Colorado River Watch Network
Water Quality Monitoring

Manual

Ninth Edition

The Colorado River Watch Network
is a program of the Lower Colorado River Authority

List of Emergency Contacts

Always inform your CRWN staff support person if an emergency has occurred.

(Austin local) 473-3200
(Toll-free) 1-800-776-5272

IN CASE OF EMERGENCY
Dial 911

INGESTION OF CHEMICALS

Poison Control Center
1-800-222-1222

TO REPORT A WATER QUALITY CONCERN

LCRA Pollution Hot Line (Toll-free)
1-800-776-5272, Ext. 6843 or;
www.lcra.org/water/pollution_form.html

TO REPORT AN ENVIRONMENTAL EMERGENCY, DISCHARGE, SPILL OR AIR RELEASE, CALL:

Texas Commission on Environmental Quality (TCEQ)
Spill Reporting Hotline 1-800-832-8224

To make an environmental complaint contact TCEQ
at 1-888-777-3186 or cmplant@tceq.state.tx.us

Federal: National Response Center and Terrorist Threats
1-800-424-8802

TO REPORT A FISH OR WILDLIFE KILL

Texas Parks and Wildlife Kills and Spills Team
(512) 389-4848

If you notice a change in your monitoring site or water quality, detected either by using the chemical test or by observation, please call CRWN staff immediately. River Watch staff will contact the appropriate personnel or direct you to the proper authorities.

Table of Contents

Introduction to the Colorado River Watch Network

The Lower Colorado River Authority (LCRA) is charged with protecting the water resources of the Colorado River basin for current and future generations. The Colorado River Watch Network contributes to this goal as an integral part of LCRA's Water Resource Protection branch. The Colorado River Watch Network (CRWN or River Watch) is an environmental education and data collection program consisting of students, teachers, partnering organizations and citizen volunteers who regularly monitor the water quality along the lower Colorado River basin.

The network covers 660 miles of the Texas Colorado River from above the Highland Lakes to the Gulf of Mexico. CRWN volunteers collect water samples from monitoring locations along the Highland Lakes, the Colorado River and numerous contributing tributaries. The data is used by LCRA to supplement its own professional monitoring efforts. In addition to providing valuable water quality information to LCRA staff, CRWN volunteers serve as educated monitors who can recognize potential pollution problems at their monitoring locations.

CRWN's mission is to support community-based environmental stewardship by providing volunteers with the information, resources and training necessary to monitor and protect the waterways of the lower Colorado River watershed.

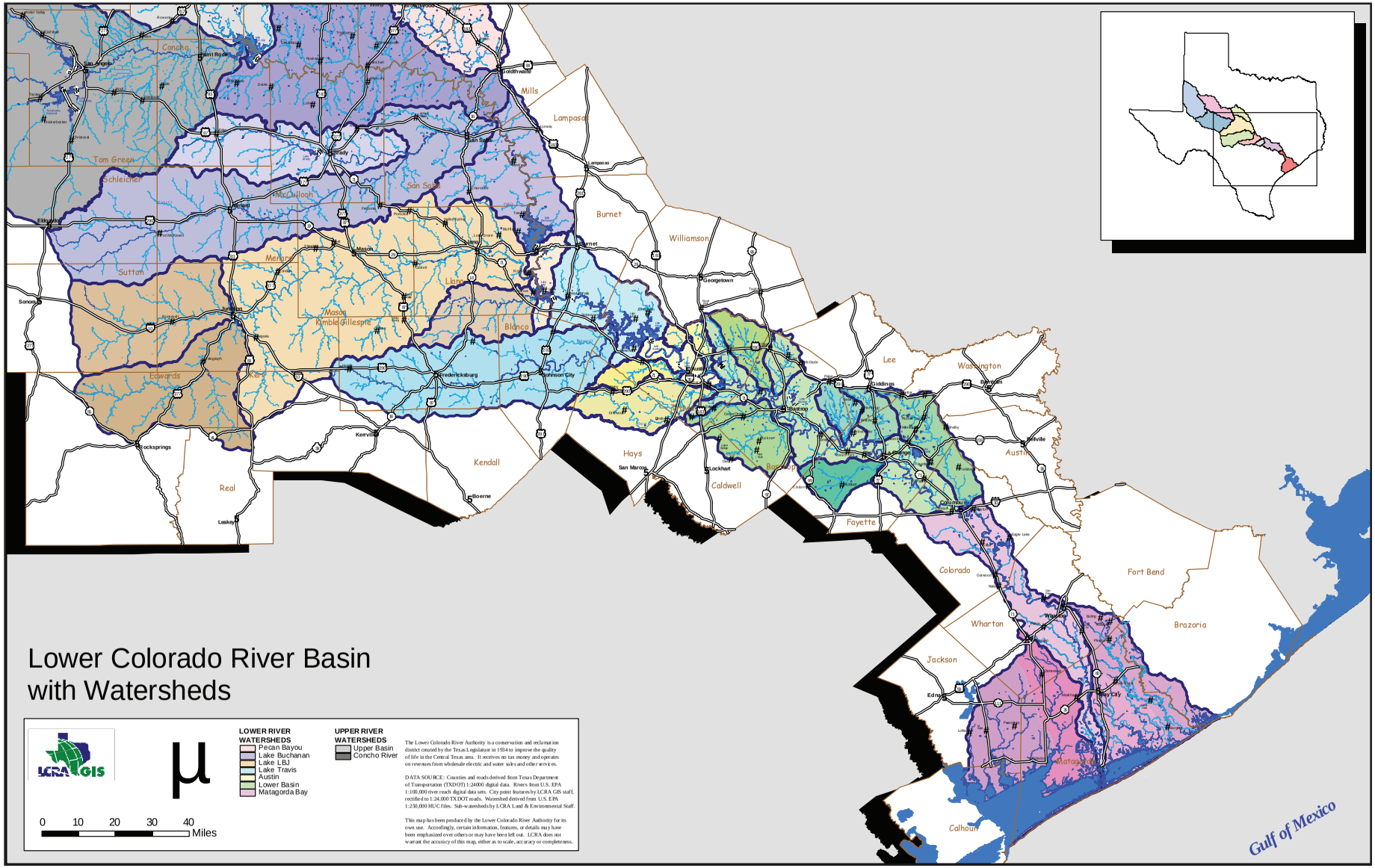
CRWN's goals are:

- Maintain a motivated volunteer monitoring network committed to preserving the integrity of the Colorado River watershed.
- Provide water quality and environmental educational opportunities to the communities in the LCRA service area.
- Complement and assist LCRA with its watershed protection strategies and act as an early warning system alerting LCRA to potential water quality threats.

The program educates CRWN volunteers about the importance of water quality and encourages them to become involved in local environmental issues. River Watch volunteers act as stewards of their waterways while collecting and reporting valuable information. The program is dedicated to the collection of accurate and reliable water quality data. This manual is a guide to proper testing procedures and was designed to supplement a formal training in proper data collection techniques.

For further information, please contact your CRWN staff support person at:

Lower Colorado River Authority
Colorado River Watch Network
P.O. Box 220
Austin, Texas 78767
(512) 473-3200 (local), 1-800-776-5272
http://www.lcra.org/water/quality/crwn


