sSELF
SOUTH SHORE ESTUARY LEARNING FACILITATOR PROGRAM

Environmental Resource Management Group Foundation
New York State Marine Education Association

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SSELF Estuary Watch Volunteer Monitoring Program

New York State Marine Education Association
South Shore Estuary Learning Facilitator Program (sSELF)
supported by
The Environmental Resource Management Foundation

sSELF Sustaining - Progress report June 2011.

The ERM foundation has generously supported our efforts over four of the last five years. (2007, $8,000; 2009, $7,000; 2010, $5,000; 2011, $4,000) The program has operated continuously since January of 2007. To date $1,500 has been paid in compensation and the remainder of the funds have been expended for equipment and supplies.

While the sSELF program has participated at teacher conferences, workshops, beach cleanups and various tabling events, the primary focus has been on the training and support of estuary monitors and the distribution of testing kits. As reported in the application for calendar year 2011, which contains past yearly reports, we have developed a diverse group of classroom and research teachers, individual students and community groups that have participated in the program. Groups collect data which is reported to our website. (http://www.seagrant.sunysb.edu/nysmea/resources-for-educators-sSELF.php) We are proud of the fact that over 600 separate trips have been made to obtain and record chemical and physical data from the waters surrounding Long Island as part of the program. These trips characteristically include a minimum of three and as many as ten stewards. Data collected in the sSELF program was recently included in a Town of Islip Watershed Management Plan It must also be noted that several of the groups using the materials are not reporting their data to the website and that the equipment is being used for other purposes ancillary to the primary program. For example, use of Kestral meter for daily recording of weather conditions at the school, etc.

With regard to specific, long term affects we would like to give three examples:

1. One of our first members Rachel Haberstroh began as an incoming high school freshman. She was influential in forming a group called the Bay Buddies and in addition did her own individual research project. That year Rachel one the local Science research competition and went to the state competition where she received high honors in the environmental category. Each subsequent year she has submitted award winning projects related to her sSELF training to a variety of competitions. During the summer of 2009 she worked at a local environmental center (Seatuck,) where her sSELF related training contributed to her being highlighted in their newsletter for her contributions. This summer she obtained a position at Stony Brook University's School of Marine and Atmospheric Sciences. She submitted a related Intel Research Project and is currently planning to enter Brown University.

2. The Bellport-Bluepoint High School Environmental Club, to which we gave one of our first presentations has been a continuously active group. In September of 2009 the teacher, advisor gave a short review of the program at the Annual South Shore Estuary Reserve Boat Tour/meeting saying that monitoring had become a cornerstone of the club's activities and a jumping off point for many individual research projects. Having the students develop a relationship with a specific site that they visit repeated times helps to foster a feeling of stewardship and connectedness with the environment that is otherwise hard to achieve. This is a feeling that is often repeated by other student or group supervisors.

3. In 2008 we began working with the Long Island Sierra Club. Several members of the group had heard about sSELF and were interested in replicating the program. We held several training sessions both in the classroom and the field to train their volunteers. We provided several kits but they eventually purchased their own and they have fundraised and gotten support from the local and national organization to replenish supplies. They are now independently training volunteers using our model and currently have approximately ten groups of about 30 stewards out testing the waters every two weeks. We continue to work closely with them. In the last year they have made over 100 monitoring trips to the estuaries. (http://www.liwatersentinels.org/)

We at NYSMEA believe that any program which we offer that is aimed primarily at a formal or informal educator has a long range and multiplying effect because each participant then contacts a number of individuals in the classroom or organizational setting.

While we have not been able to achieve all of our goals outlined in the applications, we are indebted to the ERM Foundation for support of our core program we do believe that we have germinated a seed that will continue to grow. We look forward to continued support as we move forward.

August 2010 - New teachers with their sSELF kits

Appendix

1. Rachel Haberstroh

June 2007

Brightwaters Bay Buddies touring the facilities at Dowling College after presentation by Lou Siegel on Monitoring the Estuary (6/20/07)

Just a quick note to thank you and say how terrific that presentation was -- and how much I appreciate your help with the protocols etc. It's manna from heaven for our club.

Rachel said to me in the car on the way home how much she learned -- she was somewhat amazed. Christine, the girl who referenced that sling thingamabob [psychrometer], also was particularly enthusiastic on the way home.

They all were impressed at the effort you bestowed. You made them feel important, one of them said.

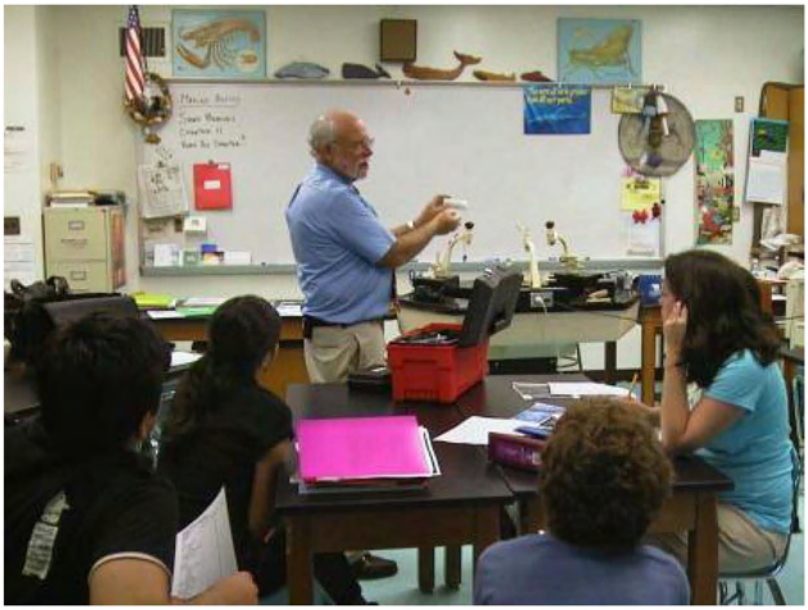
Thanks again for all.

Liz Moore
[Club Advisor]
6/21/07 email communication

September 2010

Hi Lou!
I had a great summer! I ended up working under Dr. Swanson at Stonybrook. I shared an office with his graduate student, Cassie, and I went on three of their cruises. Right now I am finalizing my research and preparing my paper for Intel. A lot of work. I am writing about stratification as a cause for hypoxia in Smithtown Bay-Long Island Sound. It's been absolutely fabulous and I've had a great time.
Yes, I am a senior! Which means college apps... so it's just been busy busy busy. But exciting also.
No I haven't forgotten. You're e-mail just prompted me to begin uploading the data again, though I think I may have put it under the wrong tab. More to come, it will all be up by tomorrow afternoon, when I go to Seattle! We did not do anything new this summer, unfortunately. But, we have a class of 10 freshman joining science research at BSHS next year, so I was hoping to take one of them under my wing and pass on my baby :) It has grown to a substantial amount of data. Also, I don't know if you got my other e-mails, but looking at the data again I realized that we need more HACH sticks again. We can order them if need be.
Oops, sorry about the long e-mail, and also so sorry about how delayed this all has been. Thank you so much for all your help and support!
Sincerely,
Rachel Haberstroh

2. Bellport-Bluepoint H.S.



Environmental Club presentation, October 2007, Bellport-Bluepoint High School

June 2010 Bellport-Bluepoint Environmental Club in the field with sSELF equipment

3. Sierra club Sentinels

Training session January 2009 at Dowling College

Selecting sites and training March 2009

Sierra Club Sentinel - Spreading the word

It is important that
students bring a
certain
ragamuffin barefoot
irreverence to their
studies;
they are not here to
worship what is
known,
but to question it.

Jacob Bronowski
***The Ascent of Man* (1975)**

The Young Man and the Seastars

A well-known author and poet was working and vacationing on the southern coast of Spain. One morning, very early, he was walking along the beach—the sun was just rising, the rain had ended, the rainbows were magnificent, the sea calm.

While enjoying the beauty about him, he glanced down the beach and saw a lone figure dancing about. Fascinated by this other person celebrating the day that was about to dawn, he moved closer. As he came nearer, he realized that the young man was not dancing, but in one graceful movement was picking objects off the beach and tossing them out into the sea. As he approached the young man, he saw that the objects were sea stars.

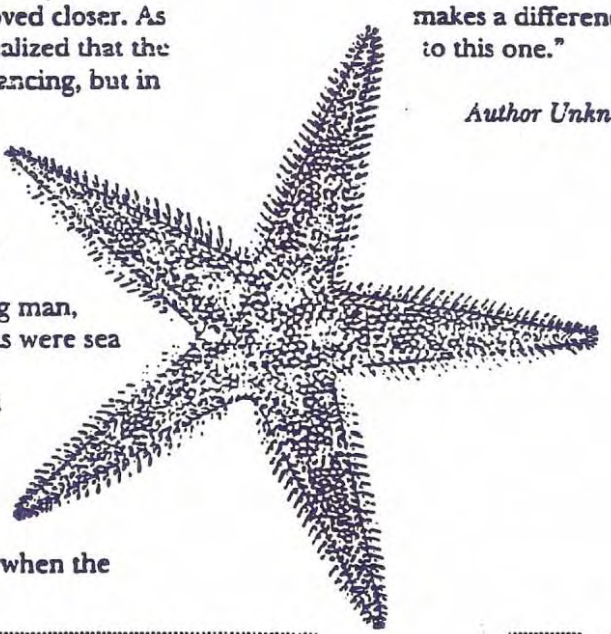
"Why in the world are you throwing sea stars into the water?"

"If the sea stars are still on the beach when the tide goes out and the sun rises higher in the sky, they will die," replied the young man as he continued tossing them out to sea.

"That's ridiculous! There are thousands of miles of beach and millions of sea stars. You can't really believe that what you're doing could possibly make a difference."

The young man picked up another sea star, paused thoughtfully, and remarked as he tossed it into the waves, "It makes a difference to this one."

Author Unknown



Sherlock Holmes and Dr. Watson went on a camping trip. After a good meal and a bottle of wine they lay down for the night, and went to sleep.
Some hours later, Holmes awoke and nudged his faithful friend.
"Watson, look up at the sky and tell me what you see.""
Watson replied, "I see millions and millions of stars."
"What does that tell you?"
Watson pondered for a minute.

"Astronomically, it tells me that there are millions of galaxies and potentially billions of planets.
Astrologically, observe that Saturn is in Leo.
Horologically, I deduce that the time is approximately a quarter pat three.
Theologically, I can see that God is all powerful and that we are small and insignificant.
Meteorologically, I suspect that we will have a beautiful day tomorrow.
What does it tell you?"

Holmes was silent for a minute, then spoke.
"Watson, you idiot, Someone has stolen our tent.

sSELF South Shore Estuary Learning Facilitator Program
New York State Marine Education Association (NYSMEA)
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General Protocol Comments

Always try to have at least two researchers for safety and to facilitate testing.
One person should read the directions and write down results while the second person carries out the readings.
Things go faster if each person does something different, however this means that you are giving up the tremendous advantage of four eyes instead of just two - which increases reliability of data.
Every Researcher must be familiar with the lab book protocols.
Check out all equipment prior to leaving home/school. (Enter your name on data sheet.)
Bring a plastic bottle or plastic bag for waste.
Bring a plastic bottle with tap water for rinsing in the field.
Bring at least 4 paper towels.
Bring a watch with second hand for timing tests.
Bring several pens to use to enter data. You may want to take a copy of the data sheet out of the lab book and put it on a clip board. **But never leave the directions home!**
You may also want to put the direction sheets in plastic protectors.
Dress appropriately
Warm weather - Wear a hat, sunglasses, bring suntan lotion, bug spray.
Cold weather – Layers of clothing, gloves, hat, good footwear
Everything should be cleaned and dried after each trip. Sample bottles, secchi disc and line should be rinsed in fresh water.
It is especially important that the kits be opened and allowed to dry after each use. (Remember you are putting away several vials, line, Etc. damp with sample (salt) water.)

Record date, time, location, tide.
A surface water sample should be taken from 18 inches (0.5m) below the surface using a clean glass or plastic bottle (a wide mouth plastic jar will facilitate getting the oxygen sample) or a Van Dorn type sampler. Use caution if the Van Dorn Sampler is utilized. You will need a clear, widemouth plastic bottle (rinse in sample water,) into which you will empty the sample for testing. One person should set and lower the sampler while the second also holds the line and the messenger. If you are onboard a boat, turn off the engine or otherwise avoid the prop-wash. Rinse the sampler in fresh water after each testing session and with the water being tested before testing begins.

The first parameters to be measured are always temperature and oxygen.
Place the thermometer into the sample and record the reading after 3 to 5 minutes.
If the oxygen sample bottle cannot be dipped into the sample as shown in the directions, run the sample into the oxygen sample bottles allowing it to overfill the bottle and while avoiding air bubbles. Add the reagents.
Do the Chemetric Oxygen sample. If there are enough people do both immediately.

Read the temperature (after 3 minutes,) and measure the density and salinity with the hydrometer.
Collect and label the half liter bottle for the lab tests, keep cool with ice.
Do the aquacheck strip tests.
Do the atmospheric tests.
The Chemetric oxygen test requires 2 minutes and mixing - until the color develops. Two people should independently match up the colors. Average the readings if there is a difference.
The Lamotte Oxygen test kit requires that you carefully read the directions and add chemicals. If you can reach into the water follow the procedure outlined in the handbook in "**Part 1 collecting the water sample**" otherwise follow directions above. Carefully carry out "**Test Procedures Part 2 adding the reagents.**" The remainder of the procedure "**Part 3 – the Titration**" can wait to be done later in the lab. You have been given a second sample bottle so that you can easily carry out two measurements. If more measurements are desired on site than the entire procedure most be carried out so that you can reuse the sample bottles or additional clean glass bottles can be used. Be sure to carefully mark and record the bottles to avoid mix up later.

Obtain an air tight container for each of the Aquacheck strip test parameters to be used for your stock. Always keep the stock tubes at home/school. The vial with the drying packet and directions should be filled with twice the number of sticks that you think you are going to use that day. This way if some water gets into the tube the whole stock is not ruined. The unused sticks can be reused for the next trip if there has been no errors. If water gets into the tube, discard test sticks and dry packet, clean and dry the tube. Always keep the pad end of the sticks downward and dry your hands before handling. Carefully follow directions. When testing salt water the tabs may appear darker than the samples given.

Use the secchi disc to measure the depth and transparency. If the water is too shallow use the transparency tube. Note that the tube measurements have to be taken quickly before materials settle in the tube.

After taking the water measurements or while waiting for tests to develop carry out the atmospheric readings using the *Kestrel meter*. You need only record the requested parameters.

Remember to rinse and dry off anything that you can before you leave.
Before leaving look back and make sure that you have not left anything behind!
Clean-up person must enter name on data sheet.

Keep the water samples cold until you return to home/school.
nitrate, nitrite, ammonia, and phosphate readings should be taken following the directions in each kit.

