – Sediment and algae suspended in water column
 - i) Agricultural runoff (50%)
 - ii) Residential and Urban Construction
 - iii) Bare soil
 - iv) Steambanks
 - v) Other (stripmining, logging)
 - d) What is the effect of high TSS?
 - i) Reduce light penetration, suppressing photosynthetic activity.
 - ii) Therefore, fewer photosynthetic organisms as a food source.
 - iii) And fewer organisms (food/oxygen limitations and alteration of spawning habitat)
 - iv) Fish and fish fry avoid high TSS areas; clogs gills and abrasive to fish.
 - e) Fecal Coliform (FC) - Bacteria that eats up fecal matter.
 - i) Feces from wildlife (mammals, birds, fish, and sometimes people's sewage spill)
 - ii) Too much FC means lots of fecal matter; lots of carbon dioxide produced taking up available dissolved oxygen.
 - iii) Changes water to acidic levels; pH change will harm organisms.
 - f) Plankton study: phyto- and zooplankton.
 - i) Indicators of pollution. First to go.
 - ii) Qualitative indicator: count species
 - iii) If too much algal blooms, die off and take oxygen. Detrimental to other organisms.

- 2) Getting ready for the lab:
 - a) SAFETY – first, second, and always. Students must follow instructions and conduct tests in a professional, careful manner.
 - b) We will wear lab coats and lab goggles at all times while in the lab to protect our clothing and our eyes. Lab goggles must be worn unless participant already wears glasses – no exceptions.
 - c) Instructor reserves the right to remove students from the lab.

Lab

- 1) Assign a recorder and give clipboard to student.
- 2) What is around lab? Point out different stations:
 - a) Measuring tools
 - b) Chemistry
 - c) Microscopes
 - d) Scale (delicate, sensitive)
 - e) Hot Plate
 - f) Video Camera
- 3) Pass out goggles, lab coats, gloves.
- 4) Divide students into approximately even teams
- 5) TSS
 - a) Show how sensitive scale is by blowing lightly on surface. Have students observe the digital screen. Even the slightest movement of the table affects it. The legs can be adjusted for stability and evenness. The windscreen protects it from a breeze.
 - b) Weigh empty beaker. Recorder records weight, but in milligrams. How do you convert grams into milligrams? Multiply by 1000 (move decimal point 3 places to right.)
 - c) Have another student measure out 100 ml of the water sample using a graduated cylinder. Put measured sample into pre-weighed beaker. How do we get the mass of just the suspended particles in the water? Removal of water leaves just the sediments. Weigh beaker with sediment and subtract empty beaker weight to get sediment weight. Most effective and cheap process – boiling.
 - d) Have a volunteer monitor hot plate. It will not look hot because ceramic does not turn red. Remind students that this hot plate will get really hot to the point that it can melt metal. Put beaker of water on top, turn on 10, water will take about 20 minutes to finish evaporating, watch for the last bubble to pop, count to 3, remove hot beaker with heat resistant mitts, and put on top of heat pads to cool. What temperature does water boil at? 212⁰F or 100⁰C. When no water, beaker is not buffered anymore and temperature will rise. Too much, beaker will crack losing valuable data, so volunteer must keep an eye on it here and there, but especially near the end.
 - e) Sometime during the lab, volunteer will remove beaker when all water has evaporated and put on heat pads to cool. When all chemical experiments are done, finish weighing beaker/sediment.
 - f) To weigh, follow the same steps as in weighing the empty beaker. To get the weight of just the sediment, subtract the total beaker/sediment mass from the beaker mass.
 - g) Also, the actual test calls for a liter of water sample but because of limited time to boil off water, we used only 100 ml. Multiply the test result by 10 to make the number statistically equal.
- 6) D.O.: Dissolved oxygen is important for the life in the water and it comes from plants, rain, wind, air-water interface.
 - a) Samples have already been fixed – oxygen is stopped from being made and being used. Sulfuric acid attaches to oxygen giving the yellow color of the samples.
 - b) Analogy: Students will be likened to the dissolved oxygen and will enter a dark room, which is the sample water container. Before they entered, each student took a flashlight from a large box. (sulfuric acid addition). Well, how many people are in the lab? Flashlights are turned on (addition of starch indicator turning water sample from yellow

to dark purple). Can see that there are students in lab but need to count them to get the number. So will take the flashlights from students and have the total count of the students (titration – take away the color purple until solution is clear giving amount of dissolved oxygen present).

- c) Each team will do a titration for dissolved oxygen. *Important to remind students that chemicals are not to be used for anything else except in the titration procedures. Also, avoid contamination by dropping chemicals above a certain distance so tips of chemical containers will not be splashed.
- (1) Measure out 20 ml of fixed water sample into titration tube.
 - (2) Invert starch indicator over titration tube and let 8 drops fall in.
 - (3) Cap tube and hold at the top. Tap the bottom of the tube to thoroughly mix starch indicator into water sample. Cannot invert or shake because lid has a hole.
 - (4) Take titrator and pop tip into thiosulfate bottle. Invert and pull end of titrator to fill until the ring is even with 0. If air bubble is seen in titrator, tap it until bubble goes to tip. Push titrator back into bottle until bubble disappears. Continue to measure out titration fluid. Pop titrator out carefully.
 - (5) Pop filled titrator into top of titration container and begin titration. Two drops of thiosulfate and tap the bottom of the container while holding to mix. Two more drops at a time and tap each time until it gets lighter in color. As soon as it becomes light purple, do only 1 drop at a time and tap to mix, making sure there are no swirls, until totally clear.
 - (6) Record how much thiosulfate was used in mg/L (equates to ppm). Recorder will average all results.
 - (7) Squirt out rest of thiosulfate back into container and rinse out titration tubes.