Lower Colorado River Basin
with Watersheds
LCRA GIS
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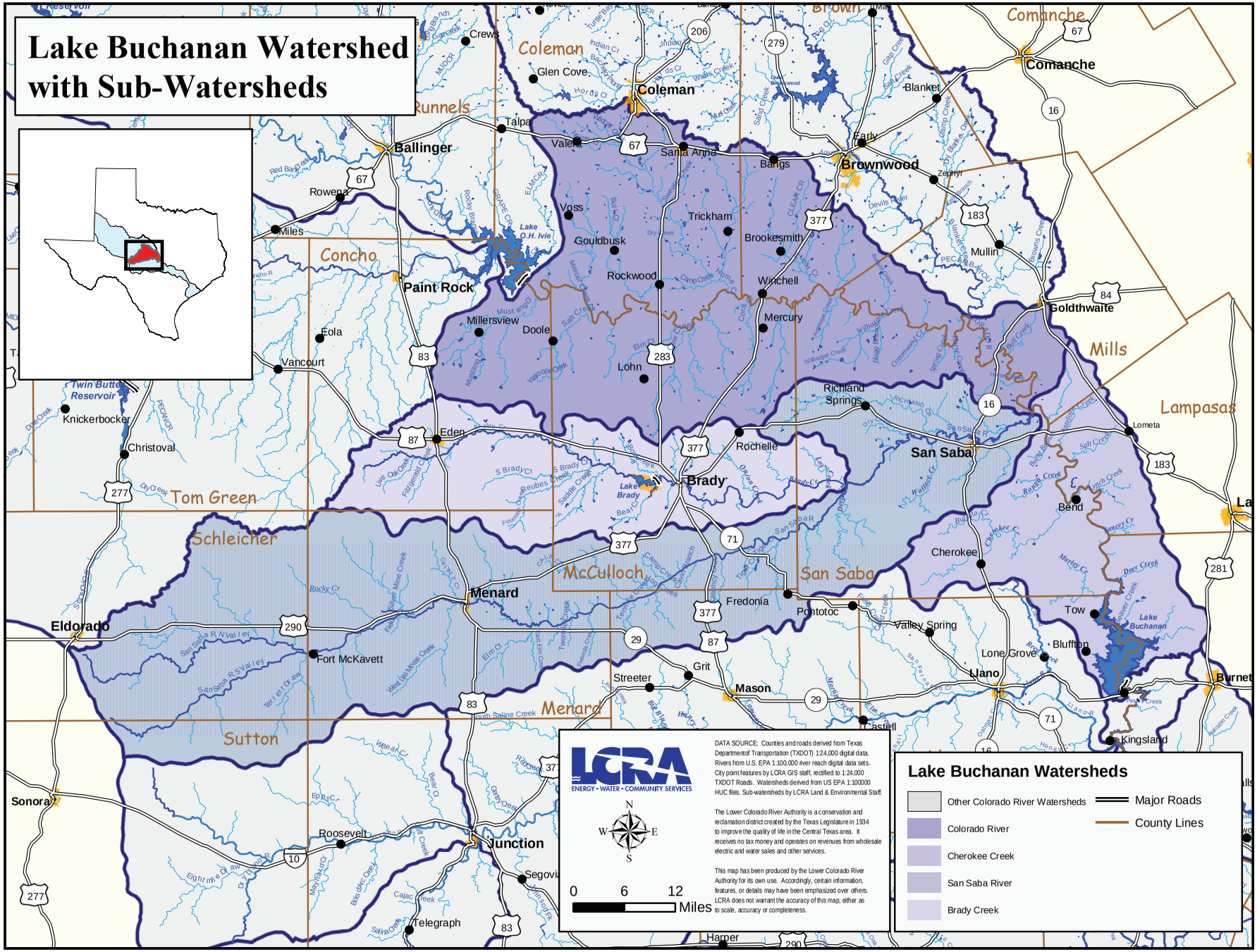
Miles
LOWER RIVER WATERSHEDS
Pecan Bayou
Lake Buchanan
Lake LBJ
Lake Travis
Austin
Lower Basin
Matagorda Bay
UPPER RIVER WATERSHEDS
Upper Basin
Concho River
The Lower Colorado River Authority is a conservation and reclamation district created by the Texas Legislature in 1934 to improve the quality of life in the Central Texas area. It receives no tax money and operates on revenues from wholesale electric and water sales and other services.
DATA SOURCE: Counties and roads derived from Texas Department of Transportation (TXDOT) 1:24000 digital data. Rivers from U.S. EPA 1:100,000 river reach digital data sets. City point features by LCRA GIS staff, rectified to 1:24,000 TXDOT roads. Watershed derived from U.S. EPA 1:250,000 HUC files. Sub-watersheds by LCRA Land & Environmental Staff.
This map has been produced by the Lower Colorado River Authority for its own use. Accordingly, certain information, features, or details may have been emphasized over others or may have been left out. LCRA does not warrant the accuracy of this map, either as to scale, accuracy or completeness.
Concho
Mills
Lampasas
Tom Green
Schleicher
McCulloch
San Saba
Burnet
Williamson
Sutton
Menard
Llano
Mason
Kimble
Gillespie
Blanco
Edwards
Kerr
Lee
Washington
Kendall
Hays
Caldwell
Bastrop
Austin
Fayette
Colorado
Fort Bend
Wharton
Brazoria
Jackson
Real
Calhoun
Gulf of Mexico


Lake Buchanan Watershed with Sub-Watersheds
Coleman
Brown
Comanche
Runnels
Concho
Tom Green
Schleicher
McCulloch
San Saba
Menard
Sutton
Mills
Lampasas
Crews
Glen Cove
Talpa
Ballinger
Rowena
Miles
Paint Rock
Eola
Vancourt
Knickerbocker
Christoval
Twin Buttes Reservoir
Eden
Valera
Santa Anna
Blanket
Early
Brownwood
Bangs
Zephyr
Voss
Trickham
Gouldbusk
Brookesmith
Mullin
Rockwood
Winchell
Goldthwaite
Millersview
Doole
Mercury
Lohn
Richland Springs
Rochelle
San Saba
Brady
Lake Brady
Lake O.H. Ivie
Lometa
Bend
Cherokee
Menard
Fredonia
Pontotoc
Valley Spring
Tow
Lake Buchanan
Eldorado
Fort McKavett
Streeter
Grit
Mason
Lone Grove
Bluffton
Llano
Burnet
Kingsland
Castell
Sonora
Roosevelt
Junction
Segovia
Telegraph
Harper
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ENERGY • WATER • COMMUNITY SERVICES
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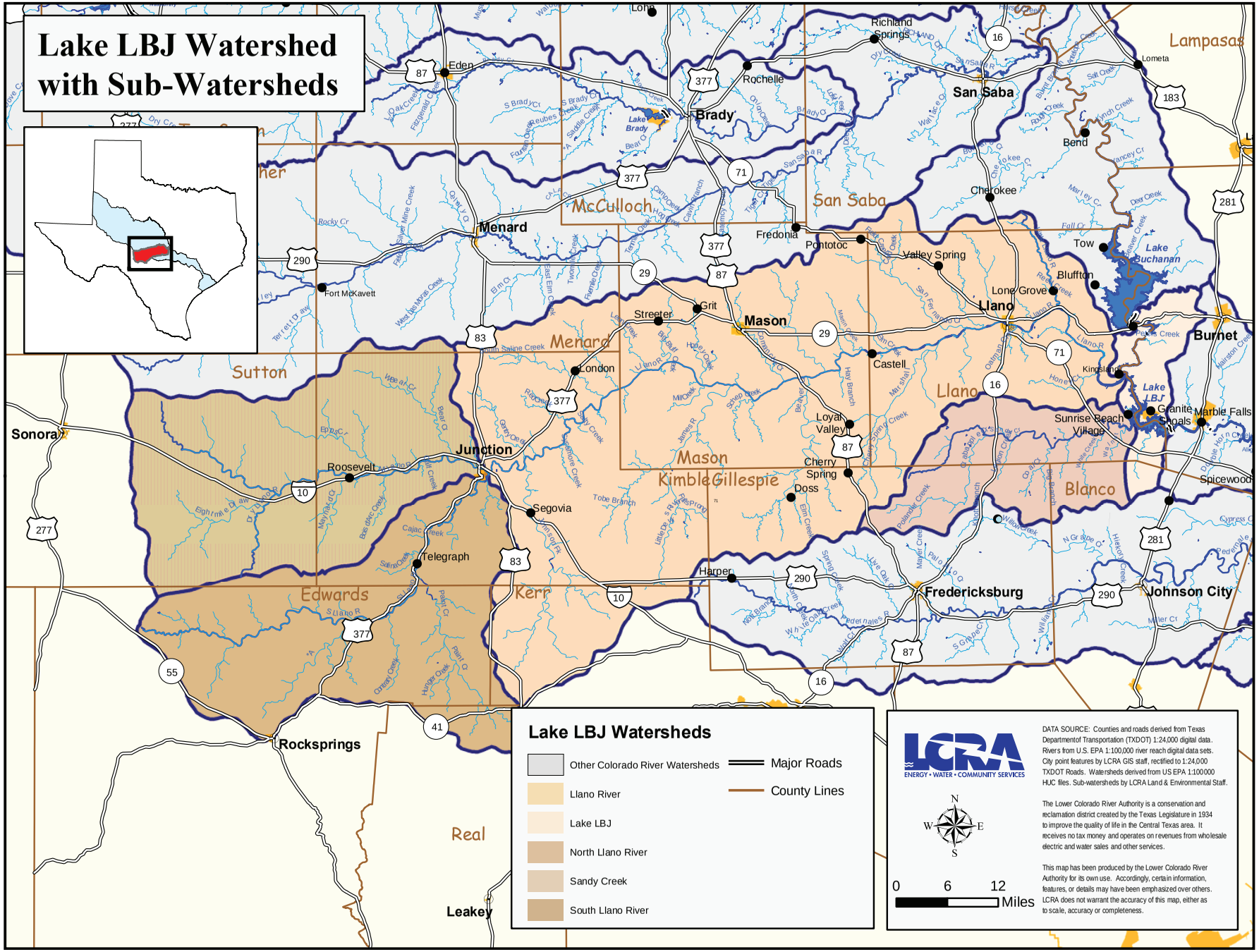
Lake Buchanan Watersheds
Other Colorado River Watersheds
Colorado River
Cherokee Creek
San Saba River
Brady Creek
Major Roads
County Lines