Mapping your site:
Make sure to accurately locate the station on your map or chart.
Load and then go to Google Earth.com.
Click on "Add Placemark"
Enter Title
Locate on map
Click on Pin and change to white balloon
Record latitude and Longitude of pin
Click on "ok" to record.
Right click on the balloon to move or make changes.

sSELF PROGRAM				
Check out person	The person(s) that checks out the equipment before leaving			
Researchers	Everyone who is on the trip			
Parameter	surface	bottom	surface	bottom
Date	Surface samples are 18"below surface.			
Time	time at which measurements begin			
Location (locate on map)	print out copy of google earth map of area			
GPS Latitude	obtain from google earth and/or GPS			
Longitude				
Tide (High,Low, incoming outgoing)	Look at surrounding area to determine collate with local tide tables			
Precipitation (rain, snow)	Is it raining or snowing?			
trend (wet, dry)	Has there been a significant event in the last 24 hours?			
cloud cover	See direction sheet. Enter % of sky covered.			
cloud type	Use Identification sheet.			
Kestrel meter	Great piece of equipment. Don't leave in sun. Once it is on - pressing the mode switch cycles through each parameter. Use the directions to understand symbols. You do not have to enter the other parameters.			
wind speed avg (mph)				
air temp C				
rel hum %				
dew point C				
compass wind direction	Locate north and then determine from where the wind is **coming**.			
Secchi disk transparency (m)	In the shade, lower until disc disappears record depth. Record color just before disc disappears. Continue to bottom-record depth. Return disc to surface-record depth at which the disc reappears. Average			
depth (m)				
color				
Transparency tube (cm)	Must be done quickly before sediments settle.			
Thermometer water temp C	Immediately place thermometer in sample. Read after 3 to 5 minutes			
Hydrometer (inst ocean)	Right after obtaining Oxygen sample get reading			
density				
Salinity ppt				
Aquacheck dip strips	Must be done by two people. Dry hands first. Keep dry. Tab should always be at bottom. Only remove one strip at a time. Follow directions on bottle. Record less than or more than if off scale. Colors may be darker than indicated in salt water.			
nitrate (ppm)				
nitrite (ppm)				
ammonia (ppm)				
phosphate (ppm)				
pH				
Lamotte Kit				
nitrate (ppm)	Sample may be brought back to lab if kept cold. Test within 24 hours following the directions in handbook. A clean plastic half liter water bottle may be used or screw top polypropylene sample bottle. Do not use detergent to clean. Rinse with clean water (distilled) after each use and with sample water before use.			
nitrite (ppm)				
ammonia (ppm)				
phosphate (ppm)				
pH				
Oxygen (mg/L)	Oxygen sample does not have to be cooled.			
Chemetric Oxygen	Carefully dispose of glass vial			
Clean-up person	The person(s) that cleans and dries the equipment.			
COMMENTS				

sSELF Program				
Check out person				
Researchers				
Parameter	surface	bottom	surface	bottom
Date				
Time				
Location (locate on map)				
GPS Latitude				
Longitude				
Tide (High, Low, incoming, outgoing)				
Precipitation (rain, snow)				
trend (wet, dry)				
cloud cover				
cloud type				
Kestrel meter				
wind speed avg (mph)				
air temp (°C)				
rel hum (%)				
dew point (°C)				
compass wind direction				
Secchi disk transparency (m)				
depth (m)				
Transparency tube (cm)				
Thermometer water temp (°C)				
Hydrometer (inst ocean)				
density				
Salinity (ppt)				
Aquacheck dip strips				
nitrate (ppm)				
nitrite (ppm)				
ammonia (ppm)				
phosphate (ppm)				
pH				
Lamotte Kit				
nitrate (ppm)				
nitrite (ppm)				
ammonia (ppm)				
phosphate (ppm)				
pH				
Oxygen (mg/L)				
Chemetric Oxygen (mg/L)				
Clean-up person				
COMMENTS				
				7-Oct

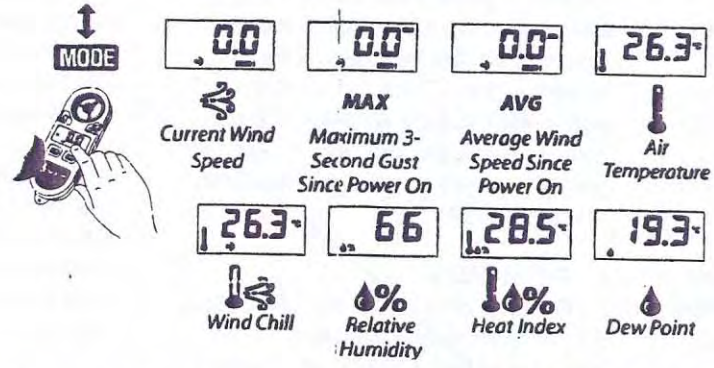
F5

OPERATION

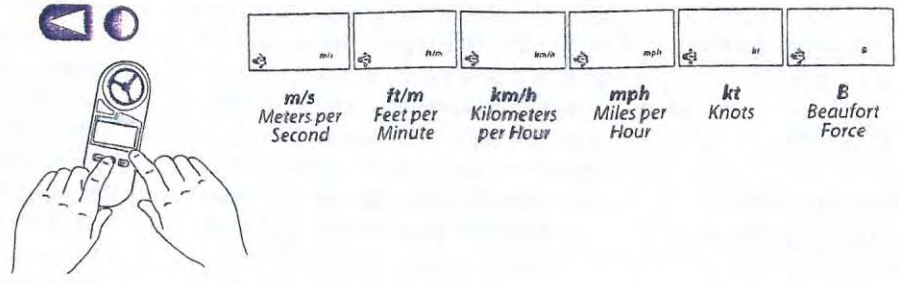
1. **Slide off cover.**

2. **Turn on.** Press the center button (◐) to turn on the unit.

3. **Select operating mode.** Press the right arrow (▶) to scroll through the measurements listed below. Press the left arrow (◀) to scroll through the measurements in reverse order. The instantaneous measurements will be displayed. (See *Understanding the Measurements* section for more information.)



4. **Select the units of measure.** Press ▶ while holding ◐ to scroll through the units of measure.



5. **Hold mode.** Press ◀ while holding ◐ to hold the measured value on the display. The word "HOLD" will blink to indicate the Hold Mode. Press ◀ while holding ◐ to exit the Hold Mode. This mode can be useful for taking measurements when unable to view the display, as within a duct. The Max and Avg Wind Speed Modes will continue to work as usual.

6. **Turn on the backlight.** Press ◐ to activate the backlight for 10 seconds. If ◀ or ▶ are pressed while the backlight is illuminated, the backlight will remain illuminated for another 10 seconds. Press ◐ while the backlight is illuminated to manually turn off the backlight.

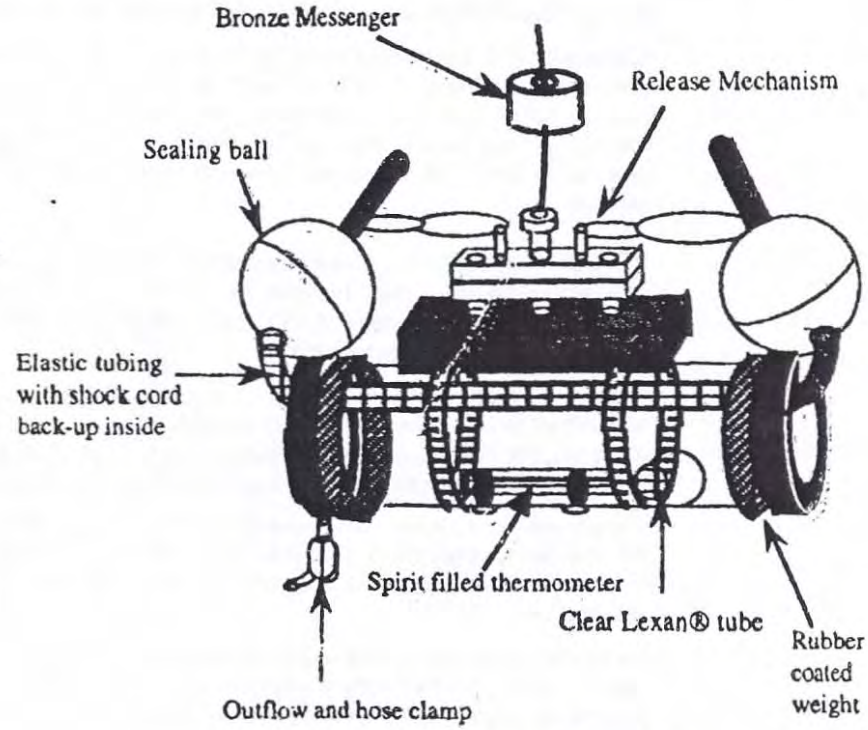
7. **Turn off.** Hold ◐ for 2 seconds to manually turn off the unit. The unit will automatically turn off if no buttons have been pressed for 45 minutes.

Messenger Activated Horizontal Point Water Sampler: Directions for Use

Loading the Bottle

1. Align the monofilament lanyards with the release mechanism (Note: twist on the ball and plastic rod to adjust the position of the shackle).

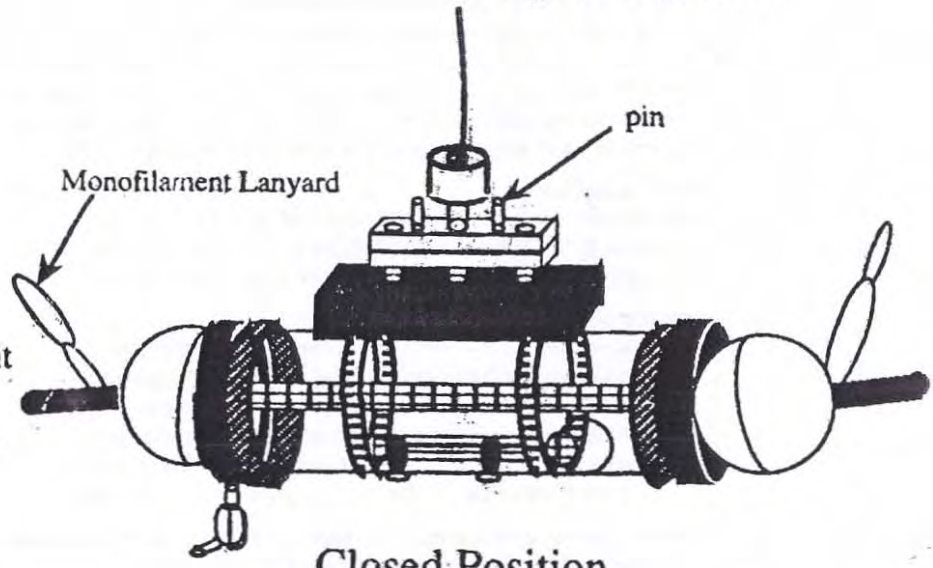
2. Pull out on the balls with the use of the plastic rods. Hook the lanyard loop over the pin on the release mechanism.



Open Position

Closing the Bottle

1. Lower the sampler to the desired depth while holding onto the bronze messenger.
2. Drop the messenger down the line and wait for it to hit the release mechanism. (you should be able to feel the messenger hit through the line)
3. Retrieve the bottle. Drain by unlocking the hoseclamp and releasing the vacuum by cracking the top ball seal.



Closed Position

FORESTRY SUPPLIERS, INC.
WATER-MARK®
JACKSON, MS • 1-800-647-5368

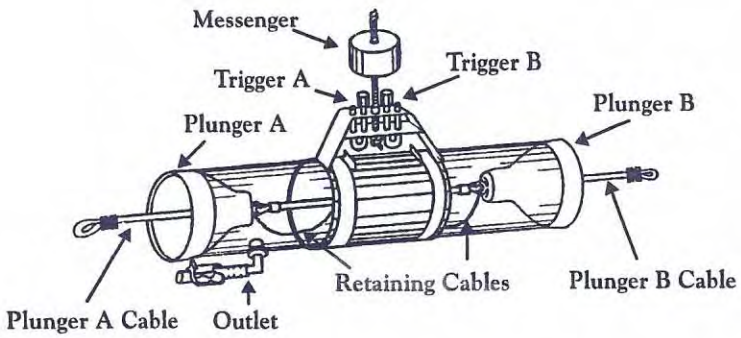
LaMotte

WATER SAMPLER

MODEL JT-1 • CODE 1077

INTRODUCTION

The LaMotte Water Sampler is designed to take a 1.0 liter sample in water with a depth of 5 meters or more. It is attached to a calibrated line which is used to measure the depth at which samples are obtained. The line is marked at 0.5 meter and 1 meter increments. A horizontal triggering device is activated by a brass messenger which is sent down the line to trip the closing mechanism and release the two fitted plungers. These plungers provide a positive seal and prevent the sample from mixing with intermediate layers of water as the sample is brought to the surface. A lead collar has been added to the water sampler to insure rapid descent and to minimize drifting due to current movements. The materials which were chosen to make the sampler were selected for their ability to prevent any contamination of the sampled water. Attached to the sampling chamber is a special drain outlet for removing sample aliquots. All components of the LaMotte Water Sampler are made with non-corrosive materials.



METHOD FOR COLLECTING WATER SAMPLES

1. To set the trigger mechanisms, hold the sampler by the brass handle with triggers in the "up" position. Pull the cable attached to Plunger A outward and hook the loop over Trigger A. This will remove Plunger A from sampling chamber.
2. After the loop is hooked over Trigger A, attach the other loop to Trigger B. This will remove Plunger B from sampling chamber.
3. The water sampler is now cocked and ready to be lowered into the water.
4. While holding the brass messenger in one hand, steadily lower the water sampler by the calibrated line until the desired depth is reached. The line is marked at 0.5 meter and 1 meter increments.
5. Hold the line in a vertical position over the sampler and release the messenger to travel down the graduated line. After the messenger trips the closing mechanism, the sample within the collection chamber is sealed from mixing with unsampled water.

   NOTE: A slight tug on the line after the messenger had been released signals the sampler has closed.
6. Gradually pull the water sampler to the surface with the line and carefully rest sampler on level surface.
7. Aliquots or portions of the sample are carefully taken by standing the water sampler upright on Plunger A and unclamping the outlet tubing. Partially remove Plunger B to prevent formation of a vacuum.

NOTE: Using the JT-1 sampler at a depth of less than 5 meters may damage the trigger.

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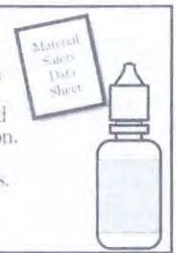
F9

GENERAL SAFETY PRECAUTIONS

1. Store the test kit in a cool, dry area.

2. Read all instructions and note precautions before performing the test procedure.

3. Read the labels on all reagent bottles. Note warnings and first aid information. Read all Material Safety Data Sheets.



4. Keep all equipment and reagent chemicals out of the reach of young children.

5. Avoid contact between reagent chemicals and skin, eyes, nose, and mouth.

6. Wear safety glasses when performing test procedures.

7. In the event of an accident or suspected poisoning, immediately call the Poison Center phone number in the front of your local telephone directory or call a physician. Additional information for all LaMotte reagents is available in the United States, Canada, Puerto Rico, and the US Virgin Islands from Chem-Tel by calling 1-800-255-3924. For other areas, call 813-248-0585 collect to contact Chem-Tel's International access number. Each reagent can be identified by the four digit number listed on the upper left corner of the reagent label, in the contents list and in the test procedures.

USE PROPER ANALYTICAL TECHNIQUES

1. Use test tube caps or stoppers, not your fingers, to cover tubes during shaking or mixing.

2. Hold dropper bottles vertically upside-down, and not at an angle, when dispensing a reagent. Squeeze the bottle gently to dispense the reagent one drop at a time.

3. Wipe up any reagent chemical spills immediately.

4. Thoroughly rinse test tubes before and after each test.

5. Tightly close all containers immediately after use. Do not interchange caps from containers.

6. Avoid prolonged exposure of equipment and reagents to direct sunlight. Protect reagents from extremes of temperature.

Parameter: Density - Salinity

METHOD: Hydrometer

MATERIALS: Hydrometer (Instant Ocean)

DIRECTIONS:

1. Rinse hydrometer with sample water before using.
2. Slowly fill hydrometer by dipping bottom corner fill port below waer surface until water flows upp and over inner weir. Or add water to top.
3. Dislodge air bubbles by tapping hydrometer gently with a pencil.
4. Placing hydrometer on a level surface, read Density measured as specific gravity (inside scale) and salinity (outside scale).
5. Use a thermometer to measure the water temperature in °C.
5. Rinse hydrometer with fresh water before storing.

Salinity notes.

Determination of Salinity using a Hydrometer is dependent upon temperature. The Instant Ocean thermometer is standardized for 25°C or (75°F) Therefore the actual Salinity may be slightly different than that determined by this direct method. This type of reading is called a relative reading. It is not absolutely correct and may differ from Salinity readings taken by other methods. It is however very useful for making comparisons between reading.

PARAMETER: Transparency

METHOD: Secchi Disk

MATERIALS: Secchi Disk
Measured Line marked in half meter intervals

DIRECTIONS:

1. Make sure that the disk is firmly attached to the line.
2. Lower the disk slowly down to the water surface in the shade. Use an umbrella of piece of cardboard to shade the area if necessary. If you are not in the shade note it on the data sheet.
3. Position your hand on the most convenient mark.
4. Count the number of marks until the disk disappears from view. Lower the disk to the bottom. Record the depth.
5. Slowly raise the disk and note when it reappears.
6. Average the points at which the disk disappeared and reappears.

NOTES:

1. Depths should be recorded in meters.
2. Seawater color can be measured using a Forel-Ule Scale.

PARAMETER: Depth

METHOD: Measured Line

MATERIALS: Measured line marked in half meter intervals
weight or secchi disk

METHOD: Lower line until weight hits bottom.
Record the number of marks that pass through your hand
until the weight breaks the surface.

PARAMETER: Transparency

METHOD: Transparency tube

MATERIALS: Transparency tube, greater than 1 liter collecting vessel

DIRECTIONS:

1. Close the crimp on the drain line.
2. Carefully collect water sample making sure not to include bottom sediments.
3. Immediately add the water to the tube.
4. Look through the top of the tube, rotate it. If the black and white disc pattern can be seen then enter the reading as greater than 120 centimeters. (>120cm)
4. Have one person partially open the crimp to slowly allow the water to flow out. A second person should look through the tube. Say "stop" when the black and white disc pattern faintly begins to appear. The crimp should be immediately closed. Record the reading in centimeters. Switch observers, remix the water, repeat the procedure and average the readings. If the two readings differ by more that 10 cm. Repeat the procedure. Average the two readings.

Note: The transparency tube readings cannot be compared directly to Secchi disc readings.

These readings should be taken at all locations where Secchi disc readings are less than 1.5 meters and those sites where the depth makes it impossible to take Secchi disc readings.

PARAMETER: CLOUD COVER

METHOD: visual estimation
MATERIALS: none

DIRECTIONS:

1. (Divide the sky into 4 quarters, estimate cloud cover for each quarter then average the estimates.
2. Use a system where 100% is overcast:

cloud cover estimation

0 -10%	is considered to be cloudless
20%-50%	scattered clouds
60%-80%	broken clouds
90%-100%	overcast

NOTES:

1. Clouds are the key weather predictor.
3. We always tend to overestimate the % of cloud cover because it is easy to see the clouds but not the spaces between them.
(globe)

PARAMETER: CLOUD TYPE

METHOD: Visual estimation

MATERIALS; cloud type chart

(DIRECTIONS:

1. Use the chart provided to identify the type of cloud.
2. You are basically comparing layered or stratus ciouds From puffy types.
3. Record the name of the type pictured in your chart.