7) B.O.D

- a) Water sample was collected 5 days ago, stored in an airtight bottle, and put into a dark cabinet. Plants can't make oxygen, but the animals in the bottle still are using the oxygen.
- (1) Pour B.O.D. water samples into D.O. bottles until it overflows.
 - (2) Fix water samples:
 - (a) 8 drops of ...
 - (b) 8 drops of ...
 - (c) Cap. Invert several times to mix.
 - (d) 8 drops sulfuric acid (H_2SO_4) = golden yellow
 - (e) Cap. Invert several times to mix.
 - (f) Not as dark golden, as D.O. levels are less. (Qualitative measure)
 - (3) Find remaining D.O. levels: Follow same steps as in D.O.
- b) Recorder records results.
- c) Show students how to take gloves off without contaminating their own hands. One gloved hand should hold the wrist part of the other glove and pull off. Place removed glove on gloved hand. Using free hand, take a hold of the wrist part of the remaining glove and pull to invert. Discard all gloves and wash hands.
- d) Collect goggles and place back in lab cabinet.

8) **After TSS, D.O., B.O.D. tests, return to conference room to go over results and conversions.**

- Math
7.A.1
7.D.1.b
- a) Q-value graphs show quality in a test: excellent, good, bad. Numbers don't always tell us what it means. Numbers are set to a standardized Q-graph that has been mathematically established. From that we can interpret the data and make a sound judgment.
- b) Students will work in groups of 3 to find the Q-value of D.O. It is a two-step process involving water temperature.
- (1) First, find percent saturation using fig. 6-1:
 - (a) Find temperature on water temperature graph and find the D.O. on the dissolved oxygen graph.
 - (b) Using ruler on percent saturation chart, connect temperature part of graph with D.O.
 - (c) The line that crosses through the dissolved oxygen saturation part of the graph gives the number that we are looking for in percent saturation.
 - (2) Second, find Q-value from % saturation using fig. 6-2:
 - (a) Take the % saturation number and plug into chart.
 - (b) Use ruler to line up and find point on curve that it crosses.
 - (c) Find the number on the left that this point correlates to.
 - (d) This number is the Q-value.
 - (3) Third, find out what the Q-value means by looking at the value on the conversion chart in terms of water quality.
 - (4) Recorder should write result on WQI worksheet.
- c) Students will do remaining calculations at school.
- d) Which factor has the most weight? The least weight? If you take a look at the WQI worksheet, there are weighting factors given to each test. The weighting factors when multiplied with each tests' Q-value and totaled gives us an overall index on the water quality.
- a) With data so far, what do students think of the marina expansion?
- b) Do you want to make changes, if the system will degrade by 10% or 35% in one or two places?
- c) Should there be some compromise?
- d) Look at the individual tests and the overall study to make your final conclusions.

9) **Two more tests back in lab: qualitative analysis of life in a drop of water and poop**

- Science
6.B.1
- a) There are two kinds of plankton collected from the plankton tow:
- Zooplankton: animals, bilateral symmetry, moves/propels itself
 - Phytoplankton: plants, radial symmetry, chlorophyll, stationary
- b) Demonstrate with instructor slide and microscope and view on TV with students. Explain how to use microscope along the way.
- c) Point out the different planktons and differentiate as zoo- or phyto-. Some phytoplankton will look as if it were moving but there are currents even in a drop of water or it might be pushed by a zooplankton.
- d) Students can pair up or triple up into teams to share one microscope each.
- e) Give each team a slide with a drop of water from the plankton tow. Add proto-slo if plankton is extremely quick moving.

- f) Once they have found something interesting, teams can visit one another's microscopes or put slide under instructor's microscope so whole class can view on TV monitor.
- g) If time permits, students can obtain another drop of water sample to view.
- h) Make sure all microscopes are turned off and slides are collected.
- i) Fecal Coliforms: bacteria that eats up fecal matter. Having some is good because animal wastes are bound to end up in the water. Too much means that the system is overloaded with fecal wastes. We will use previously collected fecal coliform data that is already printed on data sheet to calculate values.
 - (1) Give the group these numbers when whole class reconvenes at the end of field trip:
70 colonies and 240 colonies (this spike occurred due to the increase in amount of birds)
– these are real results taken from researchers.
- j) Students can take off lab coats and put them neatly back on the table in the conference room.

10) Break and End

- a) Clean up lab and equipment.
- b) To prep for second group, set-up lab as in beginning and make sure to get water sample, plankton tow and fixed D.O. samples from Group B. Give extra water bottle, D.O. bottles, and plankton vial to field instructor for afternoon section.
- c) Reconvene in the auditorium for the break. Students can lunch in auditorium or out on the deck if weather permits. All trash must go in trash can or recycling.
- d) Monitor students after setting up lab again.
- e) Conclude field trip in auditorium. Make sure all data are understood, answer any questions and ask about input of their day out in the field and in the lab.