Lake LBJ Watershed with Sub-Watersheds
Lake LBJ Watersheds
Other Colorado River Watersheds
Llano River
Lake LBJ
North Llano River
Sandy Creek
South Llano River
Major Roads
County Lines
LCRA
ENERGY • WATER • COMMUNITY SERVICES
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Miles
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San Saba
McCulloch
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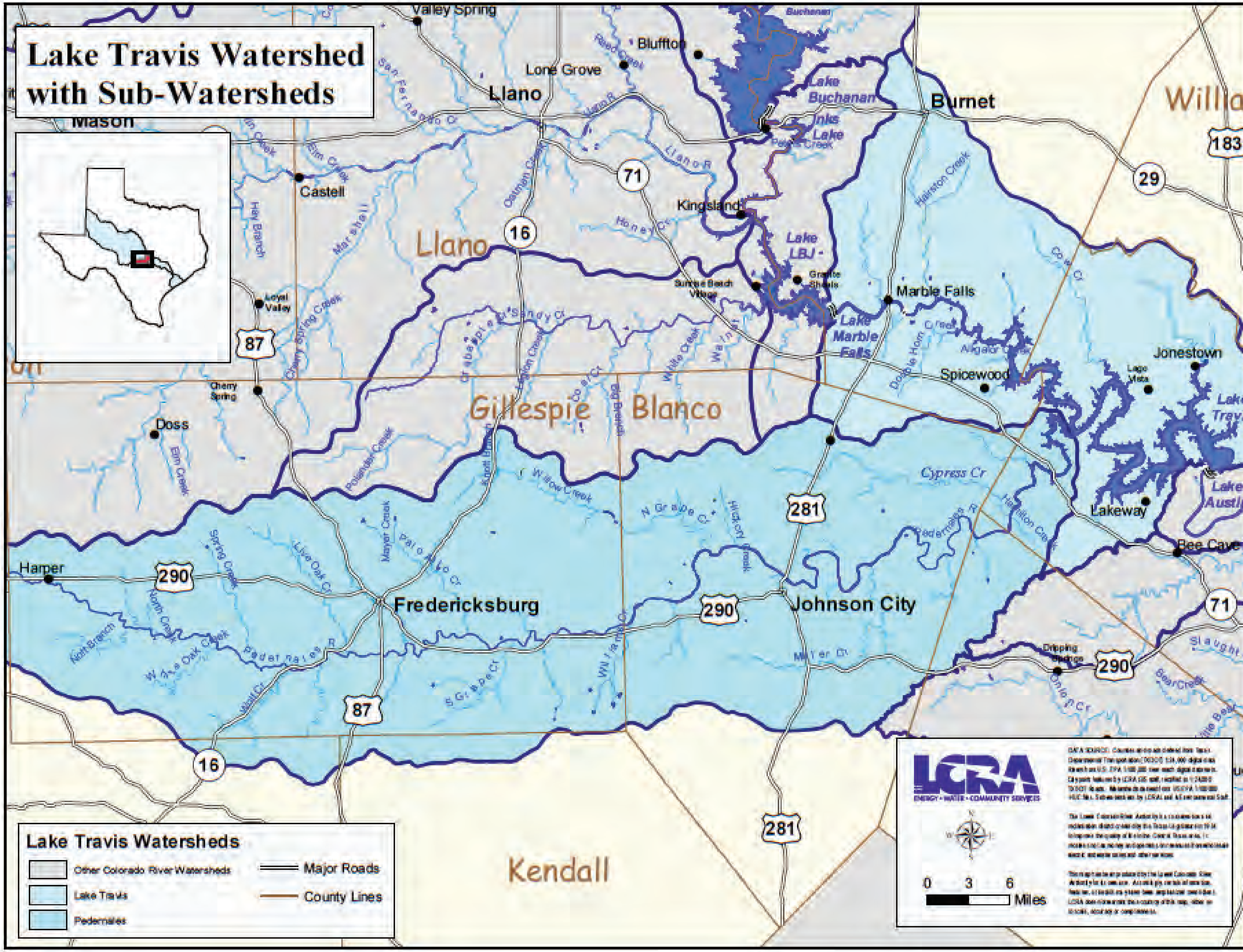
Burnet
Sutton
Edwards
Kerr
Real
Kimble
Gillespie
Blanco
Lometa
Richland Springs
Rochelle
Brady
Eden
Bend
Cherokee
Fredonia
Pontotoc
Valley Spring
Tow
Lake Buchanan
Bluffton
Lone Grove
Fort McKavett
Streeter
Grit
Castell
London
Kingsland
Lake LBJ
Granite Shoals
Marble Falls
Sunrise Beach Village
Loyal Valley
Cherry Spring
Doss
Spicewood
Sonora
Junction
Roosevelt
Segovia
Telegraph
Harper
Fredericksburg
Johnson City
Rocksprings
Leakey