National Aeronautics and Space Administration

S'COOL Cloud Identification Chart

Altitude of Cloud Base

6 km

5 km

4 km

3 km

2 km

1 km

High

Mid

Low

Cirrus

Cirrostratus

Cirrocumulus

Contrails

CONVECTIVE CLOUDS

Altostratus

Altocumulus

Stratus

Stratocumulus

Cumulonimbus

Nimbostratus

Fog

Cumulus

CERES S'COOL Project
Students' Cloud Observations On-Line
http://scool.larc.nasa.gov
http://asd-www.larc.nasa.gov/SCOOL/cldchart.html
scool@lists.nasa.gov

www.nasa.gov

EW-2004-10-04-LaRC

Oxygen CHEMets®
1 - 12 ppm

Sampling

The most critical part of any dissolved oxygen test is sampling. It is difficult to obtain an aliquot which accurately reflects the oxygen content of a sample. Exposure to the high oxygen content of "air" will cause a sample to approach saturation. Biological activity may cause rapid oxygen depletion. Dipping and pouring operations should be performed with as little agitation as possible.

Test Procedure

1. Fill the sample cup to the 25 mL mark with your sample (fig. 1).
2. Place the CHEMet ampoule in the sample cup. Snap the tip by pressing the ampoule against the side of the cup. The ampoule will fill, leaving a small bubble to facilitate mixing (fig. 2).
3. Mix the contents of the ampoule by inverting it several times, allowing the bubble to travel from end to end each time. Wipe all liquid from the exterior of the ampoule. Wait **2 minutes** for color development.
4. Hold the comparator in a nearly horizontal position while standing directly beneath a bright source of light. Place the CHEMet ampoule between the color standards moving it from left to right along the comparator until the best color match is found (fig 3). If the color of the CHEMet ampoule is between two color standards, a concentration estimate can be made.

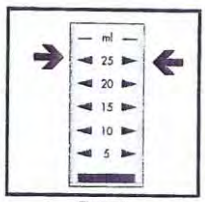


Figure 1

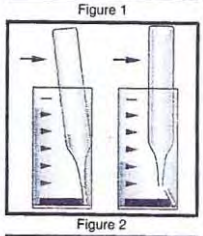


Figure 2

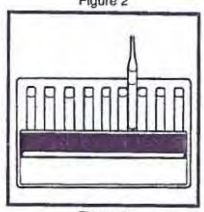


Figure 3

Test Method

The Dissolved Oxygen CHEMets®[1] test employs the indigo carmine method[2,3]. In an acidic solution, oxygen oxidizes the yellow-green colored leuco form of indigo carmine to form a highly colored blue dye. The resulting blue color is proportional to the dissolved oxygen concentration in the sample. Test results are expressed in ppm (mg/Liter) dissolved oxygen as O_2.

1. CHEMets is a registered trademark of CHEMetrics, Inc. U.S. Patent No. 3,634,038
2. ASTM D 888 - 87, Dissolved Oxygen in Water, Test Method A
3. Gilbert, T. W., Behymer, T. D., Castaneda, H. B., "Determination of Dissolved Oxygen in Natural and Wastewaters," American Laboratory, pp. 119-134, March 1982

Safety Information

Read MSDS before performing this test procedure. Wear safety glasses.

Important Note

The CHEMet ampoules contain a reagent which will deteriorate upon prolonged exposure to light. They will remain stable only if stored in the dark.

Reorder Information	**Cat. No.**
***Test Kit**, complete*	*K-7512*
***Refill**, 30 CHEMet ampoules*	*R-7512*
***Sample Cup**, 25 mL, package of six*	*A-0013*
***Comparator**, 1-12 ppm*	*C-7512*

Kits are available for dissolved oxygen analysis at other levels.

CHEMetrics
Water Analysis Systems

CHEMetrics, Inc., 4295 Catlett Road, Calverton, VA 20138-0214 U.S.A.
Phone: (800) 356-3072; Fax: (540) 788-4856; E-Mail: orders@chemetrics.com
www.chemetrics.com

2084-8

F 14

PARAMETER: WATER TEMPERATURE

METHOD: Thermometer
MATERIALS: Thermometer in protective case

DIRECTIONS:

1. Allow thermometer to stabilize for 5 minutes while Being maintained at the desired depth.
2. Record readings in degrees centigrade while the thermometer is still immersed. If using a thermometer with a reservoir for the water hold it upright so that it does not spill.

NOTES:

1. Be carefui not to break the thermometer:
2. Do not touch the bulb
3. Take reaaings quickly to avoid changes.

$°C = \frac{5}{9}(°F-32)$ $°F = \frac{9°C}{5} + 32$

PARAMETER: AIR TEMPERATURE

METHOD: Thermometer
MATERIALS: thermometer in protective case

DIRECTIONS:

1. Allow thermometer to stabilize for 5 minutes wnile protected from wind and direct sunlight.
2. Record readings in degrees centigrade.

NOTES:

1. Be carefui not to break the thermometer:
2. Do not touch the bulb
3. Take readings quickly to avoid changes.

$°C = \frac{5}{9}(°F-32)$ $°F = \frac{9°C}{5} + 32$

Oxygen Kit.

917

INTRODUCTION

Aquatic animals need dissolved oxygen to live. Fish, invertebrates, plants, and aerobic bacteria all require oxygen for respiration. Oxygen dissolves readily into water from the atmosphere until the water is saturated. Once dissolved in the water, the oxygen diffuses very slowly and distribution depends on the movement of the aerated water. Oxygen is also produced by aquatic plants, algae, and phytoplankton as a by-product of photosynthesis.

The amount of oxygen required varies according to species and stage of life. Dissolved Oxygen levels below 3 ppm are stressful to most aquatic organisms. Dissolved Oxygen levels below 2 or 1 ppm will not support fish. Levels of 5 to 6 ppm are usually required for growth and activity.

This test kit uses the azide modification of the Winkler method for determining dissolved oxygen.

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General Safety Precautions	13
Use Proper Analytical Techniques	14
Material Safety Data Sheets	15
Kit Diagrams	21
Short Form Instructions	Back Cover

WARNING! This set contains chemicals that may be harmful if misused. Read cautions on individual containers carefully. Not to be used by children except under adult supervision

KIT CONTENTS

QUANTITY	CONTENTS	CODE
30 mL	*Manganous Sulfate Solution	*4167-G
30 mL	*Alkaline Potassium Iodide Azide	*7166-G
50 g	*Sulfamic Acid Powder (7414 Kit)	*6286-H
30 mL	*Sulfuric Acid, 1:1 (5860 Kit)	*6141WT-G
60 mL	*Sodium Thiosulfate, 0.025N	*4169-H
30 mL	Starch Indicator Solution	4170WT-G
1	Spoon, 1.0 g, plastic (7414 Kit)	0697
1	Direct Reading Titrator	0377
1	Test Tube, 5-10-12.9-15-20-25 mL, glass, w/cap	0608
1	Water Sampling Bottle, 60 mL, glass	0688-DO

***WARNING:** Reagents marked with a * are considered to be potential health hazards. To view or print a Material Safety Data Sheet (MSDS) for these reagents see MSDS CD or www.lamotte.com. To obtain a printed copy, contact LaMotte by email, phone or fax.

To order individual reagents or test kit components, use the specified code numbers.

TEST PROCEDURE

PART 1 - COLLECTING THE WATER SAMPLE

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1.

Rinse the Water Sampling Bottle (0688-DO) with the sample water.

2.

Tightly cap the bottle, and submerge it to the desired depth.

3.

Remove the cap and allow the bottle to fill.

4.

Tap the sides of the bottle to dislodge any air bubbles.

5.

Replace the cap while the bottle is still submerged.

6.

Retrieve the bottle and make sure that no air bubbles are trapped inside.

TEST PROCEDURE

PART 2 - ADDING THE REAGENTS

NOTE:

Be careful not to introduce air into the sample while adding the reagents.

1. Remove the cap from the bottle.

2. Immediately add 8 drops of *Manganous Sulfate Solution (4167) **AND** Add 8 drops of *Alkaline Potassium Iodide Azide (7166).

3.

Cap the bottle and mix by inverting several times. A precipitate will form.

4.

Allow the precipitate to settle below the shoulder of the bottle.

5.

For Kit Code 7414:
Immediately use the 1.0 g spoon (0697) to add one level measure of *Sulfamic Acid Powder (6286).

OR

For Kit Code 5860:
Add 8 drops of *Sulfuric Acid, 1:1 (6141WT).

6. Cap and gently invert the bottle to mix the contents until the precipitate and the reagent have totally dissolved. The solution will be clear yellow to orange if the sample contains dissolved oxygen.

NOTE: At this point the sample has been "fixed" and contact between the sample and the atmosphere will not affect the test result. Samples may be held at this point and titrated later.

TEST PROCEDURE

PART 3 - THE TITRATION

1. Fill the titration tube (0608) to the 20 mL line with the fixed sample. Cap the tube.

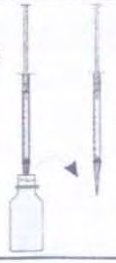
2. Depress plunger of the Titrator (0377).

3. Insert the Titrator into the plug in the top of the *Sodium Thiosulfate, 0.025N (4169) titrating solution.

4. Invert the bottle and slowly withdraw the plunger until the large ring on the plunger is opposite the zero (0) line on the scale.

NOTE:
If small air bubbles appear in the Titrator barrel, expel them by partially filling the barrel and pumping the titration solution back into the reagent container. Repeat until bubble disappears.

5. Turn the bottle upright and remove the Titrator.



NOTE:
If the sample is a very pale yellow, go to Step 9.

continued . . .

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TEST PROCEDURE

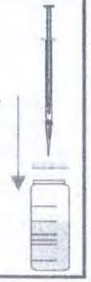
6. Insert the tip of the Titrator into the opening of the titration tube cap.

7. Slowly depress the plunger to dispense the titrating solution until the yellow-brown color changes to a very pale yellow. Gently swirl the tube during the tiration to mix the contents.

8. Carefully remove the Titrator and cap. Do not to disturb the Titrator plunger.

9. Add 8 drops of Starch Indicator Solution (4170WT). The sample should turn blue.

10. Cap the titration tube. Insert the tip of the Titrator into the opening of the titration tube cap.



11. Continue titrating until the blue color disappears and the solution becomes colorless.

12. Read the test result directly from the scale where the large ring on the Titrator meets the Titrator barrel. Record as ppm Dissolved Oxygen. Each minor division on the Titrator scale equals 0.2 ppm.

TEST PROCEDURE

NOTE:

If the plunger ring reaches the bottom line on the scale (10 ppm) before the endpoint color change occurs, refill the Titrator and continue the titration. Include the value of the original amount of reagent dispensed (10 ppm) when recording the test result.

NOTE:

When testing is complete, discard titrating solution in Titrator. Rinse Titrator and titration tube thoroughly. DO NOT remove plunger or adapter tip.

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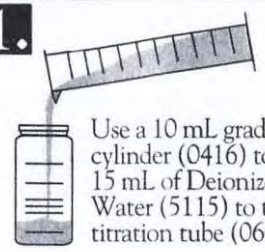
EPA COMPLIANCE

To qualify as an EPA accepted test, and to achieve the greatest accuracy, the Sodium Thiosulfate Solution, 0.025N (4169) must be standardized daily. This procedure follows Standard Methods for the Examination of Water and Wastewater. Numbers in ( ) are for LaMotte products. These products are not included in this kit but can be ordered from LaMotte Company by using the specified code number.

1.



Use a 10 mL graduated cylinder (0416) to add 15 mL of Deionized Water (5115) to the titration tube (0608).

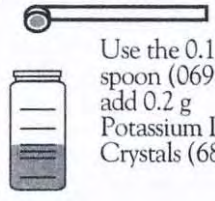
2.

Use a Direct Reading Titrator, 0-1 Range (1.0 mL capacity) (0376) to add 2 mL of Potassium Bi-iodate (7346).

3.

Add 2 drops of Sulfuric Acid, 5N (8517WT).

4.

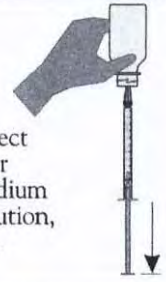


Use the 0.1 g spoon (0699) to add 0.2 g Potassium Iodide Crystals (6809).

5.

Swirl to dissolve. Solution will turn yellowish brown.

6.



Fill another Direct Reading Titrator (0376) with Sodium Thiosulfate Solution, 0.025N (4169).

EPA COMPLIANCE

7.

While gently swirling the tube, add Sodium Thiosulfate, 0.025N until the color fades to pale yellow. It will be necessary to refill the Direct Reading Titrator.

8.

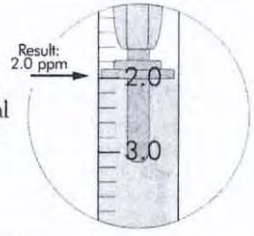
Add 3 drops of Starch Indicator Solution (4170WT). The solution will turn blue.

9.

Continue adding Sodium Thiosulfate, 0.025N until the blue color disappears and the solution is colorless.

10.

Read the test result directly from the scale where the large ring on the Titrator meets the Titrator barrel. Include the value of the original amount dispensed (1 mL). If the reading is 2.0 +/-0.1 mL, the Sodium Thiosulfate, 0.025N (4169) is satisfactory. If not, discard and replace with new reagent.



SHORT FORM INSTRUCTIONS

Read all instructions before performing test. Use this guide as a quick reference.

1. Fill Water Sampling Bottle (0688-DO).
2. Add 8 drops of *Manganous Sulfate Solution (4167).
3. Add 8 drops of *Alkaline Potassium Iodide Azide (7166).
4. Cap and mix.
5. Allow precipitate to settle.
6. Use the 1.0 g spoon to add *Sulfamic Acid Powder (6286) or add 8 drops of Sulfuric Acid, 1:1 (6141WT).
7. Cap and mix until reagent and precipitate dissolve.
8. Fill test tube (0608) to the 20 mL line.
9. Fill Titrator with *Sodium Thiosulfate, 0.025N (4169).
10. Titrate until sample color is pale yellow. DO NOT DISTURB TITRATOR.
11. Add 8 drops of Starch Indicator (4170WT).
12. Continue titration until blue color just disappears and solution is colorless.
13. Read result in ppm Dissolved Oxygen.

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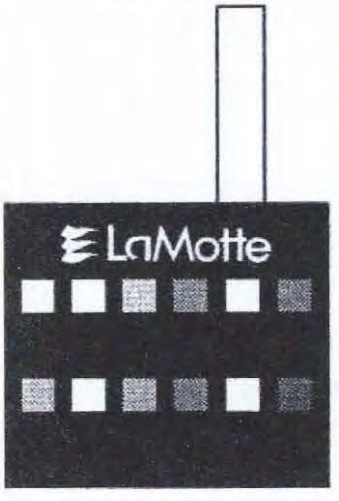
67414-MN • 3/06

F21

OCTET COMPARATOR & BI-COLOR READER

This instruction manual is furnished with LaMotte Octet Comparator Test Kits to outline in general terms the proper technique for the use and handling of the Octet Comparator and Bi-Color Reader. Individual instructions supplied with each chemical test kit specify actual test procedures.

USE OF THE OCTET COMPARATOR



The Octet Comparator contains eight permanent color standards. A test sample is inserted into the openings in the top of the comparator. The sample can then be compared to four color standards at once, and the value read off the comparator. For optimum color comparison, the comparator should be positioned between the operator and a light source, so that the light enters through the special light-diffusing screen in the back of the comparator. Avoid viewing the comparator against direct sunlight or an irregularly lighted background.

THE BI-COLOR READER • CODE 2151

Natural color or turbidity in a test sample may affect the color developed in a test reaction. The LaMotte Bi-Color Reader, used in conjunction with the Octet Comparator, compensates for this color variation. The comparator standards are viewed against test sample blanks, so that any color variation due to natural color or turbidity will be uniformly exhibited by the color standards and the test sample. Even if the color variation is pronounced, the accuracy of the test result will be maintained.

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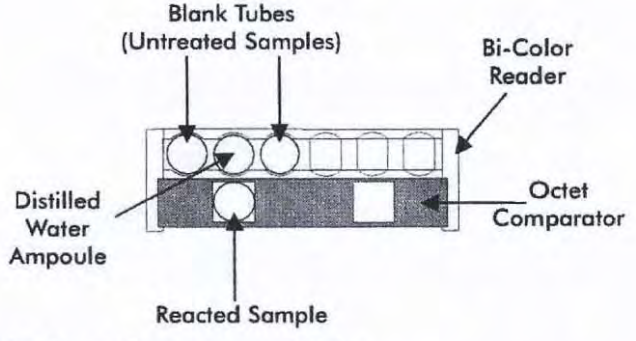
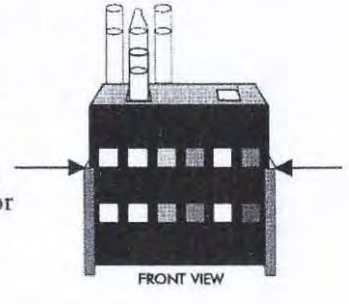
PROCEDURE

1. Place the Bi-Color Reader (2151) on table with the open side facing the operator.
2. Slide the Octet Comparator between the arms of the Bi-Color Reader, with the labels facing the operator.
3. Fill three test tubes to the line with sample water. Follow the individual test kit instructions to react one tube. The other two tubes will be used as blanks.
4. Insert the treated sample into the left-hand opening in the top of the Octet Comparator.
5. Insert the Distilled Water Ampoule (2748) into the opening in the Bi-Color Reader directly behind the reacted sample.
6. Insert the two test tubes with the unreacted samples into the openings in the Bi-Color Reader on either side of the Distilled Water Ampoule.

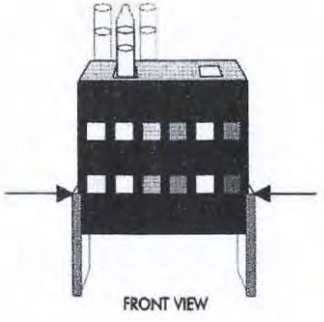
TOP VIEW



7. Slide the Octet Comparator until the bottom of the upper row of standards is level with the top of the Bi-Color Reader. Hold the comparator so natural light shines through the test tubes, and compare the reacted sample to the first and second color standards in the upper row of the Octet Comparator. If the color matches a standard, record the result. If the color does not match a standard, continue.



8. Slide the Octet Comparator until the bottom of the lower row of standards is level with the top of the Bi-Color Reader. Hold the comparator so natural light shines through the test tubes, and compare the reacted sample to the first and second color standards in the lower row of the Octet Comparator. If the color matches a standard, record the result. If the color does not match a standard, continue.



9. To compare the reacted sample to the color standards on the right side of the Octet Comparator, move the reacted sample to the opening in the right-hand side of the Octet Comparator. Move the Distilled Water Ampoule (2748) and the blank samples to the right side of the Bi-Color Reader, so that the ampoule is directly behind the reacted sample and the blanks are on either side of the ampoule. Compare the color of the reaction to the color standards as above.

TEST EQUIPMENT CARE & MAINTENANCE

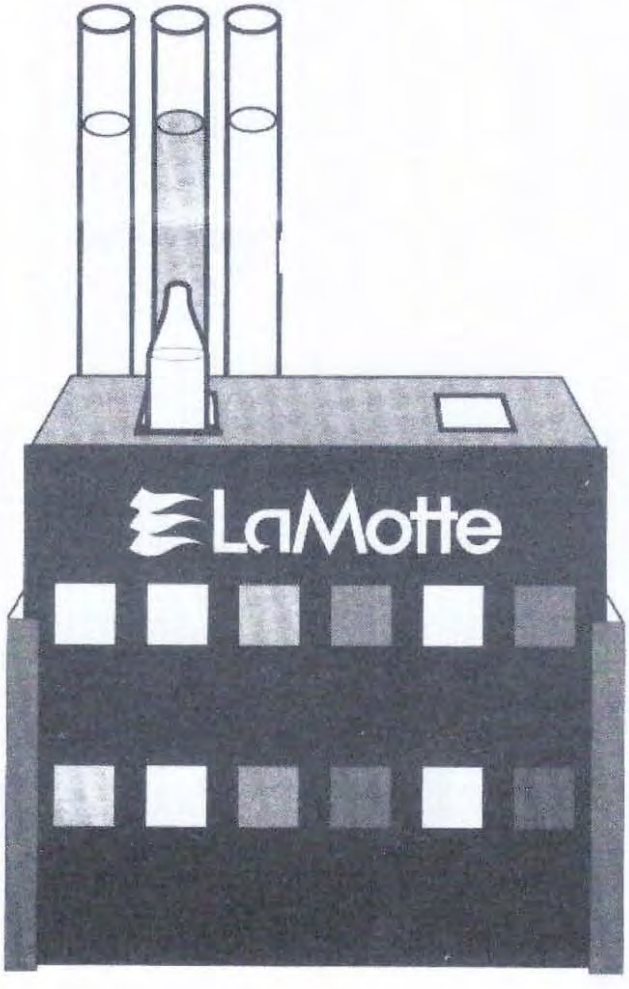
This equipment has been designed to give years of dependable service. The following suggestions are offered so that you may obtain maximum performance from this equipment:

1. Carefully follow all instructions.
2. Carefully wash and rinse all apparatus used in the test procedure.
3. Tighten reagent container caps immediately after use. Do not interchange caps.
4. Avoid prolonged exposure of all test components to direct sunlight.
5. Avoid extreme high temperatures and protect all test components from freezing.
6. Anticipate your requirements for replacement reagents.
7. Keep the reagents out of reach of young children.
8. Read reagent labels and MSDS.

AXIAL READER INSTRUCTION MANUAL

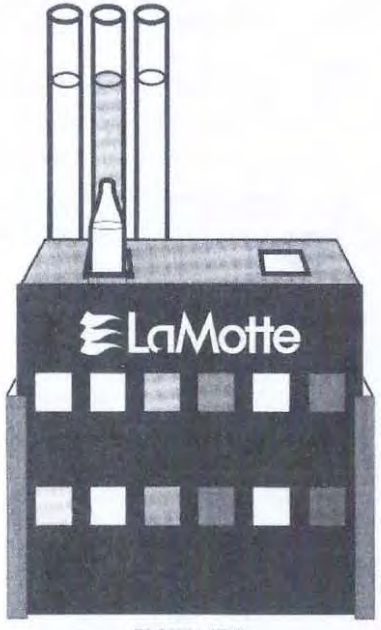
INTRODUCTION

When color reactions in test procedures produce extremely faint colors, it is difficult to quantify the color by looking directly through the diameter of the tube. Excellent readings can be made on samples exhibiting lightly colored reactions by viewing the sample down the length of the test tube. By looking down the length of the column of liquid in the tube, the color is concentrated five to ten times, depending upon the height of the liquid column. The LaMotte Axial Reader has been developed to provide an easy method for reading faint colors. The Octet Comparator unit furnished with the Axial Reader provides color standards that are equivalent to the concentrated "axial" color reading.

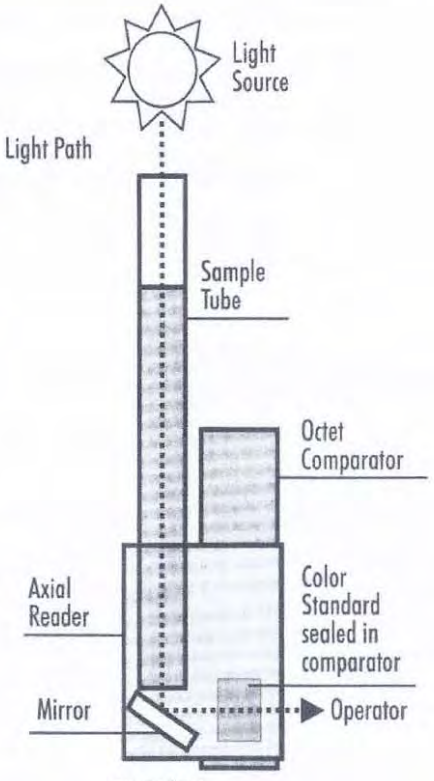


F24

SETUP



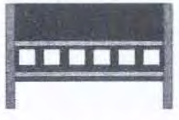
FRONT VIEW



SIDE VIEW

PROCEDURE

1 Place the Axial Reader (2071) on table top with open side facing operator. The mirror should be facing operator.



FRONT VIEW

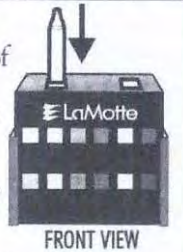
2 Position the Octet Comparator in the open slot of the Axial Reader with labels facing the operator. The bottom of the comparator should be flat on the table surface.

FRONT VIEW

3 Fill two test tubes to the 10 mL line. These are the blanks. Fill the third tube with sample water according to the test procedure instructions.

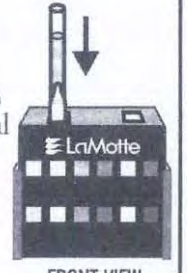
4 Treat one test tube according to test procedures; the other two will be used as blanks. Remove the test tube caps after adding the reagents and mixing.

5 Insert ampoule of distilled water into square hole on left side of Octet Comparator.



FRONT VIEW

6 Insert test tube with treated sample into slot in Axial Reader directly behind distilled water ampoule.



FRONT VIEW

7 Insert two test tubes with untreated sample into slots in Axial Reader on either side of treated sample.

FRONT VIEW

8 Slide Octet Comparator down until top is even with top of Axial Reader. Hold comparator so natural light (or dalite fluorescent light) shines down through test tubes. Compare color in center test tube to colors in top left corner of Octet Comparator.

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NITRATE/NITRITE TEST KIT

MODEL NCR-2 • CODE 3519

QUANTITY	CONTENTS	CODE
2 x 120 mL	*Mixed Acid Reagent	*V-6278-J
5 g	*Nitrate Reducing Reagent	*V-6279-C
5 g	*Color Developing Reagent	*V-6281-C
2	Spoons, 0.1g, plastic	0699
4	Test Tubes, 2.5 & 5.0 mL, glass	0820
1	Water Sample Bottle	0688
1	Dispenser Cap	0692
1	Nitrate-N Comparator, 0.25-10.0 ppm	3109

***WARNING:** Reagents marked with a * are considered to be potential health hazards. To view or print a Material Safety Data Sheet (MSDS) for these reagents see MSDS CD or www.lamotte.com. To obtain a printed copy, contact LaMotte by e-mail, phone or fax.

To order a complete set of refill reagents or test kit components, use the specified code number.

NOTE: Place Dispenser Cap (0692) on *Mixed Acid Reagent (V-6278). Save this cap for refill reagents.

Nitrites can cause serious interference in the Nitrate test. To obtain the actual nitrate-nitrogen concentration, follow Procedures A & B. Subtract the nitrite reading obtained in Procedure B (as ppm nitrate-nitrogen) from the nitrite reading obtained in Procedure A (as nitrate-nitrogen).

The best results are obtained when the sample and reagents are at 23 ±2°C.

PROCEDURE A - NITRATE TEST

1. Fill sample bottle (0688) with sample water.
2. Fill test tube (0820) to bottom line (2.5 mL) with water from the sample bottle.
3. Dilute to second (5.0 mL) line with *Mixed Acid Reagent (V-6278). Cap and mix. Wait two minutes.
4. Use the 0.1 g spoon (0699) to add one level measure (avoid any excess) of *Nitrate Reducing Reagent (V-6279). Cap and invert the tube 50-60 times in one minute. Wait 10 minutes.

F26

5. Mix before inserting the tube into the Nitrate-N Comparator (3109). Match sample color to a color standard. Record as ppm Nitrate-Nitrogen.
6. To convert to ppm Nitrate (NO3), multiply the test result by 4.4. Record as ppm Nitrate.

   NOTE: To obtain the actual nitrate concentration, follow with Procedure B and subtract the nitrite reading from the reading obtained in the nitrate test.

PROCEDURE B - NITRITE TEST

1. Fill the sample bottle (0688) with sample water.
2. Fill test tube (0820) to bottom line (2.5 mL) with water from the sample bottle.
3. Dilute to top (5.0 mL) line with *Mixed Acid Reagent (V-6278). Cap and mix.
4. Use the 0.1 g spoon (0699)to add one level measure (avoid any excess) of *Color Developing Reagent (V-6281). Cap and invert the tube 50-60 times in one minute. Wait 10 minutes.
5. Mix before inserting the tube into the Nitrate-N Comparator (3109). Match sample color to a color standard. Record as ppm Nitrite as Nitrate-Nitrogen.
6. Use the following table to convert reading to Nitrite-Nitrogen. Record as ppm Nitrite-Nitrogen.

Comparator Reading	Divide By
0.5 or less	3.5
0.5-1.5	4.6
over 2.0	5.8

NOTE: If the nitrate-nitrogen reading is higher than 10.0 the sample can be diluted 1:1 with nitrate and nitrite free water, the test run and the resultant value obtained multiplied by 2.

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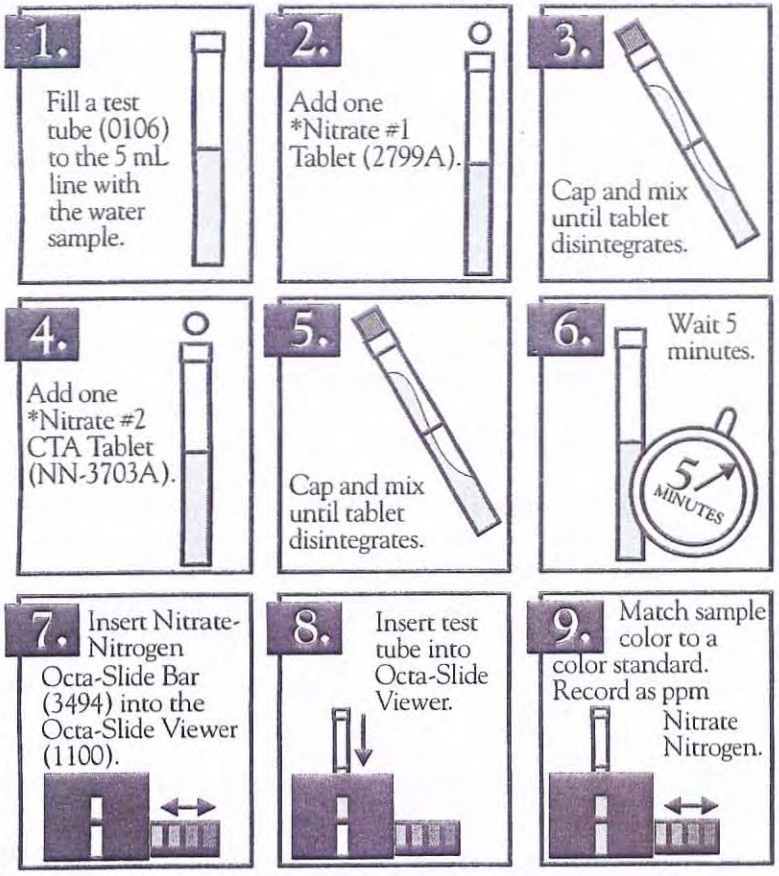
10/04

PROCEDURE



To convert to Nitrate, multiply results by 4.4. Record as ppm Nitrate.

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P274

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NITRATE NITROGEN TABLET KIT

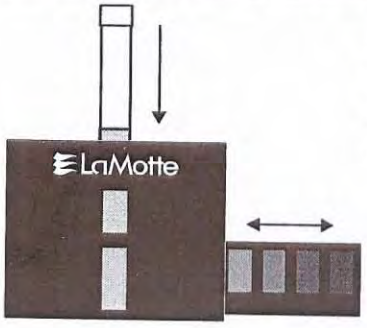
CODE 3354

QUANTITY	CONTENTS	CODE
50	*Nitrate #1 Tablets	*2799A-H
50	*Nitrate #2 CTA Tablets	*NN-3703A-H
2	Test Tubes, plastic, w/caps	0106
1	Nitrate-Nitrogen Octa-Slide, 0-15 ppm	3494
1	Octa-Slide Viewer	1100

***WARNING:** Reagents marked with a * are considered to be potential health hazards. To view or print a Material Safety Data Sheet (MSDS) for these reagents see MSDS CD or www.lamotte.com. To obtain a printed copy, contact LaMotte by e-mail, phone or fax.

To order individual reagents or test kit components, use the specified code number.

USE OF THE OCTA-SLIDE VIEWER



The Octa-Slide Viewer should be held so non-direct light enters through the back of the comparator. With sample tube inserted at top, slide the Octa-Slide bar through the viewer and match with color standard.

WARNING! This set contains chemicals that may be harmful if misused. Read cautions on individual containers carefully. Not to be used by children except under adult supervision

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AMMONIA-NITROGEN TEST KIT

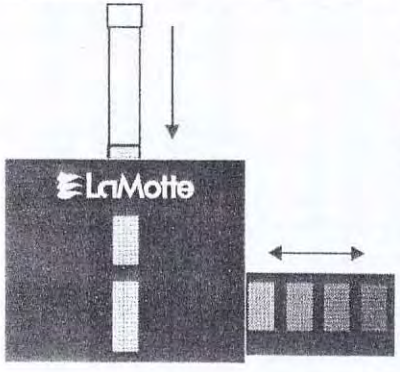
SALICYLATE METHOD • CODE 3304

QUANTITY	CONTENTS	CODE
60 mL	*Salicylate Ammonia #1	*3978LWT-H
30 mL	*Salicylate Ammonia #2	*3979WT-G
30 mL	Salicylate Ammonia #3	3982WT-G
2	Test Tubes, plastic, w/caps	0106
1	Octa-Slide Viewer	1100
1	Ammonia-Nitrogen Octa-Slide Bar, 0 - 2 ppm	3441

*WARNING: Reagents marked with a * are considered to be potential health hazards. To view or print a Material Safety Data Sheet (MSDS) for these reagents see MSDS CD or www.lamotte.com. To obtain a printed copy, contact LaMotte by email, phone or fax.

To order individual reagents or test kit components, use the specified code number.

USE OF THE OCTA-SLIDE VIEWER



The Octa-Slide Viewer should be held so non-direct light enters through the back of the viewer. With sample tube inserted at top, slide the Octa-Slide bar through the viewer and match with color standard.