Lake Travis Watershed
with Sub-Watersheds
Mason
Valley Spring
Llano
Lone Grove
Bluffton
Burnet
Castell
Kingsland
Marble Falls
Spicewood
Jonestown
Lago Vista
Lakeway
Bee Cave
Loyal Valley
Cherry Spring
Doss
Harper
Fredericksburg
Johnson City
Dripping Springs
Llano
Gillespie
Blanco
Kendall
Lake Buchanan
Inks Lake
Lake LBJ
Lake Marble Falls
Lake Travis
Lake Austin
Cypress Cr
Hamilton Creek
Pedernales R
Willow Creek
Hickory Creek
Palo Alto Cr
Live Oak Cr
Spring Creek
North Creek
Wolf Creek
Hay Branch
Elm Creek
Lake Travis Watersheds
Other Colorado River Watersheds
Lake Travis
Pedernales
Major Roads
County Lines
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LCRA
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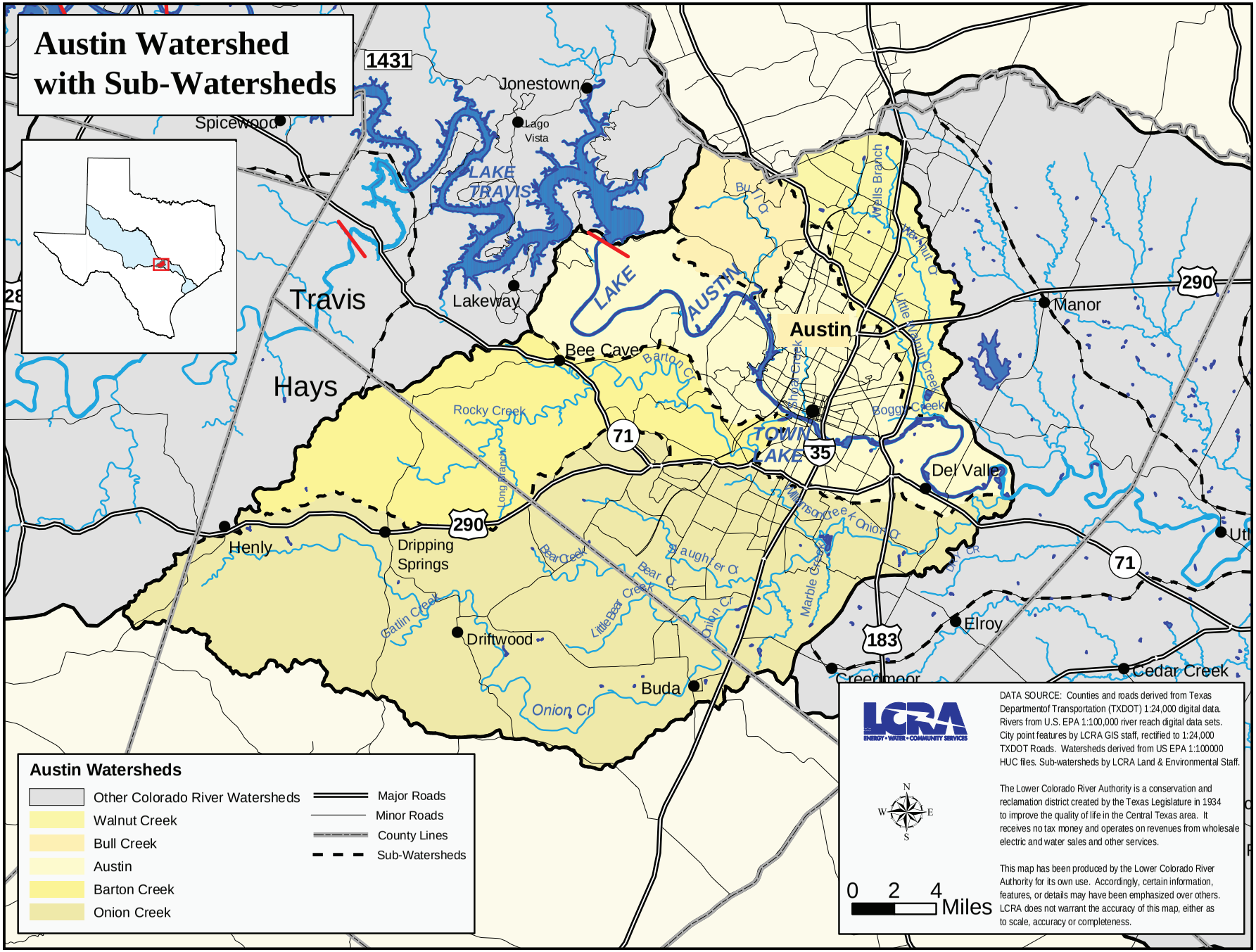
Austin Watershed with Sub-Watersheds
1431
Jonestown
Spicewood
Lago Vista
LAKE TRAVIS
Travis
Lakeway
LAKE AUSTIN
Austin
Manor
290
Bee Cave
Barton Cr
Hays
Rocky Creek
71
TOWN LAKE
35
Del Valle
Henly
290
Dripping Springs
Bear Creek
Bear Cr
Slaughter Cr
Onion Cr
Marble Creek
Elroy
71
183
Driftwood
Buda
Cedar Creek
Creedmoor
Austin Watersheds
Other Colorado River Watersheds
Walnut Creek
Bull Creek
Austin
Barton Creek
Onion Creek
Major Roads
Minor Roads
County Lines
Sub-Watersheds
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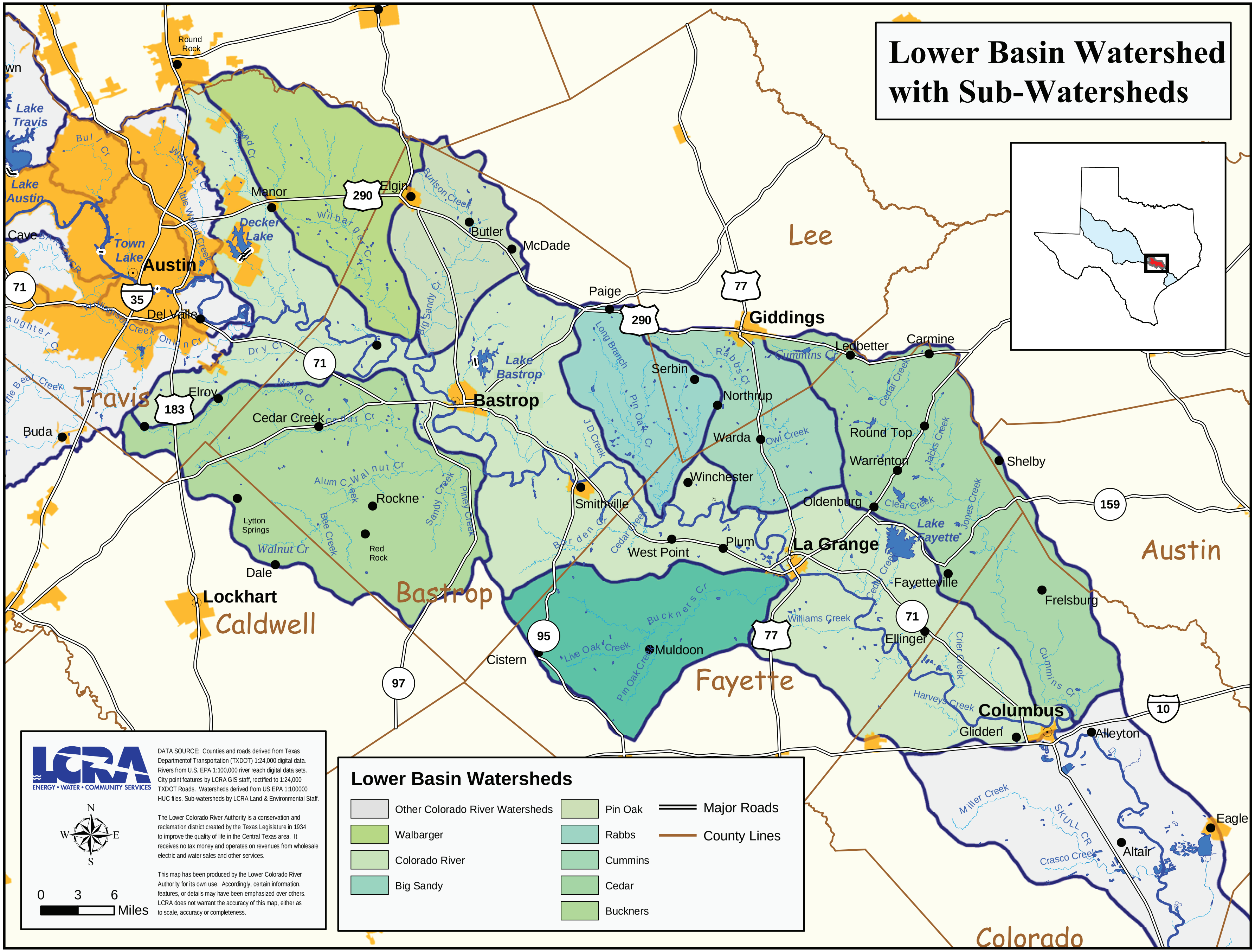
Lower Basin Watershed
with Sub-Watersheds
Lower Basin Watersheds
Other Colorado River Watersheds
Walbarger
Colorado River
Big Sandy
Pin Oak
Rabbs
Cummins
Cedar
Buckners
Major Roads
County Lines
Lee
Austin
Travis
Bastrop
Caldwell
Fayette
Colorado
Austin
Round Rock
Manor
Elgin
Butler
McDade
Paige
Giddings
Ledbetter
Carmine
Serbin
Northrup
Warda
Round Top
Warrenton
Shelby
Winchester
Oldenburg
Bastrop
Smithville
West Point
Plum
La Grange
Fayetteville
Frelsburg
Ellinger
Muldoon
Cistern
Columbus
Glidden
Alleyton
Altair
Eagle
Del Valle
Elroy
Cedar Creek
Buda
Rockne
Red Rock
Lytton Springs
Dale
Lockhart
Lake Travis
Lake Austin
Town Lake
Decker Lake
Lake Bastrop
Lake Fayette
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LCRA
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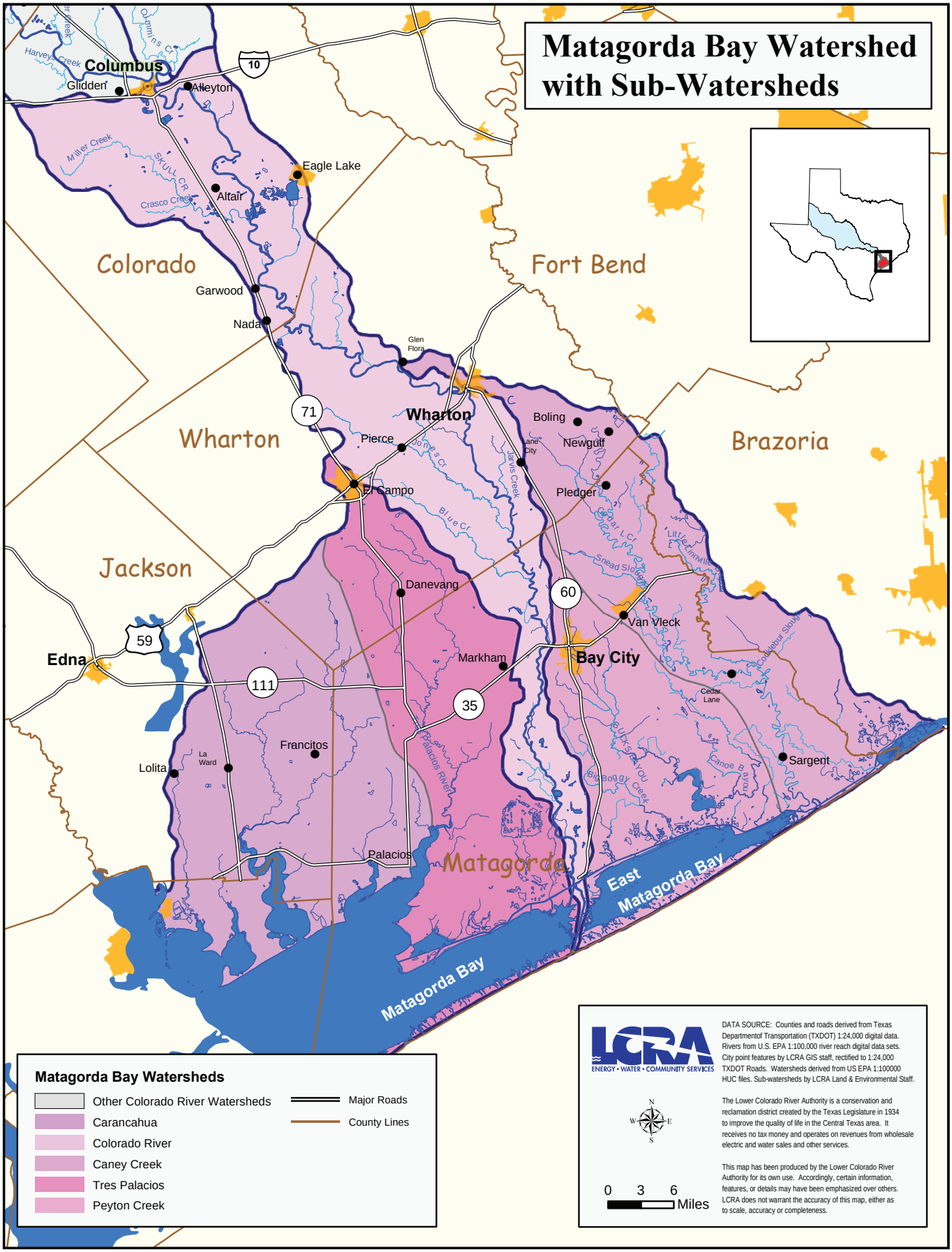
0 3 6 Miles


Matagorda Bay Watershed with Sub-Watersheds
Columbus
Glidden
Alleyton
Eagle Lake
Altair
Colorado
Fort Bend
Garwood
Nada
Glen Flora
Wharton
Pierce
El Campo
Boling
Newgulf
Pledger
Brazoria
Jackson
Danevang
Van Vleck
Edna
Markham
Bay City
Cedar Lane
Francitos
Lolita
La Ward
Sargent
Palacios
Matagorda
East Matagorda Bay
Matagorda Bay
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71
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111
35
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Matagorda Bay Watersheds
Other Colorado River Watersheds
Carancahua
Colorado River
Caney Creek
Tres Palacios
Peyton Creek
Major Roads
County Lines
LCRA
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0 3 6
Miles

Monitoring Basics

Why Monitor?

Reasons for conducting water quality monitoring vary depending on the individual monitor and the chosen site and its primary use. Typical reasons include the desire for the development of baseline data for a site, the ability to document water quality changes over time and the need to screen for potential water quality problems. Added benefits of participating in a water quality monitoring program include a heightened awareness of watershed functions and a commitment to environmental stewardship.

Water Quality Parameters Tested

The Colorado River Watch Network currently monitors four core parameters of water quality. They are dissolved oxygen, temperature, pH and specific conductance. Additional tests conducted at some sites are nitrates, *E. coli* bacteria, salinity, Secchi depth or transparency, watershed and stream surveys and macroinvertebrate assessments. Physical observations are also reported including water color, odor, significant rainfall, and algae abundance.

Using Your Data

The data submitted by monitors is stored in a database from which trend analyses can be generated. Selected monitoring data is used to compile monthly water quality reports for communities. To ensure that your data is of the highest quality, it is important that you follow the procedures in this manual. When working with students be sure to observe their techniques and, if necessary, run duplicates of the tests to ensure both precision and accuracy. See "Data Management" for information about online data entry.

Site Selection

The River Watch program strives to maintain a representative geographical distribution of monitoring locations throughout the lower Colorado River basin. Maintaining a long-term site data record is also a priority. CRWN staff will assist monitors with the selection of their monitoring location. The following are important considerations for site selection:

- How long is the volunteer able to commit to the program? (CRWN requires a two-year commitment)
- Is the site safe and accessible? Does it have public access?
- Is there a specific concern in the area?
- Is there an existing site established at the proposed location or has there been one in the past? (CRWN or other monitoring programs)
- Does the site meet your monitoring goals while providing LCRA with meaningful water quality information?

Monitoring Consistency Requirements

As long as data is submitted regularly, supplies will be refreshed as needed. The monitor agreement requires a two year commitment of once monthly monitoring and data submittal. If extenuating circumstances prevent fulfilling the volunteer commitment, please contact your support staff. If a monitor does not submit data for 3 months, CRWN staff will initiate contact with the monitor. After 6 months or if annual expectations are not met, equipment may be retrieved.

Establish Sampling Frequency

Once the commitment level of the potential monitor has been determined, it is important to establish a sampling protocol. It is necessary to collect water quality information for at least *12 consecutive months* in order to witness the seasonal influence on water quality. CRWN requires each monitoring location to be tested at least *once per month*, preferably at regular intervals. It is important for each monitoring event to occur at approximately the same time of day. Water quality is dynamic and is influenced by changes in multiple factors. It is helpful if a standard collection time can be established.

When collecting a water sample, it is necessary to *follow all instructions* each time a sample is collected. This helps to ensure the collection of reliable and accurate CRWN volunteer data. This includes providing prompt, complete data submittals after each monitoring event.

Monitoring when there is no Flow, in Dry or Rainy Conditions

If there is no flow at a stream site, and accessible, isolated pools remain in the stream bed, collect and report data as normal making sure to comment on the low to no flow condition of the stream. Pools may represent natural low-flow conditions in Texas streams, and the chemistry of these pools will reveal natural background conditions.

Additionally, if your normal monitoring site is dry but there is a pool up or downstream from your usual monitoring location, you may monitor there IF IT IS SAFE and within 1/4 of a mile.

If you are unable to collect other water quality parameters because the stream bed holds no water, submit date, time and the air temperature and indicate flow severity as dry. Samples may be collected immediately after or during a rain event as long as conditions are safe.

Safety and Equipment Management

General Safety Precautions

Nothing is more important to the River Watch than the safety of its participants. Monitors should never put themselves at risk to collect water quality data. Common field hazards include fire ants, bees and wasps, spiders, snakes, poison ivy, steep, rocky or slick banks, and intense sun. Monitoring sites are sometimes located in remote areas, and the River Watch strongly encourages participants to monitor with a partner. If there is any question about the safety of a location, monitors should contact CRWN staff and discuss their concerns before proceeding to monitor.

Try to monitor with at least one partner. Always let someone else know where you are, when you intend to return, and what they should do if you don't come back at the appointed time. If possible, carry a cell phone so you can call for help if you need it.

Have a first aid kit handy. Know any important medical conditions of team members (e.g., heart conditions, diabetes, or allergic reactions to bee stings) and bring along any doctor-prescribed medications that might be needed. It is best if at least one team member has first aid/CPR training.

Listen to weather reports. Never go sampling if severe weather is predicted or if a storm occurs while at the site.

Wear protective clothing. The proper clothing and footwear can help you avoid hazards on both land and in the water. If you are monitoring from a bridge, be sure to wear bright colors that are readily visible to traffic.

If you drive, park in a safe location. Be sure your car doesn't pose a hazard to other drivers and that you don't block traffic.

Put your wallet, keys and cell phone in a safe place, such as a watertight bag you keep in a pouch strapped to your waist. Without proper precautions, wallet, keys and phone might end up downstream.

Be wary of passing traffic if you are sampling from a bridge. Never lean over bridge rails unless you are firmly anchored to the ground or the bridge with good hand and foot holds.

Do not walk on unstable stream banks. Disturbing these banks can accelerate erosion and might prove dangerous if a bank collapses. Disturb streamside vegetation as little as possible.

Be very careful when walking in the stream itself. Rock-bottomed streams can be very slippery and can contain deep pools; muddy-bottomed streams also might prove treacherous in areas where mud, silt or sand has accumulated in sinkholes. If you must cross the stream, use a walking stick to steady yourself and to probe for deep water or muck.

Never wade in swift or high water. Do not monitor if the stream is at flood stage.

Never cross private property without the permission of the landowner. Better yet, sample only at public access points such as bridge or road crossings or public parks.

Watch for irate dogs, farm animals, wildlife (particularly snakes), and insects such as ticks, hornets, fire ants and wasps. Know what to do if you get bitten or stung, especially if you are allergic! Wear boots and light-colored long pants and long-sleeved shirts to minimize your exposure to insects. Spray pant legs and sleeves with insect repellent, if necessary.

Know how to identify poison ivy, poison oak, sumac and other types of vegetation in your area that can cause rashes and irritation.

Never drink the water in a stream. Assume it is unsafe to drink, and bring your own water from home.

Do not monitor if the stream appears to be severely polluted or is posted against body-contact recreation. Take a picture of the problem, and contact your city, county or state department of environmental quality. (See contacts listed on inside cover.)

Keep all equipment and chemicals away from small children. Tape the phone number of the local poison control center to your sampling kit.

Avoid contact between chemical reagents and skin, eye, nose and mouth. Wear protective gloves and goggles when performing the tests and handling wastes. Follow the procedure for donning and doffing gloves found on following page. Never use your fingers to stopper a sample bottle (e.g., when you are shaking a solution). Leave petri dish lids on when examining bacteria colonies. Dispose of gloves after use. Never reuse gloves! Wash your hands with antibacterial soap when sampling, testing and clean up is completed.

Read Material Safety Data Sheets (MSDS). As a precaution, read these informative sheets found at the end of this section before using chemicals. Be familiar with the hazardous chemicals in the kits.

Have water and paper towels available for cleansing and disposal. Wipe up any chemical spills as soon as they occur.

Be familiar with the proper chemical disposal techniques (See Proper Waste Disposal on page 4 of this section.)

Remember: If at any time you feel uncomfortable about the condition of the stream or your surroundings, stop monitoring and leave the site at once. Your safety is more important than the data!

Glove Donning and Doffing Procedure

1. After donning gloves, roll a short section back to create a cuff.

2. When doffing gloves, grasp cuff of glove with thumb and finger and pull. Do not contact skin with contaminated gloves.

3. Pull glove, but do not completely remove.

4. With glove that is partially removed repeat steps 2 and 3 on other gloved hand.

5. Completely remove gloves. Contaminated portion of glove is now inside and non contaminated area is on the outside.

Note: All used gloves should be considered contaminated and not reused.

Protecting Your Equipment and Reagents

Keep Equipment Clean

Thoroughly rinse test tubes, vials and bottles after each test with distilled water. Use a bottle brush for test tubes. If the pH comparator and nitrate tests are included in your tests, label 1 test tube for pH and one for NO_3. Carefully follow the cleaning procedures included with each protocol. Remove debris and used materials from kit after each use.

Close All Containers

After use, tightly close all chemical containers. Do not switch the caps (this can contaminate the reagents). It may help to label the reagent caps to prevent confusion.

Avoid Extreme Temperatures

Do not expose chemicals to direct sunlight for long periods of time. Do not leave kits in the car. Protect all supplies from extreme temperatures by storing at room temperature.

Watch Expiration Dates

Expiration dates are marked on chemical reagents, calibration solutions and Coliscan Easygel™. Please become familiar with these dates and indicate with your data submittal a month or two before the expiration date that you need replacement reagents or solutions. If you find you have expired reagents, monitor and make that notation on your data sheet.

Proper Waste Disposal

Dissolved Oxygen, Calibration Standard Solutions, pH and LaMotte Nitrates: When running these tests, consolidate the waste into a single, clearly marked container with a lid. After completing the tests, the waste can be rinsed down a municipal waste system drain with plenty of water (a dilution of about five parts tap water to one part waste is advised to neutralize the acidic nature of the waste). This is not a hazardous waste, but one should take precautions when handling the liquid due to the caustic nature of the reagents. **Monitors should NOT pour waste solutions on the ground or into the stream.** River Watch advises participants NOT to empty waste into a septic system, as the chemicals may interfere with the biological decomposition processes.

CHEMets Nitrate test disposal: If you conduct this optional test, mixing the waste products from the DO test with the CHEMets nitrate test may create gas products with an unpleasant odor and/or could potentially chemically react. CHEMets waste should be poured into a separate labelled waste bottle to be collected by CRWN staff at the annual site visit. Do not pour bottle contents down the drain. Thoroughly wrap glass ampoule in paper towel and place in a sealed plastic bag to discard in trash.

E. coli bacteria:
Used Coliscan Easygel™ containers and; pipettes may be recycled, and Whirl Pak™ bags can be directly disposed of in any trash receptacle. Any used petri dishes with bacteria colonies should be disinfected with alcohol or bleach then sealed in plastic bags and placed in a trash bin.

ALWAYS WASH HANDS THOROUGHLY AFTER SAMPLING, CONDUCTING THE CHEMICAL TESTS AND HANDLING PROCESSED PETRI DISHES.