WARNING! This set contains chemicals that may be harmful if misused. Read cautions on individual containers carefully. Not to be used by children except under adult supervision

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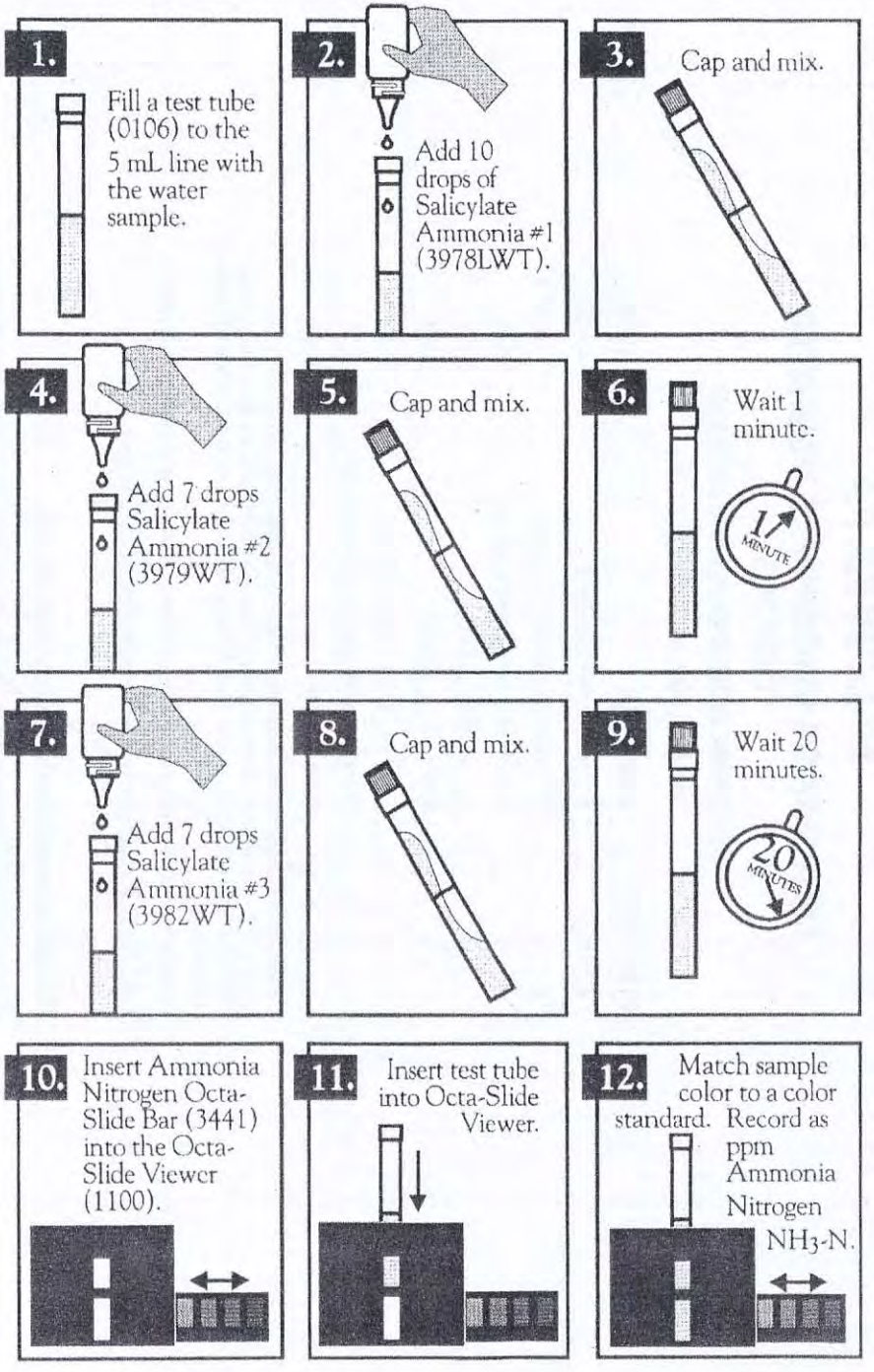
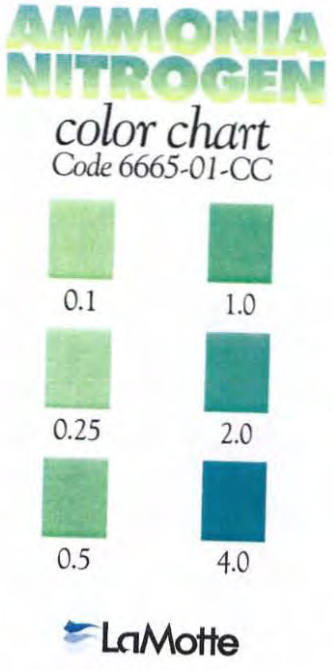
PROCEDURE





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AMMONIA-NITROGEN TEST KIT

CODE 5864

QUANTITY	CONTENTS	CODE
50	*Ammonia #1 Tablets	*3968A-H
50	*Ammonia #2 Tablets	*3969A-H
2	Test Tubes, plastic, w/cap	0106
1	Ammonia-Nitrogen Color Chart, 0.1 - 4.0 ppm	6665-01-CC

***WARNING:** Reagents marked with a * are considered to be potential health hazards. To view or print a Material Safety Data Sheet (MSDS) for these reagents see MSDS CD or www.lamotte.com. To obtain a printed copy, contact LaMotte by email, phone or fax.

To order individual reagents or test kit components, use the specified code number.

PROCEDURE

1. Fill test tube (0106) to 5 mL line with sample water.
2. Add one *Ammonia #1 Tablet (3968A) and one *Ammonia #2 Tablet (3969A). Cap and mix until tablets disintegrate. Wait 5 minutes.
3. Hold test tube flat against the white section of the Ammonia-Nitrogen Color Chart (6665-01-CC). Match sample color to a color standard. Record as ppm Ammonia-Nitrogen.

   NOTE: Sample may be turbid. This will not affect the test results.
4. To convert result to Ammonia, multiply reading by 1.3. Record as ppm Ammonia.

WARNING! This set contains chemicals that may be harmful if misused. Read cautions on individual containers carefully. Not to be used by children except under adult supervision

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F284

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LOW RANGE PHOSPHATE IN WATER TEST KIT

ASCORBIC ACID REDUCTION METHOD

MODEL PAL • CODE 3121-01

QUANTITY	CONTENTS	CODE
2 x 30 mL	*Phosphate Acid Reagent	*V-6282-G
5 g	*Phosphate Reducing Reagent	*V-6283-C
3	Test Tubes, 10 mL, glass, w/caps	0843
1	Pipet, 1.0 mL, plastic	0354
1	Spoon, 0.1 g, plastic	0699
1	Distilled Water Ampoule, 5 mL	2748
1	Phosphate Comparator, 0.0-2.0 ppm	3122
1	Axial Reader	2071

***WARNING:** Reagents marked with a * are considered to be potential health hazards. To view or print a Material Safety Data Sheet (MSDS) for these reagents see MSDS CD or www.lamotte.com. To obtain a printed copy, contact LaMotte by e-mail, phone or fax.

To order individual reagents or test kit components, use the specified code number.

Read Axial Reader Instruction Manual (35048) before proceeding.

NOTES:

This test determines levels of orthophosphates only.

This test should be run on clear samples only. Filter the sample if necessary.

Best results are obtained when solution temperatures are 23-25°C.

WARNING! This set contains chemicals that may be harmful if misused. Read cautions on individual containers carefully. Not to be used by children except under adult supervision

PROCEDURE

1. Fill test tube (0843) to 10 mL line with sample water.
2. Use 1.0 mL pipet (0354) to add 1.0 mL of *Phosphate Acid Reagent (V-6282). Cap and mix.
3. Use 0.1 g spoon (0699) to add one level measure of *Phosphate Reducing Reagent (V-6283). Cap and mix until dissolved. Wait 5 minutes.
4. Remove cap from test tube. Place tube in Phosphate Comparator (3122) with Axial Reader (2071). Read Axial Reader Instruction Manual before proceeding. Fill two test tubes (0843) to the 10 mL line with sample water. Place in Axial Reader. Match sample color to a color standard. Record as ppm Orthophosphate.

F29

PARAMETER: Plankton measurement

METHOD: Plankton Net

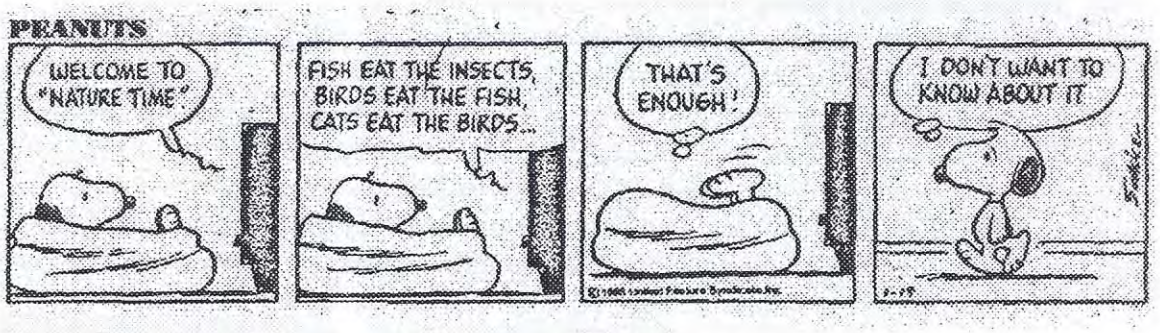
MATERIALS: Plankton net, line, collection bottle, lens, dishes

DIRECTIONS:

1. Firmly attach the bottle to the net and net to the line.
2. Close off drain if one is present.
3. Place the net into current from dock, boat or shore.
4. Record the amount of time that the net is set.
5. When the net is brought up keep it in a vertical position until the water drains.
6. Open stopcock or unscrew bottle to obtain sample.
7. Rinse clinging organisms by reimersing net and repeating procedure.

NOTES:

1. Care should be taken to avoid ripping net on bulkhead or obstructions. Tying the line to a 4 to 5 foot pole is often useful.
2. Always try to have two people working the net one should hold the line spool and the other the net. This is a good general practice for all over the side pieces of equipment to avoid loss.
3. At the beach avoid filling the net with sand by allowing it to hit the bottom.
4. Keep samples cold for trip back to lab.
5. As soon as possible rinse the net and line in fresh water and hang to dry



COMMON NAME: _____
GENUS: _____
SPECIES: _____
PHYLUM: _____
CLASS: _____
ORDER: _____
FAMILY: _____
LOCATION: _____
RANGE: _____
COMMENTS: _____

TAXONOMIST: _____
REFERENCE: _____

COMMON NAME: _____
GENUS: _____
SPECIES: _____
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TAXONOMIST: _____
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FAMILY: _____
LOCATION: _____
RANGE: _____
COMMENTS: _____

TAXONOMIST: _____
REFERENCE: _____

What's the Point of Non-Point Source Pollution?

By Chester Arnold
and Melissa Beristain

Nonpoint source pollution is a fancy term for polluted runoff. Water washing over the land, whether from rain, car washing, or the watering of crops or lawns, picks up an array of contaminants. This can include oil and sand from roadways, agricultural chemicals from farmland, and nutrients and toxic materials from urban and suburban areas. This runoff finds its way into our waterways, either directly or through storm drain collection systems.

The term nonpoint is used to distinguish this type of pollution from point source pollution, which comes from specific sources such as sewage treatment plants or industrial facilities. Scientific evidence shows that, although huge strides have been made in cleaning up major point sources, our precious water resources are still threatened by the effects of polluted runoff. In fact, the Environmental Protection Agency has estimated that this type of pollution is now the single largest cause of the deterioration of our nation's water quality.

Why Should We Care?

The effects of polluted runoff are not limited to large lakes or coastal bays. In fact, chances are that you don't have to look any farther than your neighborhood stream or duck pond. Water pollution in your community, and perhaps in your own backyard, can result in anything from weed-choked ponds to fish kills to contaminated drinking water.

There's not much chance that you can ignore this problem, even if you want to. Concern over polluted runoff has resulted in an ever-increasing number of state and federal laws enacted over the last five years.

What Causes Polluted Runoff?

You do. We all do. Polluted runoff is the cumulative result of our everyday personal actions and our local land use policies. Here's a brief rundown on the causes and effect of the major types of pollutants carried by runoff.

Pathogens: Pathogens are disease-causing microorganisms, such as bacteria and viruses, that come from the fecal waste of humans and animals. Exposure to pathogens, either from direct contact with water or through ingestion of contaminants, can make people sick. Because of this, bathing beaches and shellfish beds are closed to the public when testing reveals significant pathogen levels. Pathogens wash off the land from wild animals, farm animal and pet waste, and can also enter our waterways from improperly functioning septic tanks, leaky sewer lines and boat sanitary disposal systems.

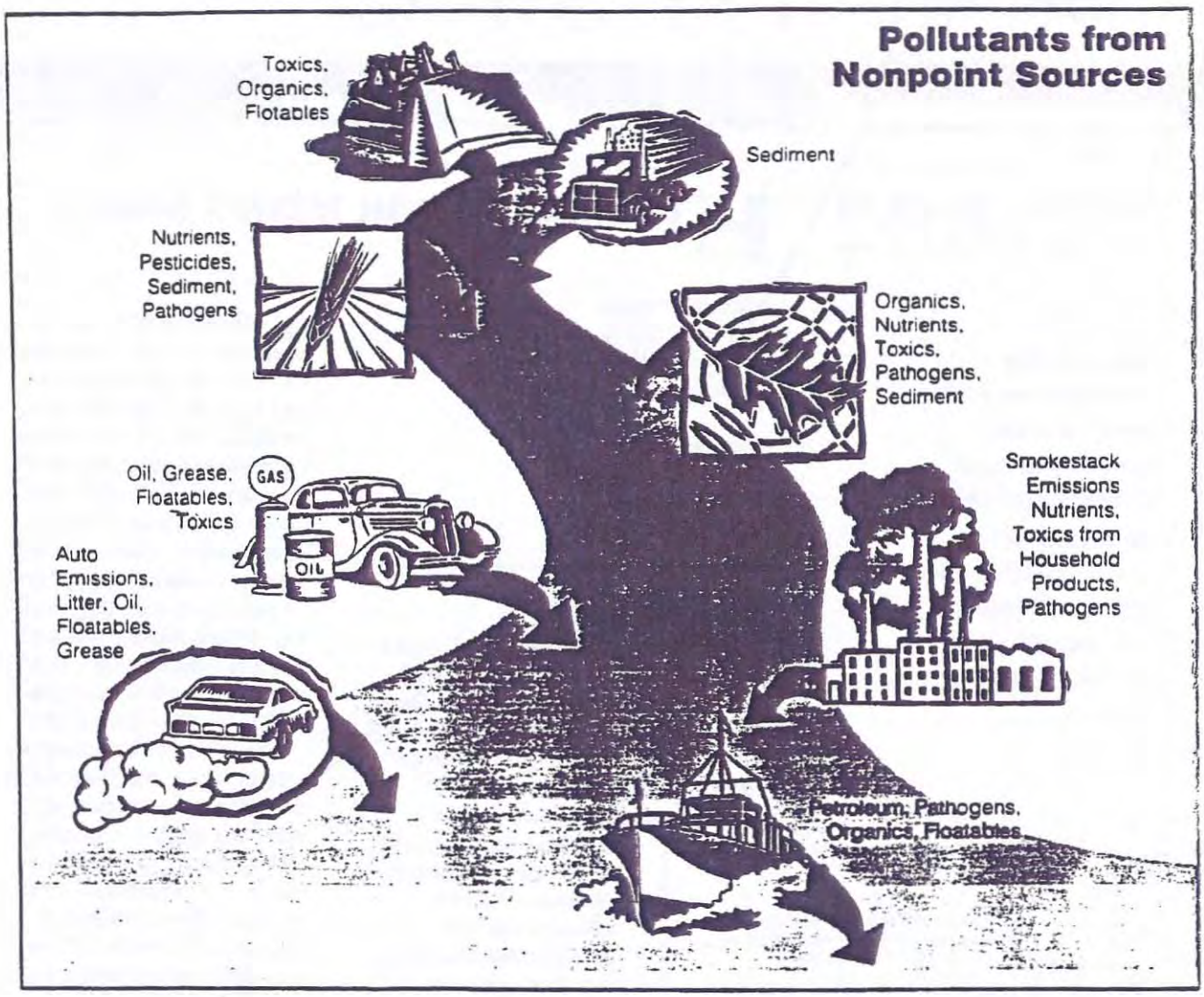
Nutrients: Nutrients are compounds that stimulate plant growth, like nitrogen and phosphorous. Under normal conditions, nutrients are beneficial and necessary, but in high concentrations, they can become an environmental threat. Nitrogen contamination of drinking water can cause health problems, including "blue baby" syndrome. Overfertilization of ponds, bays and lakes by nutrients can lead to massive alga blooms, the decay of which can create odors and rob the waters of life-sustaining dissolved oxygen. Nutrients in polluted runoff can come from agricultural fertilizers, septic systems, home lawn care products, and yard and animal wastes.

Sediment: Sand, dirt and gravel eroded by runoff usually end up in stream beds, ponds or shallow coastal areas, where they can alter stream flow and decrease the availability of healthy aquatic habitat. Poorly protected construction sites, agricultural fields, roadways and suburban gardens can be major sources of sediment.

Toxic Contaminants: Toxic contaminants are substances that can harm the health of aquatic life and/or human beings. Toxins are created by a wide variety of human practices and products, and include heavy metals, pesticides and organic compounds like PCBs. Many toxins are very resistant to breakdown and tend to be passed through the food chain to be concentrated in top predators. Fish consumption health advisories are the result of concern over toxins. Oil, grease and gasoline from roadways, and chemicals used in homes, gardens, yards and on farm crops, are major sources of toxic contaminants.

Debris: Trash is without doubt the simplest type of pollution to

R1



understand. It interferes with enjoyment of our water resources and, in the case of plastic Styrofoam, can be a health threat to aquatic organisms. Typically, this debris starts as street litter that is carried by runoff into our waterways.

What is the Connection Between Polluted Runoff and Land Use?

Polluted runoff is largely the result of the way we develop, use and maintain our land. As the intensity of development increases, so does the generation of nonpoint source water pollution. A good indicator of the intensity of development is the amount of impervious surface. By blocking the infiltration of water and its associated pollutants into the soil, impervious surfaces, like asphalt, concrete and roofing, interfere with natural processing of nutrients, sediment, pathogens and other contaminants, The greater the impervious surface coverage in a watershed, the greater the potential degradation of that watershed's water systems.

This article was written for the NEMO Project, "Nonpoint Education for Municipal Officials," a project of the University of Connecticut Cooperative Extension System.

From Ecolog Winter '95
A Sound Waters Publication

R2

Forcing Functions and Effects on Water Quality

R3

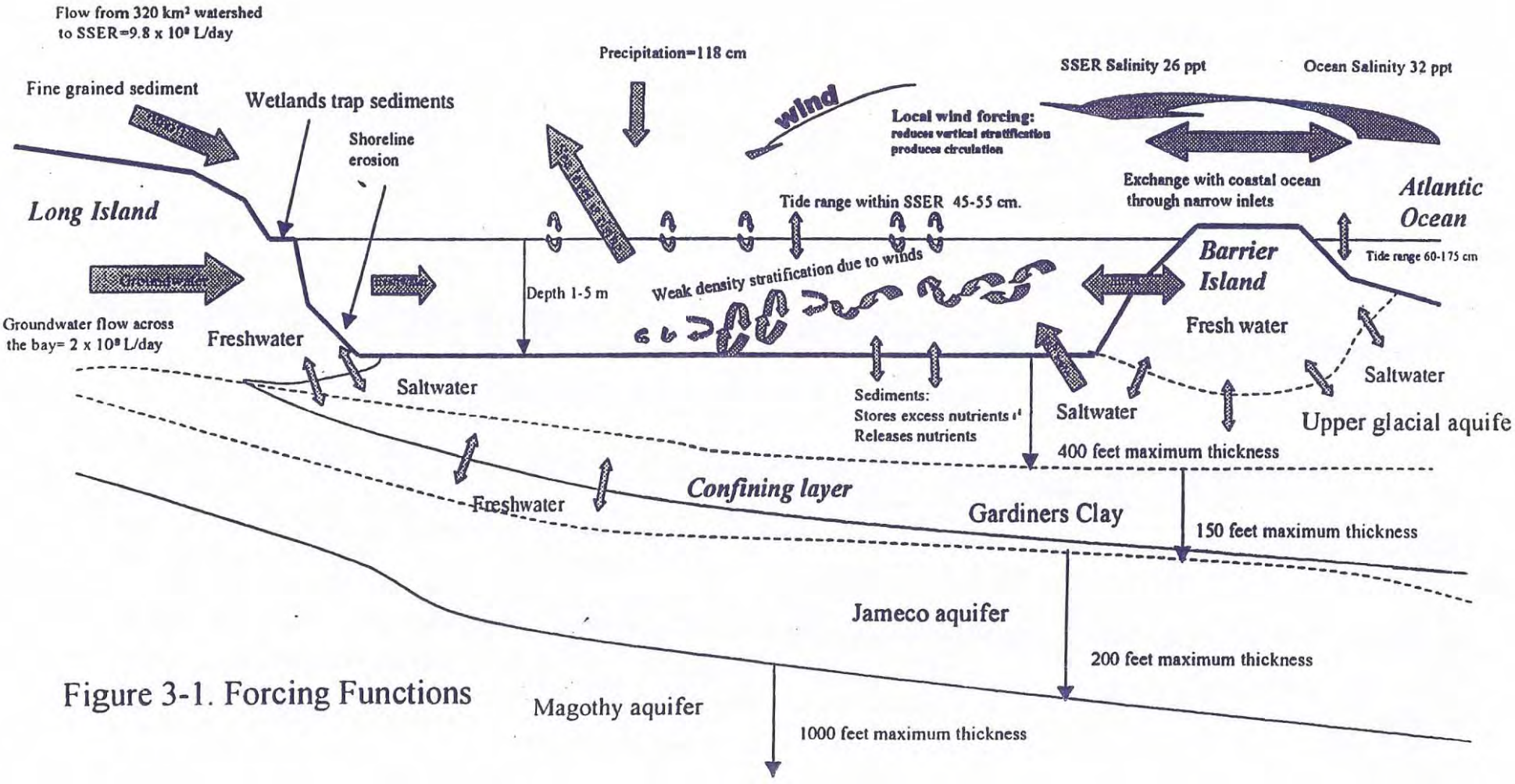
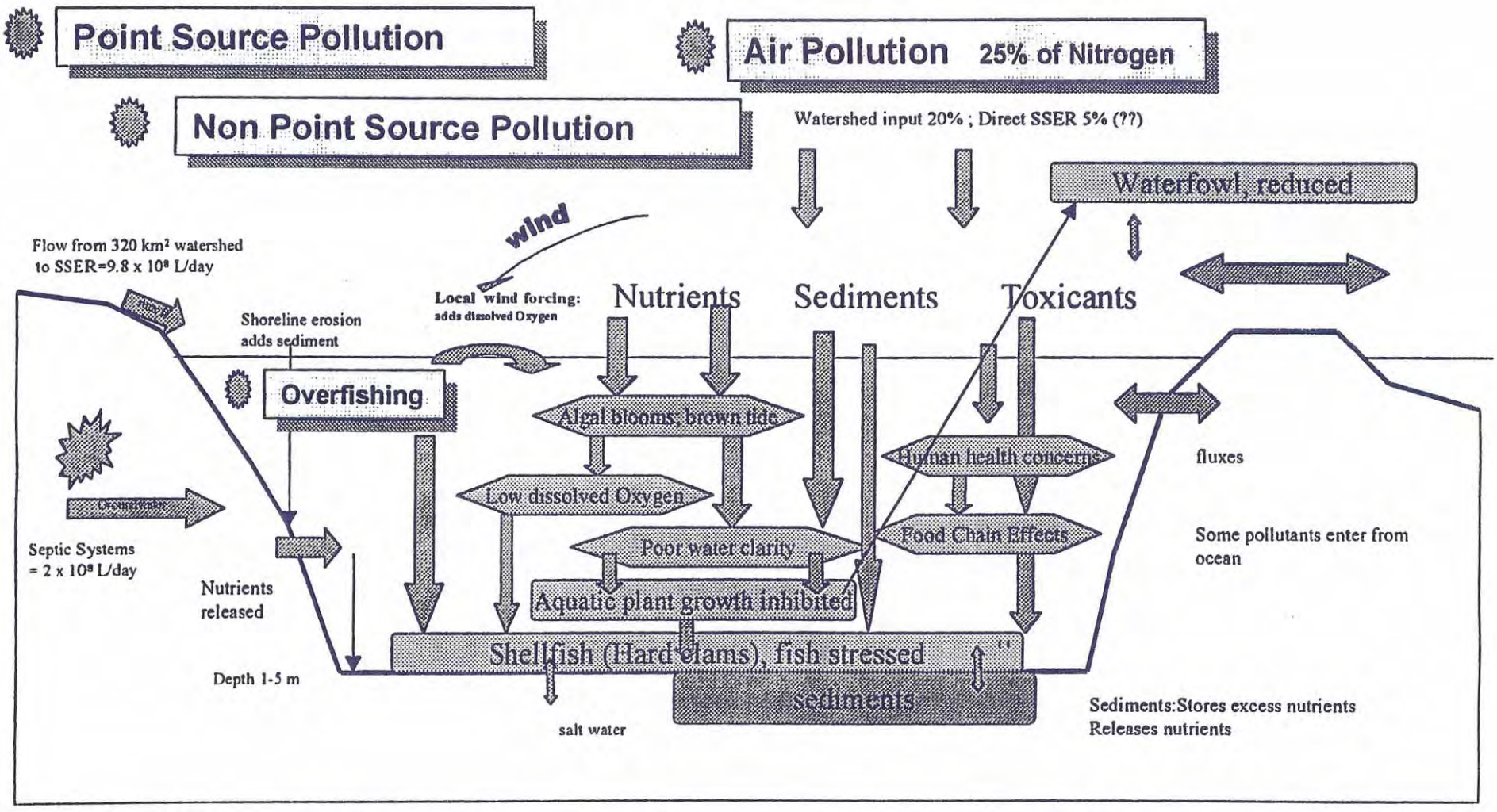


Figure 3-1. Forcing Functions

Effect of Pollution on Water Quality



South Shore Estuary Reserve

Figure 3-3. Effect of Pollution on Water Quality

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Monitoring Strategy

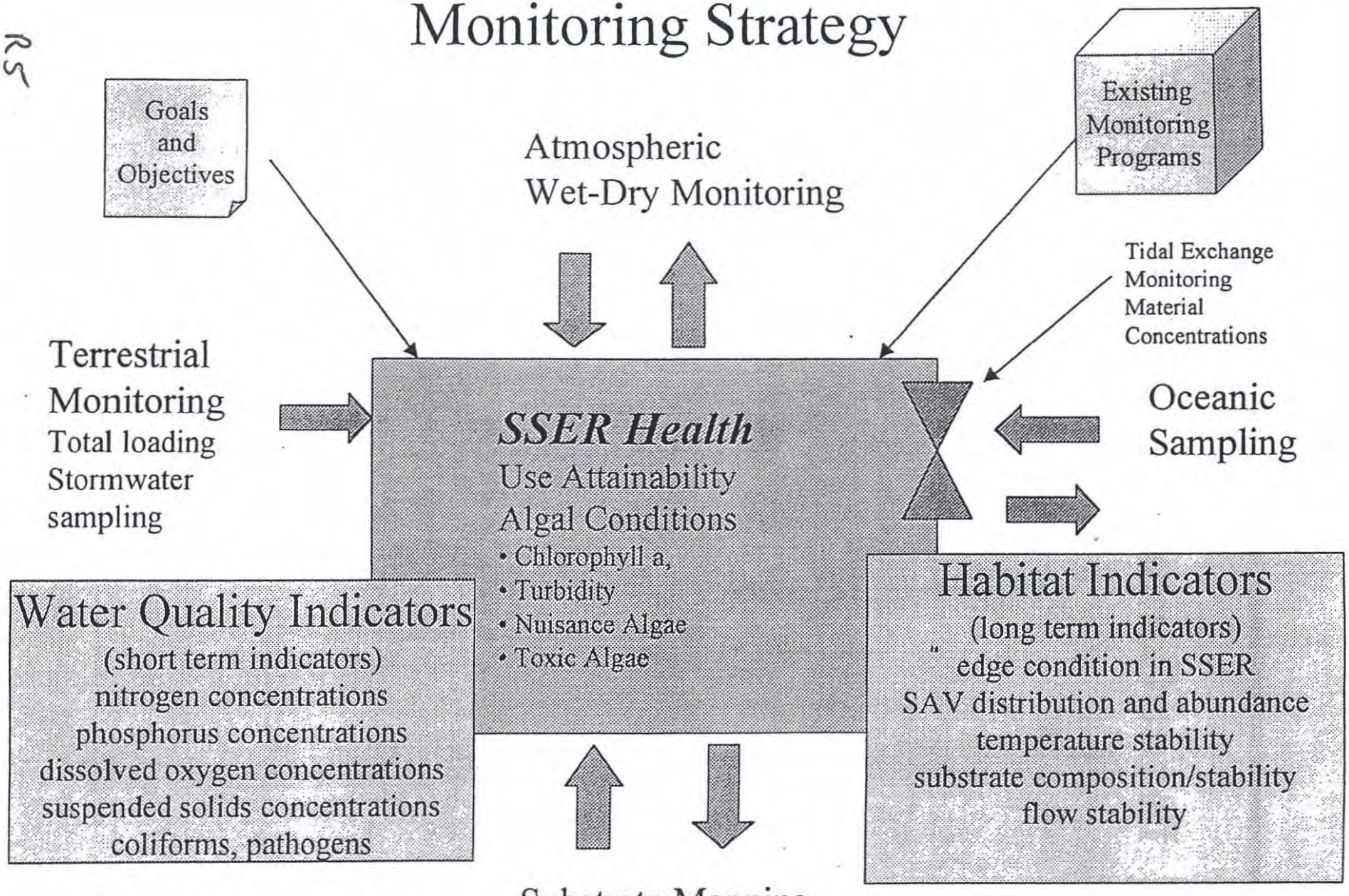


Table 6-1. Monitoring Strategy

Desired State

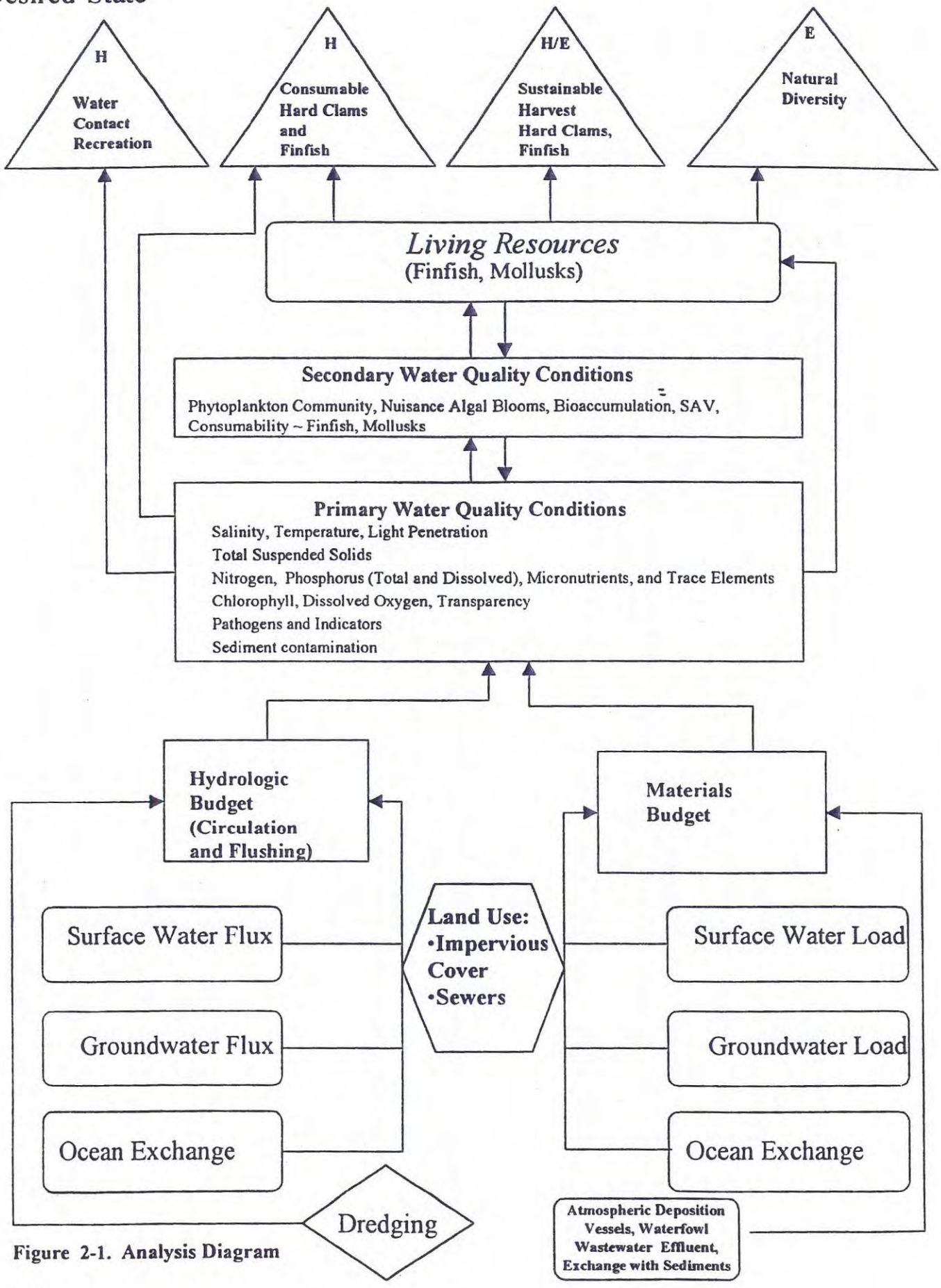


Figure 2-1. Analysis Diagram

RC

NEW YORK STATE MARINE EDUCATION ASSOCIATION

peter piper picked a peck of
pickeled (& fresh)

PLANKTON

The plankton lobby

R7

PARAMETER: Plankton measurement

METHOD: Plankton Net

MATERIALS: Plankton net, line, collection bottle, lens, dishes

DIRECTIONS:

1. Firmly attach the bottle to the net and net to the line.
2. Close off drain if one is present.
3. Place the net into current from dock, boat or shore.
4. Record the amount of time that the net is set.
5. When the net is brought up keep it in a vertical position until the water drains.
6. Open stopcock or unscrew bottle to obtain sample.
7. Rinse clinging organisms by reimersing net and repeating procedure.

NOTES:

1. Care should be taken to avoid ripping net on bulkhead or obstructions. Tying the line to a 4 to 5 foot pole is often useful.
2. Always try to have two people working the net one should hold the line spool and the other the net. This is a good general practice for all over the side pieces of equipment to avoid loss.
3. At the beach avoid filling the net with sand by allowing it to hit the bottom.
4. Keep samples cold for trip back to lab.
5. As soon as possible rinse the net and line in fresh water and hang to dry

PROBLEM: WHAT TYPES OF MICROSCOPIC LIFE CAN BE FOUND IN THE OCEAN?