MATERIAL SAFETY DATA SHEET

LaMOTTE COMPANY
PO BOX 329 - CHESTERTOWN - MARYLAND - 21620
TELEPHONE # FOR INFORMATION 410-778-3100

24 Hour Emergency Number (CHEM-TEL) 800-255-3924

1. PRODUCT IDENTIFICATION

Alkaline Potassium Iodide Azide *Code Nr.* **7166**

2. HAZARDOUS INGREDIENTS

NAME	CAS #	TSCA #	%	PEL	TLV
Potassium Hydroxide	1310-58-3		60 - 70	C 2 mg/cubic m	C 2 mg/cubic m
• Sodium Azide	26628-22-8		<1	C 0.1 ppm (skin) as HN3	C 0.3 mg/cubic m as NaN3
Potassium Iodide	7681-11-0		14	N/E	N/E

3. NON-HAZARDOUS INGREDIENTS EXCEPT WATER (7732-18-5)

NAME	CAS #	%
Water to 100%		

4. PHYSICAL DATA

Appearance: Clear Colorless Liquid

Solubility in Water: Soluble	*Odor:* None	*Boiling Point:* Unknown	*Melt. Point:* N/A
Vapor Pressure: Unknown	*Vapor Density:* Unknown	*pH:* 14	

5. FIRE AND EXPLOSION DATA

Flash Point (method used) N/A | *Flammable Limit: LEL:* N/A | *UEL:* N/A

Extinguishing Media: Not a fire hazard

HMIS Hazard: Health - 3 *Flammability -* 0 *Reactivity -* 2 *Scale: 4 = Extreme, 3 = High, 2 = Moderate, 1 = Slight, 0 = Least*

Special Fire Fighting Procedures:
Wear self contained breathing apparatus and protective clothing to prevent inhalation and contact with eyes.

Unusual Fire & Explosion Hazard:
Violent exothermic reaction occurs with water.May produce enough heat to ignite combustibles. Can react with metals to produce hydrogen, forming explosive mix with air.

6. REACTIVITY DATA

Stability: ☒ *Stable* ☐ *Unstable*

Conditions to avoid: Heat

Incompatibility (Materials to avoid):
Strong acids, metals

Hazardous Decomposition Products: Hydrogen gas

7. HEALTH HAZARD DATA

Toxicity: orl rat LD50: 365 mg/kg for potassium hydroxide; 27 mg/kg for sodium azide solid

Primary Route of Entry: ☐ *Inhalation* ☒ *Skin* ☐ *Ingestion* ☐ *N/A*

Carcinogenicity: ☒ *None* ☐ *NTP* ☐ *OSHA* ☐ *IARC*

Other Health Related Comments:

Target Organs: Corrosive to all body parts, Eyes, Skin,

Signs and symptoms of exposure:
Severe burns, may be fatal if swallowed

Medical Condition Aggravated by Exposure: N/A

8. EMERGENCY FIRST AID PROCEDURES

Eye Contact: Immediately flush with water for 15 minutes. Get medical attention immediately.

Ingestion: Do not induce vomiting. Rinse out mouth, drink plenty of water and call a doctor immediately.

Inhalation:
Remove to fresh air.

Skin Contact:
Immediately flush with water while removing affected clothing and rinse skin thoroughly for 15 minutes. Consult physician.

9. SPILL AND DISPOSAL PROCEDURES

Spill and Leak:
Neutralize by carefully and slowly adding dilute hydrochloric acid (conc. 6M or less) to pH 7. Collect waste liquid. Dispose of as follows:

Disposal:
Small amt.<25 mL -Flush neutralized waste to drain with water. Large amt.-Sodium azide can react with metal--such as copper pipes--to form shock or friction sensitive metal azides (explosive). Dispose of larger amts. as hazardous waste, according to federal, state and local regulations.

10. PRECAUTIONARY MEASURES

In Handling: ☒ *Gloves* ☒ *Eye Protection* ☐ *N/A* ☒ *Other:* Lab Coat

Ventilation ☒ *Normal* ☐ *Mechanical* ☐ *Respiratory Protection*

Work/Hygienic Practices: Avoid contact with skin and clothing.

11. SPECIAL PRECAUTIONS

Store away from incompatible items (acids, metals).

DATE: 3/1/02

The above information is believed to be correct but does not claim to be all inclusive and should be used only as a guide.

• This is a toxic chemical subject to reporting requirements of section 313 of EPCRA and 40CFR372.

Material Safety Data Sheet

OSHA "Hazard Communication" (29 DFR 1910.1200)

Section I-Manufacturer and Product

Product Name: Coliscan Easygel

Product Number: 25001

Micrology Laboratories, LLC.
1303 Eisenhower Dr. S
Goshen, IN 46526 USA
Phone 574-533-3351

Section II-Hazardous Ingredients

This product contains no hazardous ingredients as defined by the OSHA Hazaard Communication Standard.

Section III-Physical Data

Boiling point:	N/D	Color and appearance:	Tan liquid
Vapor pressure:	N/D	Specific gravity:	N/D
Vapor density:	N/D	% Volatile by volume:	N/A
Evaporation rate:	N/D	Solubility in water:	N/A
pH:	7.4 $\pm$ 0.2	Viscosity:	N/D

Section IV-Fire and Explosion Hazard Data

Flash point:	N/A	Flammable limits-LEL:	N/A
Extinguishing media:	Waterspray	Flammable limits-UEL:	N/A

Special Fire Fighting Procedures or Unusual Fire and Explosion Hazards:

Wear full protective clothing, including helmet, self-contained, poisitive pressure or pressure demand breathing apparatus, bunker coat and pants, bands around arms, wasit and legs, face mask, and protective covering for exposed areas of the head. Use water to keep fire-exposed containers cool.

Section V-Health Hazard Data

This product contains no hazardous ingredients as defined by the OSHA Hazaard Communication Standard. However, in the event of a spill or accident involving this material, good personal hygiene should be practiced.

Section VI-Reactivity Data

Stability:	Stable	Conditions to avoid:	N/D
Incompatability:	N/D	Hazardous polymerization:	Will not occur

Section VII-Spill or Leak Procedures

Spill:	Wipe up and dispose of with normal lab trash.
Waste disposal:	Sterilize where appropriate. Incinerate or dispose in landfill.

Section VIII-Suggested First Aid

Eye contact:	Flush with water, consult physician.
Skin contact:	No need for first aid is anticipated.
Inhalation:	N/A
If swallowed:	No need for first aid is anticipated.

Section IX-Special Protection Information

Respiratory protection:	Not required under normal product usage.
Ventilation:	Not required under normal product usage.
Protective gloves:	Not required under normal product usage.
Eye protection:	Safety glasses or face shield during preparaton of media.
Other protective equipment:	Not required under normal product usage.

Section X-Special Precautions/Comments

Recommended storage:	Freeze
Date of preparation:	8 March 2007

Abbreviations: N/D = Not Determined N/A = Not Applicable

The information on this data sheet is believed to be accurate. Any use of this product which does not comply with the recommendations of this data sheet or which involves using the producat in combination with any other product or any other process is the responsibility of the user.

MATERIAL SAFETY DATA SHEET

LaMOTTE COMPANY
PO BOX 329 - CHESTERTOWN - MARYLAND - 21620
TELEPHONE # FOR INFORMATION 410-778-3100

24 Hour Emergency Number (CHEM-TEL) 800-255-3924

1. PRODUCT IDENTIFICATION

Manganous Sulfate Solution *Code Nr.* **4167**

2. HAZARDOUS INGREDIENTS

NAME	CAS #	TSCA #	%	PEL	TLV
Manganese Sulfate monohydrate	10034-96-5	7785-87-7	36	5 mg/cubic m as Mn	C 5 mg/cubic m as Mn

3. NON-HAZARDOUS INGREDIENTS EXCEPT WATER (7732-18-5)

NAME	CAS #	%
Water to 100%		

4. PHYSICAL DATA

Appearance: Clear Pink Liquid

Solubility in Water: Soluble	*Odor:* None	*Boiling Point:* Unknown	*Melt. Point:* N/A
Vapor Pressure: <17 @ 20 deg C	*Vapor Density:* <1 (Air=1)	*pH:* 3	

5. FIRE AND EXPLOSION DATA

Flash Point (method used) N/A | *Flammable Limit: LEL:* N/A | *UEL:* N/A

Extinguishing Media: Not a fire hazard

HMIS Hazard: Health - 1 *Flammability -* 0 *Reactivity -* 0 *Scale: 4 = Extreme, 3 = High, 2 = Moderate, 1 = Slight, 0 = Least*

Special Fire Fighting Procedures:
N/A

Unusual Fire & Explosion Hazard:
N/A

6. REACTIVITY DATA

Stability:
☒ *Stable*
☐ *Unstable*

Conditions to avoid: N/A

Incompatibility (Materials to avoid):
N/A

Hazardous Decomposition Products: N/A

7. HEALTH HAZARD DATA

Toxicity: Unknown

Primary Route of Entry: ☐ *Inhalation* ☒ *Skin* ☒ *Ingestion* ☐ *N/A*

Carcinogenicity: ☒ *None* ☐ *NTP* ☐ *OSHA* ☐ *IARC*

Other Health Related Comments:
Manganese investigated as a tumorigen, mutagen, reproductive effector.

Target Organs: N/A

Signs and symptoms of exposure:
May irritate eyes and skin. Harmful if swallowed.

Medical Condition Aggravated by Exposure: N/A

8. EMERGENCY FIRST AID PROCEDURES

Eye Contact: Immediately flush with water for 15 minutes. Consult a physician.

Ingestion: Induce vomiting immediately. Consult a physician.

Inhalation:
N/A

Skin Contact:
Flush thoroughly with water. Remove affected clothing and wash skin with soap and water. Consult physician.

9. SPILL AND DISPOSAL PROCEDURES

Spill and Leak:
Mop up carefully and hold for disposal.

Disposal:
Small quantity: Flush down drain with excess water. Large quantity: Containerize and dispose of as hazardous waste according to federal, state and local regulations.

10. PRECAUTIONARY MEASURES

In Handling: ☒ *Gloves* ☒ *Eye Protection* ☐ *N/A* ☒ *Other:* Lab Coat

Ventilation ☒ *Normal* ☐ *Mechanical* ☐ *Respiratory Protection*

Work/Hygienic Practices: Wash after handling.

11. SPECIAL PRECAUTIONS

N/A

DATE: 3/1/02

The above information is believed to be correct but does not claim to be all inclusive and should be used only as a guide.

- This is a toxic chemical subject to reporting requirements of section 313 of EPCRA and 40CFR372.

CHEMetrics, Inc.
4295 Catlett Rd., Calverton, VA 20138
(800) 356-3072 (540) 788-9026
Fax (540) 788-4856 E-mail technical@chemetrics.com

After Hours Emergency Nos.: **(703) 447-9550**
(540) 272-3874
Creation Date: **10/07/05 (2913-6)**
Revision Date: **05/20/10**

MATERIAL SAFETY DATA SHEET

I.I. CHEMICAL IDENTIFICATION

TRADE NAME: NITRATE CHEMets® REFILL, Vacu-vials® AMPOULES and ZINC FOIL PACKS

CATALOG NOS.: R-6905 and K-6913 (ampoules and foil packs)

DESCRIPTION: Reagent ampoules and zinc foil packs for the determination of nitrate in water. (Note: Complete kits contain reagent ampoules, foil packs, and Acidifier Solution, Catalog No. A-6901. See A-6901 MSDS also.)
Each CHEMet™ ampoule contains approximately 0.5 mL of liquid reagent sealed under vacuum. Each Vacu-vial™ ampoule contains approximately 2 mL of liquid reagent sealed under vacuum. Each foil pack contains approximately 1.5 grams of solid reagent.

In the Ampoule:
NFPA RATINGS: HEALTH: 1 FLAMMABILITY: 0 REACTIVITY: 0

In the Foil Pack:
NFPA RATINGS: HEALTH: 1 FLAMMABILITY: 0 REACTIVITY: 0

II. COMPOSITION / INFORMATION ON INGREDIENTS

In the Ampoule:
COMPONENT: Cyclohexanediamine Tetraacetic Acid, Disodium Magnesium Salt
CAS NO.: 63451-33-2 PERCENT: < 0.5

COMPONENT: 2,5-Dihydroxybenzoic Acid
CAS NO.: 490-79-9 PERCENT: < 2.0

COMPONENT: 4,5-Dihydroxynaphthalene-2,7-disulfonic acid
CAS NO.: 5808-22-0 PERCENT: < 2.0

COMPONENT: Sulfanilic Acid Sodium Salt, Hydrate
CAS NO.: 123333-70-0 PERCENT: < 4.0

COMPONENT: Isopropyl Alcohol
CAS NO.: 67-63-0 PERCENT: 5.0

COMPONENT: Ethylene Glycol
CAS NO.: 107-21-1 PERCENT: < 18.0

COMPONENT: Deionized Water
CAS NO.: 7732-18-5 PERCENT: > 67.5

COMPONENT: Other components[1]
CAS NO.: N/A PERCENT: < 1.0

In the Foil Pack:
COMPONENT: Silica Gel
CAS NO.: 112926-00-8 PERCENT: < 11.0

COMPONENT: Sodium Citrate
CAS NO.: 68-04-2 PERCENT: 27.0

COMPONENT: Zinc Metal, Granular
CAS NO.: 7440-66-6 PERCENT: < 62.0

COMPONENT: Other components[1]
CAS NO.: N/A PERCENT: < 1.0

[1]Any component of this mixture not specifically listed (e.g. "other components") is not considered to present a carcinogen hazard.

III. HAZARDS IDENTIFICATION

ACUTE TOXICITY: irritation, cough, vomiting, abdominal pain
CHRONIC TOXICITY: Irritation, bronchitis
MEDICAL CONDITIONS AGGRAVATED BY EXPOSURE: Eye, skin, and respiratory disorders

IV. FIRST AID MEASURES

EYE AND SKIN CONTACT: Immediately flush eyes and skin with water for 15 minutes.
INGESTION: Do not induce vomiting. If victim is conscious and alert, give 2-4 cupfuls of water. Never give anything by mouth to an unconscious person. Seek medical advice.
INHALATION: Remove to fresh air. If necessary, give artificial respiration by mechanical means, do not use mouth to mouth resuscitation, seek medical advice.

V. FIRE FIGHTING MEASURES

FLASH POINT: N/A AUTOIGNITION POINT: N/A
FLAMMABILITY LIMITS: UPPER: N/A LOWER: N/A
EXTINGUISHING MEDIA: Dry chemical, carbon dioxide or alcohol foam

VI. ACCIDENTAL RELEASE MEASURES

Take up with absorbent material. Place in small containers for disposal.

VII. HANDLING AND STORAGE

Always wear eye protection when working with these ampoules.
WARNING: Do not break the tip of the ampoule unless it is completely immersed in your sample. Breaking the tip in the air may cause the glass ampoule to shatter.
If this product is used as directed, the user will not come in contact with or be exposed to any of its chemical components.
Wash thoroughly after handling. Avoid contact with eyes.
Fragile. Liquid in glass. Handle with care.
Exposure of this product to temperatures up to 120°F (49°C) or even below 32°F (0°C) will not create a safety hazard. For optimum analytical accuracy, the product should be stored in the dark at room temperature, and product components should not be used beyond expiration date.

VIII. EXPOSURE CONTROLS / PERSONAL PROTECTION

OSHA PEL: 400 ppm TWA isopropyl alcohol
ACGIH TLV: 100 mg/m^3 C ethylene glycol, 200 ppm TWA isopropyl alcohol
PROTECTIVE EQUIPMENT: Impact- and splash-resistant eyewear; Protective gloves compatible with the hazardous reagent constituents identified on this MSDS.

IX. PHYSICAL AND CHEMICAL PROPERTIES

In the Ampoule:
STATE: Liquid APPEARANCE: Colorless to brown tint ODOR: None
SOLUBILITY IN WATER: Miscible pH: 3.5 SPECIFIC GRAVITY: 1.02
BOILING POINT: 125°C MELTING POINT: -2°C
VAPOR PRESSURE: N/A VAPOR DENSITY: N/A

In the Foil Pack:
STATE: Solid APPEARANCE: Gray, granular powder ODOR: None
SOLUBILITY IN WATER: Miscible VAPOR PRESSURE / DENSITY: N/A
BOILING POINT: N/A MELTING POINT: N/A

X. STABILITY AND REACTIVITY

INCOMPATIBILITIES: Strong oxidants, strong bases, flames, sparks
HAZARDOUS DECOMPOSITION PRODUCTS: Toxic and/or flammable gases, oxides of carbon, nitrogen, sulfur, and zinc. Stable under normal conditions.

XI. TOXICOLOGICAL INFORMATION

CARCINOGENIC STATUS: Ethylene glycol: ACGIH - Group A4, not classifiable as a human carcinogen. Isopropyl alcohol: IARC - Group 3, not classifiable as to its carcinogenicity to humans. No other data available at this time.

XII. ECOLOGICAL INFORMATION

Ethylene glycol biodegrades rapidly, may leach to ground water, and is not expected to bioconcentrate. Isopropyl alcohol is not expected to adsorb to sediment or to bioconcentrate, but is dangerous to aquatic life in high concentration. No other data available at this time.

XIII. DISPOSAL CONSIDERATIONS

Dispose of in a manner consistent with Federal, State, and Local Regulations.

XIV. TRANSPORT INFORMATION

CHEMets® Refill: Not regulated.
CHEMets® and Vacu-vials® Kits contain Acidifier Solution, Catalog No. A-6901 in addition to ampoules and foil packs. See A-6901 MSDS for Transport Information.

XV. REGULATORY INFORMATION

EUROPEAN INFORMATION:
EU Symbols: None
Risk Phrases: None
Safety Phrases: In case of accident or if you feel unwell, seek medical advice immediately (show the label where possible).

CANADIAN INFORMATION:
WHMIS Classification: D2A, D2B
All chemical components of this product are listed on Canada's DSL or are exempt.

U.S. INFORMATION:
OSHA: This product meets the criteria for a hazardous substance as defined in the Hazard Communication Standard (29 CFR 1910.1200).
SARA Section 313: This product contains isopropyl alcohol and ethylene glycol which are subject to the reporting requirements of Section 313 of SARA Title III.
All chemical components of this product are listed on the TSCA Inventory.

XVI. OTHER INFORMATION

THE ABOVE INFORMATION IS BELIEVED TO BE ACCURATE AND REPRESENTS THE BEST INFORMATION CURRENTLY AVAILABLE TO US. ALL PRODUCTS ARE OFFERED IN ACCORDANCE WITH THE MANUFACTURER'S CURRENT PRODUCTION SPECIFICATIONS AND ARE INTENDED SOLELY FOR USE IN ANALYTICAL TESTING. THE MANUFACTURER SHALL IN NO EVENT BE LIABLE FOR ANY INJURY, LOSS OR DAMAGE RESULTING FROM THE HANDLING, USE OR MISUSE OF THESE PRODUCTS.

CHEMetrics, Inc.
4295 Catlett Rd., Calverton, VA 20138
(800) 356-3072 (540) 788-9026
Fax (540) 788-4856 E-mail technical@chemetrics.com

After Hours Emergency Nos.: **(703) 447-9550**
(540) 272-3874
Creation Date: **12/23/09 (2989-1)**
Revision Date:

MATERIAL SAFETY DATA SHEET

I. CHEMICAL IDENTIFICATION

TRADE NAME: NITRATE ACIDIFIER SOLUTION

CATALOG NO.: A-6901

DESCRIPTION: An accessory solution used in conjunction with reagent ampoules in the determination of nitrate in water. Each bottle contains approximately 18 mL of accessory solution.