INTRODUCTION: Floating organisms in the sea which have a limited ability to swim and are at the mercy of the wind, waves, tides and currents are called PLANKTON.

The **Phytoplankton** have chlorophyll and can produce organic compounds and oxygen.
The organisms which depend upon other organisms for food are the **Zooplankton**.
A plankton net is used to obtain a concentrated sample by sampling a large amount of water.
Holoplankton are organisms, like algae and copepods, which spend their entire lives as plankton.
Many large animals have planktonic stages in their life cycle so it is possible to find fish or worm, clam, seastar, lobster, crab and shrimp larvae. These types of larval organisms are called **Meroplankton**.

MATERIALS: compound microscope, dissecting microscope, slides, dishes, eyedroppers, coverslips, plankton sample

PROCEDURE:

1. Examine a fresh sample in a dish using the dissecting microscope. Use both high and low power. Draw and try to identify any large specimens using the identification keys on your desk.

2. Squeeze an eyedropper bulb and then carefully stick it below the water in the sample dish and suck up some of the material from the bottom. Be careful not to blow bubbles and disturb the sample. Allow the solid material to settle to the bottom of the dropper for a few seconds. Place a drop on the center of your slide Cover with a coverslip.
3. Observe using both low and high power.
Draw and try to identify any large specimens using the identification keys on your desk.

QUESTIONS:

1. For each organism attempt to: draw it, estimate it's size, identify it's common and scientific name, give the Phylum , describe how it moves, give any other interesting aspects. If there are many organisms draw a few representatives. Each drawing should be at least 5 cm. (2 in.) big.

2. Which organisms are most abundant in your sample?

3. How was the sample collected?

4. Why do most plankton live near the surface of the ocean?

5. What factors determine what type of organisms are present?

6. How do the planktonic organisms avoid sinking?

HOW TO USE A MICROSCOPE

1. Set the microscope up in a position where light is available.
2. Clean lenses with lens paper. Do not tilt the stage.
3. Click low power lens into place.
4. Turn the coarse adjustment until the lens is as close as possible to the stage.
5. Adjust light until you get a bright, blue-white light, using:
    a. the diaphragm - which should be set on the largest opening
    b. the mirror (if present)

6. Place the slide on the stage:
    Slowly turn the coarse adjustment until "something" is seen.
    Now move the slide to make sure that the object seen is really on the slide. If the object does not move when the slide is moved it is probably dirt on the lens or stage.
    Continue moving the coarse adjustment until "something" is seen which is on the slide.
    Do not turn the coarse adjustment more than 1/2 a turn.
    If nothing can be seen, close down the diaphragm a little and try again starting with the lens as close as possible to the stage.
    Move the slide with one hand while you adjust the focus with the other.

7. Once you have something in focus, use the fine adjustment to get a clearer image. Try adjusting the light with the diaphragm to get greater depth of field.

A good microscopist keeps one hand on the fine adjustment; one hand on the diaphragm and the other hand moving the slide. (Its not easy!)

8. Remember not to move the scope once you have made all of the adjustments.
   Many people find it easier to work on live specimens without using the slide clips.

9. To shift to high power:
    rotate the high power lens into place while you are watching the stage from the side of the scope to be sure that the lens does not hit the slide. Then slowly lower the lens using the fine adjustment while you are looking through the eyepiece.

You may find that more light is necessary because the high power lens is smaller.

10. To use oil immersion:
    First view the object under high power and center it in the field of view.
    Rotate the nose piece so that no lens is in place.
    Use the coarse adjustment to give you more room between the lenses and the stage
    Use the light passing through from below to carefully center
        a small amount of oil on to the surface of the coverslip.
    While looking from the side of the microscope lower the oil immersion lens into the oil.
    Then look through the ocular and use the fine adjustment to focus on the object.
    You will have to adjust the light because of the reduced lens opening.
    If it is a wet mount slide you may find that the coverslip shifts. Try drawing off some of the liquid, by capillary action, with a paper towel placed near the edge of the coverslip.

R10

DISSOLVED OXYGEN FACT SHEET

Oxygen is critical to the survival of aquatic plants and animals, and a shortage of dissolved oxygen is not only a sign of pollution, it is harmful to fish. Some aquatic species are more sensitive to oxygen depletion than others, but some general guidelines to consider when analyzing test results are:

5–6 ppm	**Sufficient for most species**
<3 ppm	**Stressful to most aquatic species**
<2 ppm	**Fatal to most species**

Because of its importance to the fish's survival, aquaculturists, or "fish farmers," and aquarists use the dissolved oxygen test as a primary indicator of their system's ability to support healthy fish.

WHERE DOES THE OXYGEN COME FROM?

The oxygen found in water comes from many sources, but the largest source is oxygen absorbed from the atmosphere. Wave action and splashing allows more oxygen to be absorbed into the water. A second major source of oxygen is aquatic plants, including algae; during photosynthesis plants remove carbon dioxide from the water and replace it with oxygen.

Absorption

Oxygen is continuously moving between the water and surrounding air. The direction and speed of this movement is dependent upon the amount of contact between the air and water. A tumbling mountain stream or windswept, wave-covered lake, where more of the water's surface is exposed to the air, will absorb more oxygen from the atmosphere than a calm, smooth body of water. This is the idea behind aerators: by creating bubbles and waves the surface area is increased and more oxygen can enter the water.

Photosynthesis

In the leaves of plants, one of the most important chemical processes on Earth is constantly occurring: photosynthesis. During daylight, plants constantly take carbon dioxide from the air, and in the presence of water convert it to oxygen and carbohydrates, which are used to produce additional plant material. Since photosynthesis requires light, plants do not photosynthesize at night, so no oxygen is produced. Chemically, the photosynthesis reaction can be written as:

$$\text{Light} + n\text{CO}_2 + n\text{H}_2\text{O} \longrightarrow (\text{C}_2\text{HO})n + n\text{O}_2$$

$$\text{Light} + \text{Carbon Dioxide} + \text{Water} \longrightarrow \text{Carbohydrate} + \text{Oxygen}$$

R11

Immediately upon formation of the precipitate, the oxygen in the water oxidizes an equivalent amount of the manganous hydroxide to brown-colored manganic hydroxide. For every molecule of oxygen in the water, four molecules of manganous hydroxide are converted to manganic hydroxide. Chemically, this reaction can be written as:

$$4Mn(OH)_2 + O_2 + 2H_2O \longrightarrow 4Mn(OH)_3$$

Manganous Hydroxide + Oxygen + Water ⟶ Manganic Hydroxide

After the brown precipitate is formed, a strong acid, such as Sulfamic Acid Powder (6286) or Sulfuric Acid, 1:1 (6141) is added to the sample. The acid converts the manganic hydroxide to manganic sulfate. At this point the sample is considered "fixed" and concern for additional oxygen being introduced into the sample is reduced. Chemically, this reaction can be written as:

$$2Mn(OH)_3 + 3H_2SO_4 \longrightarrow Mn_2(SO_4)_3 + 6H_2O$$

Manganic Hydroxide + Sulfuric Acid ⟶ Manganic Sulfate + Water

Simultaneously, iodine from the potassium iodide in the Alkaline Potassium Iodide Azide Solution is oxidized by manganic sulfate, releasing free iodine into the water. Since the manganic sulfate for this reaction comes from the reaction between the manganous hydroxide and oxygen, the amount of iodine released is directly proportional to the amount of oxygen present in the original sample. The release of free iodine is indicated by the sample turning a yellow-brown color. Chemically, this reaction can be written as:

$$Mn_2(SO_4)_3 + 2KI \longrightarrow 2MnSO_4 + K_2SO_4 + I_2$$

Manganic Sulfate + Potassium Iodide ⟶ Manganous Sulfate + Potassium Sulfate + Iodine

The final stage in the Winkler titration is the addition of sodium thiosulfate. The sodium thiosulfate reacts with the free iodine to produce sodium iodide. When all of the iodine has been converted the sample changes from yellow-brown to colorless. Often a starch indicator is added to enhance the final endpoint. Chemically, this reaction can be written as:

$$2Na_2S_2O_3 + I_2 \longrightarrow Na_2S_4O_6 + 2NaI$$

Sodium Thiosulfate + Iodine ⟶ Sodium Tetrathionate + Sodium Iodide

WHERE DOES THE OXYGEN GO?

Once in the water, oxygen is used by the aquatic life. Fish and other aquatic animals need oxygen to breathe or respire. Oxygen is also consumed by bacteria to decay, or decompose, dead plants and animals.

Respiration

All animals, whether on land or underwater, need oxygen to respire, grow and survive. Plants and animals respire throughout the night and day, consuming oxygen and producing carbon dioxide, which is then used by plants during photosynthesis.

Decomposition

All plant and animal waste eventually decomposes, whether it is from living animals or dead plants and animals. In the decomposition process, bacteria use oxygen to oxidize, or chemically alter, the material to break it down to its component parts. Some aquatic systems may undergo extreme amounts of oxidation, leaving no oxygen for the living organisms, which eventually leave or suffocate.

OTHER FACTORS

The oxygen level of a water system is not only dependent on production and consumption. Many other factors work together to determine the potential oxygen level, including:

- **Salt vs. fresh water** - Fresh water can hold more oxygen than salt water.
- **Temperature** - Cold water can hold more oxygen than warm water.
- **Atmospheric pressure (Altitude)** - The greater the atmospheric pressure the more oxygen the water will hold.

TESTING DISSOLVED OXYGEN

Dissolved oxygen is often tested using the Azide modification of the Winkler method. When testing dissolved oxygen it is critical not to introduce additional oxygen into the sample. Many people avoid this problem by filling the sample bottle all the way and allowing the water to overflow for one minute before capping.

The first step in a DO titration is the addition of Manganous Sulfate Solution (4167) and Alkaline Potassium Iodide Azide Solution (7166). These reagents react to form a white precipitate, or floc, of manganous hydroxide, $Mn(OH)_2$. Chemically, this reaction can be written as:

$$MnSO_4 + 2KOH \longrightarrow Mn(OH)_2 + K2SO_4$$

Manganous Sulfate + Potassium Hydroxide ⟶ Manganous Hydroxide + Potassium Sulfate

APPENDIX E OXYGEN SOLUBILITY TABLE

Table A: Solubility of Oxygen in mg/l in Water Exposed to Water-Saturated Air at 760 mm Hg Pressure.
Salinity = Measure of quantity of dissolved salts in water.
Chlorinity = Measure of chloride content, by mass, of water.
$S(^{0}/_{00}) = 1.80655 \times \text{Chlorinity}\ (^{0}/_{00})$

Temp °C	Chlorinity:0 Salinity:0	5.0 ppt 9.0 ppt	10.0 ppt 18.1 ppt	15.0 ppt 27.1 ppt	20.0 ppt 36.1 ppt	25.0 ppt 45.2 ppt
0.0	14.62	13.73	12.89	12.10	11.36	10.66
1.0	14.22	13.36	12.55	11.78	11.07	10.39
2.0	13.83	13.00	12.22	11.48	10.79	10.14
3.0	13.46	12.66	11.91	11.20	10.53	9.90
4.0	13.11	12.34	11.61	10.92	10.27	9.66
5.0	12.77	12.02	11.32	10.66	10.03	9.44
6.0	12.45	11.73	11.05	10.40	9.80	9.23
7.0	12.14	11.44	10.78	10.16	9.58	9.02
8.0	11.84	11.17	10.53	9.93	9.36	8.83
9.0	11.56	10.91	10.29	9.71	9.16	8.64
10.0	11.29	10.66	10.06	9.49	8.96	8.45
11.0	11.03	10.42	9.84	9.29	8.77	8.28
12.0	10.78	10.18	9.62	9.09	8.59	8.11
13.0	10.54	9.96	9.42	8.90	8.41	7.95
14.0	10.31	9.75	9.22	8.72	8.24	7.79
15.0	10.08	9.54	9.03	8.54	8.08	7.64
16.0	9.87	9.34	8.84	8.37	7.92	7.50
17.0	9.67	9.15	8.67	8.21	7.77	7.36
18.0	9.47	8.97	8.50	8.05	7.62	7.22
19.0	9.28	8.79	8.33	7.90	7.48	7.09
20.0	9.09	8.62	8.17	7.75	7.35	6.96
21.0	8.92	8.46	8.02	7.61	7.21	6.84
22.0	8.74	8.30	7.87	7.47	7.09	6.72
23.0	8.58	8.14	7.73	7.34	6.96	6.61

R14

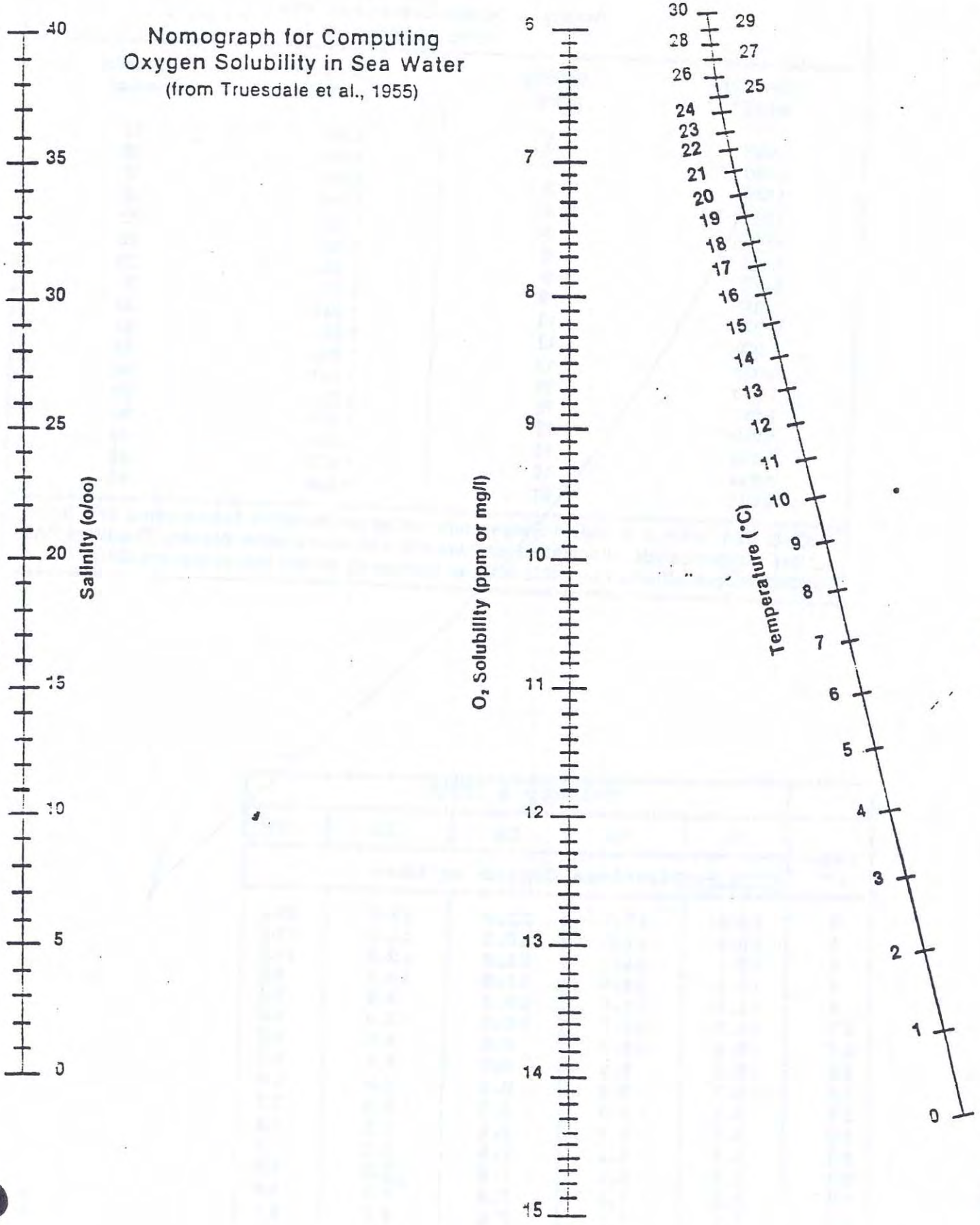
Temp °C	Chlorinity:0 Salinity:0	5.0 ppt 9.0 ppt	10.0 ppt 18.1 ppt	15.0 ppt 27.1 ppt	20.0 ppt 36.1 ppt	25.0 ppt 45.2 ppt
24.0	8.42	7.99	7.59	7.21	6.84	6.50
25.0	8.26	7.85	7.46	7.08	6.72	6.39
26.0	8.11	7.71	7.33	6.96	6.62	6.28
27.0	7.97	7.58	7.20	6.85	6.51	6.18
28.0	7.83	7.44	7.08	6.73	6.40	6.09
29.0	7.69	7.32	6.96	6.62	6.30	5.99
30.0	7.56	7.19	6.85	6.51	6.20	5.90
31.0	7.43	7.07	6.73	6.41	6.10	5.81
32.0	7.31	6.96	6.62	6.31	6.01	5.72
33.0	7.18	6.84	6.52	6.21	5.91	5.63
34.0	7.07	6.73	6.42	6.11	5.82	5.55
35.0	6.95	6.62	6.31	6.02	5.73	5.46
36.0	6.84	3.52	6.22	5.93	5.65	5.38
37.0	6.73	6.42	6.12	5.84	5.56	5.31
38.0	6.62	6.32	6.03	5.75	5.48	5.23
39.0	6.52	6.22	5.98	5.66	5.40	5.15
40.0	6.41	6.12	5.84	5.58	5.32	5.08
41.0	6.31	6.03	5.75	5.49	5.24	5.01
42.0	6.21	5.93	5.67	5.41	5.17	4.93
43.0	6.12	5.84	5.58	5.33	5.09	4.86
44.0	6.02	5.75	5.50	5.25	5.02	4.79
45.0	5.93	5.67	5.41	5.17	4.94	4.72

* This table is provided for your information only. It is **NOT** required when calibrating the Model 85 in accordance with the instructions outlined in the section entitled Calibration.

R15

Nomograph for Computing Oxygen Solubility in Sea Water

(from Truesdale et al., 1955)



R16

AquaChek Total Ammonia, Pond Test Strip

AquaChek, Ammonia Test Strips are used for the detection of total ammonia that is
a sum of dissolved ammonia gas (NH_3) and ammonium ions (NH_4^+) in aquarium and pond water.

Source of Ammonia in the aquatic environment.

Ammonia is formed of bacterial degradation of nitrogen containing compounds such as urea, amino acids, proteins, etc. In addition nitrites and nitrates can be converted to ammonia by bacteria in the process named denitrification.
Ammonia introduced into surface water from communal and industrial effluents, local decomposition of organics in the soil and from fertilizers washed from the soil by heavy rainfall. Even though ammonia concentration in water is low, it can be indicator of unhygienic conditions.
In aquarium and ponds, ammonia is produced by the decomposition of dead plants and fish, non-consumed fish-food and waste excreted by the fish.

Toxic Ammonia Species

An increased level of ammonia is very toxic for living organisms. In nature, the problem of ammonia accumulation often takes place in overcrowded confined conditions.
Ammonia levels of from as low as 0.01 ppm to 0.02 ppm for sustained periods can kill fish. It is therefore a leading cause of ill or dead of fish.
The degree of ammonia toxicity depends on the length of exposure and the type of fish. But in general, containing 0.02-0.03 ppm NH_3 is considered safe, at 0.07-0.1 ppm NH_3 fish stress can be observed. Water containing higher than 0.2 ppm NH_3 lead to the death of fish. If the level is greater than 0.4 ppm NH_3 fish death can occur quite rapidly.
In the aquatic environment, dissolved ammonia gas (NH_3) and ammonium ions (NH4+) exist in a fast equilibrium, rapidly converting from one form to the other:

$$NH_3 + H^+ \rightarrow NH_4^+$$
$$NH_4^+ + OH^- \rightarrow NH_3$$

Dissolved ammonia is much more toxic for fish than ammonium ions. Alkaline water in which the pH is greater than 7.0, favors the formation of the toxic ammonia form. Therefore the water pH plays a critical role in fish health.
Aquarium/pond owners have several options available to them in order to avoid a rise in the dissolved ammonia level. For example, frequent water changes, efficient chemical or biological filtration, water pH adjustment and avoiding overcrowded systems can be used to keep ammonia in check. However, unless one can measure the amount of ammonia, the owner unaware whether or not there is an increased risk of a fish kill by toxic ammonia. For this reason, ammonia has sometimes been referred to as the invisible killer of fish.

R17

Nitrite, Pond Test Strips

Nitrite is one of the inorganic nitrogen compounds in various water types that originate from the decomposition of organic material. It is rather toxic intermediate formed in bacterial decomposition of proteins:

	hydrolysis		*oxidation*		*oxidation*	
proteins	→	**ammonia**	→	**nitrite**	→	**nitrate**

Nitrite Toxicity.

Nitrite causes hemoglobin damage that lead to suppression of oxygen transportation in the blood. Children, particularly babies, exhibit a much higher susceptibility to nitrite toxicity than adults do and isolated fatalities have occurred from excessive nitrite consumption. Nitrite can also form toxic nitrosoamines in living organism that are very strong tumor promoters.
Hemoglobin damage is a well-known cause of toxicity in fish. The nitrite enters the gills and prevents the blood from carrying oxygen.

Recommended Nitrite Levels.

Established balanced aquarium having sufficient plants typically contains less than 0.1 ppm NO_2^-. The nitrite level of a newly set up aquarium may exceed 1-3 ppm NO_2^-. The upper tolerance limit is dependent on the time of exposure and the species of fish.
The nitrite level should be checked regularly as levels of more than 1 ppm may be detrimental to the fish health.

Test principles

AquaCheck Nitrite test is a modification of the Griess reaction. In the presence of an acidic buffer the nitrite diazotizes an aromatic amine to yield a diazonium salt. This product couples with another aromatic amine to produce a red-violet azo dye.

Test Performance and Procedure.

To detect the nitrite level, dip a strip into the sample water for 1 second and remove. Hold the strip level, with pad facing up, for 30 seconds. Compare test pad color with color chart having 6 color blocks that correspond to 0, 0.15, 0.3, 1, 1.5 and 3.0 ppm Nitrite Nitrogen. Test pad color is changed from white to pink with increasing nitrite levels.

R18

Nitrate, Pond Test Strips

AquaChek, Nitrate Test Strips are used for nitrate (NO_3^-) determination in aquarium and pond water.

Nitrate sources in surface/ground water.

Nitrate in surface/ground water originates from the rain water and from the rotting and decay of dead plant and animal organisms. In areas used intensively for farming nitrate from inorganic fertilizers and liquid manure can be washed out of the soil and enter the ground water and then tap water. This process occurs mostly in autumn and spring when rainfall is the highest and high nitrate levels are found in soil after high doses of nitrogen fertilization.

Nitrate level in different water samples.

The Nitrate concentration of natural surface water varies typically between 0.4-0.8 ppm NO_3^-. Non-polluted ground water contains up to 20 ppm NO_3^-. Polluted surface water may contain up to 150 ppm NO_3^-. High nitrate concentration may be indicative of fecal contamination. Increased levels of nitrate can be found in aquarium and pond water if the nitrate level in surface tap water is high.
Nitrate is also produced in aquarium and ponds as an end product in the degradation of dead plants and animals, unconsumed food and fish waste. The nitrate concentration can serve as an index of pollution of aquarium/pond water. The nitrate concentration in aquarium water should not exceed 100 ppm NO_3^-.

Test principles.

The indicator test pad contains a reducing agent that reduces nitrate to nitrite. Subsequently, the nitrite diazotizes an aromatic amine. The product couples with another aromatic amine to produce a red-violet azo dye;

$$NO_3^- + \text{reducing agent} \longrightarrow NO_2^-$$

$$R\text{-}NH_2 + NO_2^- \rightarrow R\text{-}N{=}NH$$

$$R\text{-}N{=}NH + HRNH_2 \rightarrow R\text{-}N{=}N\text{-}R$$

colorless — *Red-violet*

Test Performance and Procedure.

To detect the nitrate level, dip a test strip into the water sample for 1 second and remove. At 60 seconds, compare the test pad color to color chart having 7 color blocks that correspond to 0, 1, 2, 5, 10, 20 and 50 ppm Nitrate Nitrogen. Test pad color is changed from light yellow through rose to red-pink with increasing Nitrate concentration.

R19

Test Principles.

AquaChek, Total Ammonia test strips provide the best way to measure ammonia in aquarium/pond water and to detect a risk of fish kill.

An indicaor pad responds specifically to dissolved (toxic) ammonia gas. The indicator changes color from yellow to dark green, dependent on the ammonia concentration in the range of 0.25 – 6.0 ppm. Sample pretreatment with service pad converts the ionized form of ammonia (NH_4^+) to non-ionized ammonia (NH_3), so tha all ammonia forms can be detected and information about potential toxicity can be obtained.

Test Procedure

For total ammonia detection with AquaChek Ammonia Test Strips, fill the sample vial provided in the kit above the top line with aquarium/pond water. Vigorously move test strip up and down in water sample for 30 seconds, making sure all pads are submerged. Remove test strip and shake off excess water. Wait 30 seconds for color to fully develop. Hold test strip with pads facing away from you, and read small pad through back of plastic strip. Compare pad to color chart having 6 color block at 0, 0.25, 0.5, 1, 3 and 6 ppm Total Ammonia.

R20

WHAT IS TRANSPARENCY?

Pure water naturally reduces the intensity of light as the light travels farther through the water, with higher attenuation at the longer light wavelengths. The lower energy, reddish light suffers the greater natural attenuation. Dissolved chemicals, colloids, and suspended particles in water cause further attenuation by absorbing and reflecting/scattering of the incident light beam. Transparency is the ability of water to transmit light. Any incident light attenuated, reflected/scattered, or absorbed decreases the transparency of the water; thus the "dirtier" the water, the lower the transparency.

HOW IS TRANSPARENCY MEASURED?

Two basic methods are used; one employing incident light and the other depending upon reflected light. The incident light reading is accomplished by an electrical devise that sends a light beam in a single direction, and compares the amount of light emitted to the amount of light transmitted (i.e. received by a photo cell.) If the water contains a high level of contaminants in the form of dissolved chemical, colloids, and suspended solids then less of the incident beam will reach the receiver, because most of the light will be reflected/scattered or absorbed by the foreign materials, thus a low transparency reading.

The other method, which is well known to lake monitors, is the Secchi disk reading. This method relies upon the reflected light of the sun from a disk lowered through the water column. Typically the disk is lowered until it disappears and this depth is averaged with the depth at which it reappears as the disk is raised. This produces a transparency reading.

Another method for quantifying water "cloudiness" is turbidity. Turbidity is measured most commonly with a nephelometer. This device sends an incident light beam in a single direction, and senses the light which is scattered /reflected at a right angle to the incident beam. Particles in the water scatter the light: the more particles; the more scattered the light; and so the higher the turbidity reading. Very clean water scatters very little light, and so has a low turbidity reading. The unit of measurement for a nephelometer is the nephelometric turbidity unit (NTU).

It should be noted that transparency is measured either in line with the incident light beam or at an acute angle as with the Secchi disk. A nephelometer measures at a right angle to the incident light. Because the optical measurement methods are different, the readings of transparency and a nephelometer cannot be directly related. There are no tables that convert NTUs to Transparency for all waters. Monitors can relate NTUs and transparency for a particular water body only by comparing nephelometer readings with transparence readings for a number of samples, throughout the different seasons of the year. And then generate a custom conversion table.

SPECIAL NOTE

Under budget restraints and eagerness to get the job done some have used a hammer to drive a screw. Just because a scale of NTUs is on the side of a tube does not make it a nephelometer nor if the tube is calibrated with formazin standards is it a nephelometer.

WHAT ARE THE APPROPRIATE APPLICATIONS OF A TRANSPARENCY TUBE?

Transparency tubes are most frequently used to document the clarity of running water. Rather than using a conjugation of a verb (good, better, best,) a numeric scale in centimeters is affixed to the tube. Thus the monitor is able to document numerically the transparency results. This follows the typical Secchi disk reading for lake transparency. From these results, correlations can be made to other data collected from the watershed. Watershed data may include: rain fall, soil types, per cent of different land use, delinquent misuse of the land and water (poor development practices, over grazing, improper discharges, etc.)

Lawrence Enterprises Inc. P.O. Box 344 Seal Harbor ME, 04675 www.watermonitoringequip.com

Kestral meter

UNDERSTANDING THE MEASUREMENTS

Wind Speed - average over the previous three seconds. The measurement will be accurate for air flow through the front or rear of the unit.

Maximum Wind Gust - maximum 3 - second wind speed since the unit was turned on.

Average Wind Speed - average wind speed since the unit was turned on.

Temperature - instantaneous temperature of the thermistor, which is located at the end of the long coiled leads in the open cavity below the impeller. The exposed thermistor will respond quickly to changes in temperature when air flows past it. For fastest response, either hold the unit into the wind or wave the unit side to side for 15 seconds. Readings should be taken in the shade. Water and snow temperatures can be taken by hold the unit in the water or snow.

Wind Chill - combination of wind speed and temperature, as defined by the US National Weather Service. Wind chill is the effective temperature on a human or animal at low temperatures due to wind speed. Wind chill readings will be the same as the temperature readings above 45°F or below 3 mph.

Relative Humidity - amount of moisture in the air compared to the amount of moisture the air can hold for the given temperature, represented as a percent. Because relative humidity is also a function of the temperature, the response time will be dependent on the temperature response time (see temperature section above). Readings should be taken in the shade.

Heat Stress – combination of temperature and humidity, as defined by the US National Weather Service. Heat stress is the effective temperature on a human or animal at high temperatures due to humidity. Heat stress readings will be the same as the temperature readings below 70°F.

Dewpoint – calculated based on temperature and humidity measurements, as a measure of moisture content in the air. If the dewpoint is very close to the temperature, the air is humid. If the temperature and dewpoint are the same, dew will form. If this happens below freezing, frost will form.

Why does the Impeller Appear Imbalanced?

It is NORMAL for the impeller to oscillate as it comes to a stop. It is NOT imbalanced. Rather, it contains a very small magnet that responds to the earth's magnetic fields. This does not affect the accuracy of the wind speed readings because the magnetic field applies both a braking and an accelerating force which cancel each other. The impeller has been calibrated to provide wind speed readings accurate to within at least ± 3%.

High Speed Use

After several hours of sustained operation over 25 M/S (~49 KT, 90 KM/H, 56 MPH or 4,923 FPM), the Kestrel will lose some accuracy due to wear of the sapphire bearings in the impeller.

Replacing the Impeller

You may recalibrate the wind speed readings by replacing the impeller. Press FIRMLY on the sides of the black impeller housing with your thumbs to remove the entire assembly. When inserting the new impeller, be sure the arrow is facing the display side of the unit, and is aligned with the top of the meter. Press on the sides of the housing rather than the center.

Replacing the Impeller

Taking Accurate Humidity, Heat Stress and Dewpoint Measurements

The patented system for measuring relative humidity allows for extremely fast and accurate readings. The sensor is located in the large hole on the rear of the unit. Even extreme and abrupt changes in the surrounding humidity will be measured within several minutes. To test this, place your hand around the rear of the unit. Within several seconds, the humidity will

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AIRGUIDE
706 Holly Lane
Mankato, MN 56001
1-800-227-6433

WinDial Wind Speed Reading	Actual Outside Temperature: 35°	30°	25°	20°	15°	10°	5°	0°	−5°	−10°	−15°
	The "Wind Chill Factor" will make the temperature seem to be:										
0	35	30	25	20	15	10	5	0	−5	−10	−15
5 mph	33	27	21	16	12	7	1	−6	−11	−15	−20
10 mph	21	16	9	2	−2	−9	−15	−22	−27	−31	−38
15 mph	16	11	1	−6	−11	−18	−25	−33	−40	−45	−51
20 mph	12	3	−4	−9	−17	−24	−32	−40	−46	−52	−60
25 mph	7	0	−7	−15	−22	−29	−37	−45	−52	−58	−67
30 mph	5	−2	−11	−18	−26	−33	−41	−49	−56	−63	−70
35 mph	3	−4	−13	−20	−27	−35	−43	−52	−60	−67	−72

Temperatures are Fahrenheit scale.

BEAUFORT NUMBER	WEATHER MAP SYMBOL	U.S. WEATHER BUREAU TERM	VELOCITY IN M.P.H.	VELOCITY KNOTS	VELOCITY METERS PER SECOND	SIGNS OF VELOCITY ON LAND	SIGNS OF VELOCITY AT SEA
0		Calm	Less than 1	Less than 1	Less than .4	Smoke rises vertically	Sea like a mirror
1		Light	1-3	1-3	.45-1.3	Smoke drifts, normal weather vane unmoved	Slight ripples
2		-----	4-7	4-6	1.8-3.1	Wind felt on face, weather vane moves	Small wavelets
3		Gentle	8-12	7-10	3.6-5.3	Leaves in motion, light flag extended	Large wavelets, slight crests
4		Moderate	13-18	11-16	5.8-8.0	Dust raised, small branches moved	Small waves, some whitecaps
5		Fresh	19-24	17-21	8.5-10.7	Small trees in leaf sway, crests on water	Moderate waves, many whitecaps
6		Strong	25-31	22-27	11.0-13.8	Larger branches move, overhead wires whistle	Large waves, white foam crests
7		-----	32-38	28-33	14.3-17.0	Whole trees moving, difficulty in walking	Seas heap up, blowing foam
8		-----	39-46	34-40	17.5-20.5	Breaks twigs off trees, harder to walk	Moderately high waves, more foam
9		Gale	47-54	41-47	21.0-24.0	Slight structural damage	High waves, much foam and spray
10		-----	55-63	48-55	24.6-28.0	Trees uprooted, much structural damage	Very high waves, white surface
11		Whole Gale	64-73	56-63	28.6-32.6		Exceptionally high waves, sea all white with foam and spray
12*		Hurricane	74-82	64-71*	33.0-36.6		Air filled with foam and spray, sea all white

*Hurricane forces of higher strength than those shown carry additional Beaufort Numbers according to this schedule: (13) 72-80 Knots; (14) 81-89 Knots; (15) 90-99 Knots; (16) 100-109 Knots; (17) 110-118 Knots. Average speeds in this range are seldom found on land.

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Figure 1. WIND VELOCITY BY VARIOUS SCALES OF MEASURE