NFPA RATINGS: HEALTH: 3 FLAMMABILITY: 0 REACTIVITY: 1

II. COMPOSITION/INFORMATION ON INGREDIENTS

COMPONENT: Hydrochloric Acid, Concentrated
CAS NO.: 7647-01-0 PERCENT: < 69.0

COMPONENT: Deionized Water
CAS NO.: 7732-18-5 PERCENT: > 31.0

III. HAZARDS IDENTIFICATION

Corrosive. Causes burns.
ACUTE TOXICITY: Irritation, burns, labored breathing, pain, vomiting, permanent eye injury, cough, delayed lung edema
CHRONIC TOXICITY: Irritation, tooth erosion, bronchitis, dermatitis
MEDICAL CONDITIONS AGGRAVATED BY EXPOSURE: Eye, skin, and respiratory disorders

IV. FIRST AID MEASURES

EYE AND SKIN CONTACT: Immediately flush eyes and skin with water for 15 minutes.
INGESTION: Do not induce vomiting. If victim is conscious and alert, give 2-4 cupfuls of milk or water. Never give anything by mouth to an unconscious person. Seek medical attention.
INHALATION: Remove to fresh air. If necessary, give artificial respiration by mechanical means, do not use mouth to mouth resuscitation, seek medical advice.

V. FIRE FIGHTING MEASURES

FLASH POINT: N/A AUTOIGNITION POINT: N/A
FLAMMABILITY LIMITS: UPPER: N/A LOWER: N/A
EXTINGUISHING MEDIA: Dry chemical, carbon dioxide, water spray or foam

VI. ACCIDENTAL RELEASE MEASURES

Take up with absorbent material. Place in small containers for disposal. Ventilate spill area.

VII. HANDLING AND STORAGE

If this product is used as directed, the user will not come in contact with or be exposed to any of its chemical components.
Wash thoroughly after handling. Avoid contact with eyes.
Exposure of this product to temperatures up to 120°F (49°C) or even below 32°F (0°C) will not create a safety hazard. For optimum analytical accuracy, the product should be stored in the dark and at room temperature, and if applicable, should not be used beyond expiration date.

VIII. EXPOSURE CONTROLS/PERSONAL PROTECTION

OSHA PEL: 5 ppm C Hydrochloric acid
ACGIH TLV: 2 ppm C Hydrochloric acid
PROTECTIVE EQUIPMENT: Impact- and splash-resistant eyewear; Protective gloves compatible with the hazardous reagent constituents identified on this MSDS.

IX. PHYSICAL AND CHEMICAL PROPERTIES

STATE: Liquid APPEARANCE: Colorless ODOR: Pungent
SOLUBILITY IN WATER: Complete pH: 0.1
BOILING POINT: 100°C MELTING POINT: 0°C
VAPOR PRESSURE: N/A SPECIFIC GRAVITY: 1.1
VAPOR DENSITY: N/A

X. STABILITY AND REACTIVITY

INCOMPATIBILITIES: Bases, strong oxidizers, metals, reducing agents
HAZARDOUS DECOMPOSITION PRODUCTS: hydrogen chloride, chlorine and hydrogen gas
Stable under normal conditions.

XI. TOXICOLOGICAL INFORMATION

CARCINOGENIC STATUS: Hydrochloric acid: IARC - Group 3, not classifiable as to its carcinogenicity to humans
No other data available at this time.

XII. ECOLOGICAL INFORMATION

Hydrochloric acid hydrolyzes when exposed to water, will neutralize soil carbonate-based components, and evaporates from soil.
No other data available at this time.

XIII. DISPOSAL CONSIDERATIONS

Dispose of in a manner consistent with Federal, State, and Local Regulations.

XIV. TRANSPORT INFORMATION

U.S. DOT, IATA, and IMDG: Dangerous Goods in Excepted Quantities
Hazard Class: 8 UN No.: 1760 Packing Group: II

XV. REGULATORY INFORMATION

EUROPEAN INFORMATION:
EU Symbols: C - CORROSIVE
Risk Phrases: Causes burns. Irritating to respiratory system.
Safety Phrases: In case of contact with eyes or skin, rinse immediately with plenty of water and seek medical advice. Wear suitable protective clothing, gloves, and eye/face protection. In case of accident or if you feel unwell, seek medical advice immediately (show the label where possible).

CANADIAN INFORMATION:
WHMIS Classification: D1A, E
All chemical components of this product are listed on Canada's DSL.

U.S. INFORMATION:
RCRA: Contains RCRA regulated substances. EPA Waste ID No.: D002
OSHA: This product meets the criteria for a hazardous substance as defined in the Hazard Communication Standard (29 CFR 1910.1200).
All chemical components of this product are listed on the TSCA Inventory.

XVI. OTHER INFORMATION

MATERIAL SAFETY DATA SHEET
LaMOTTE COMPANY
PO BOX 329 - CHESTERTOWN - MARYLAND - 21620
TELEPHONE # FOR INFORMATION 410-778-3100
24 Hour Emergency Number (CHEM-TEL) 800-255-3924

1. PRODUCT IDENTIFICATION

Nitrate #1 Tablet *Code Nr.* **2799**

2. HAZARDOUS INGREDIENTS

NAME	*CAS #*	*TSCA #*	*%*	*PEL*	*TLV*
Sulfamic Acid	5329-14-6		6	N/E	N/E
All other ingredients are proprietary, NJTSRN 80100291-5011p					

3. NON-HAZARDOUS INGREDIENTS EXCEPT WATER (7732-18-5)

NAME	*CAS #*	*%*
All other ingredients are proprietary, NJTSRN 80100291-5011p		

4. PHYSICAL DATA

Appearance: Small White Tablet
Solubility in Water: Soluble | *Odor:* None | *Boiling Point:* N/A | *Melt. Point:* Unknown
Vapor Pressure: N/A | *Vapor Density:* N/A | *pH:* 2 (1 tablet in 10mL water)

5. FIRE AND EXPLOSION DATA

Flash Point (method used) N/A | *Flammable Limit: LEL:* N/A | *UEL:* N/A
Extinguishing Media: Not a fire hazard
HMIS Hazard:Health - 1 *Flammability -* 0 *Reactivity -* 0 *Scale: 4 = Extreme, 3 = High, 2 = Moderate, 1 = Slight, 0 = Least*
Special Fire Fighting Procedures:
N/A
Unusual Fire & Explosion Hazard:
N/A

6. REACTIVITY DATA

Stability: ☒ *Stable* ☐ *Unstable*
Conditions to avoid: Moisture
Incompatibility (Materials to avoid):
N/A
Hazardous Decomposition Products: SOx

7. HEALTH HAZARD DATA

Toxicity: Unknown
Primary Route of Entry: ☐ *Inhalation* ☒ *Inaestion* ☒ *Skin* ☐ *N/ A*
Carcinogenicity: ☒ *None* ☐ *OSHA* ☐ *NTP* ☐ *IARC*
Other Health Related Comments:
Target Organs: N/A
Signs and symptoms of exposure:
May be irritating to skin. May be harmful if swallowed.
Medical Condition Aggravated by Exposure: N/A

8. EMERGENCY FIRST AID PROCEDURES

Eye Contact: Flush with water for 15 minutes. Consult physician.
Ingestion: Drink plenty of water. Consult physician.
Inhalation:
Remove to fresh air.
Skin Contact:
Flush skin thoroughly with water. Wash with soap and water.

9. SPILL AND DISPOSAL PROCEDURES

Spill and Leak:
Sweep up and dissolve in water. Wash down drain with excess water.
Disposal:
Dispose according to federal, state and local regulations.

10. PRECAUTIONARY MEASURES

In Handling: ☐ *Gloves* ☒ *Eve Protection* ☐ *N / A* ☒ *Other:* Lab Coat
Ventilation ☒ *Normal* ☐ *Mechanical* ☐ *Respiratory Protection*
Work/Hygienic Practices: Avoid handling tablets.

11. SPECIAL PRECAUTIONS

N/A

DATE: 2/9/99 The above information is believed to be correct but does not claim to be all inclusive and should be used only as a g

† This is a toxic chemical subject to reporting requirements of section 313 of EPCRA and 40CFR372.

MATERIAL SAFETY DATA SHEET

LaMOTTE COMPANY
PO BOX 329 - CHESTERTOWN - MARYLAND - 21620
TELEPHONE # FOR INFORMATION 410-778-3100
24 Hour Emergency Number (CHEM-TEL) 800-255-3924

1. PRODUCT IDENTIFICATION

Nitrate CTA Testabs *Code Nr.* **3703**

2. HAZARDOUS INGREDIENTS

NAME	*CAS #*	*TSCA #*	*%*	*PEL*	*TLV*
†Zinc Dust	7440-66-6		1	N/E	10 mg/cubic m
All other ingredients are proprietary, NJTSRN 80100291-5067p					

3. NON-HAZARDOUS INGREDIENTS EXCEPT WATER (7732-18-5)

NAME	*CAS #*	*%*
All other ingredients are proprietary NJTSRN 80100291-5067p		

4. PHYSICAL DATA

Appearance: Small Gray Tablet

Solubility in Water: Soluble	*Odor:* None	*Boiling Point:* Unknown	*Melt. Point:* Unknown
Vapor Pressure: N/A	*Vapor Density:* N/A	*pH:* 3 (1 tablet in 5mL water)	

5. FIRE AND EXPLOSION DATA

Flash Point (method used) N/A | *Flammable Limit: LEL:* N/A | *UEL:* N/A

Extinguishing Media: Not a fire hazard

HMIS Hazard:Health - 1 *Flammability -* 0 *Reactivity -* 0 *Scale: 4 = Extreme, 3 = High, 2 = Moderate, 1 = Slight, 0 = Leas*

Special Fire Fighting Procedures:
N/A

Unusual Fire & Explosion Hazard:
N/A

6. REACTIVITY DATA

Stability: ☒ *Stable* ☐ *Unstable*

Conditions to avoid: Heat, moisture

Incompatibility (Materials to avoid):
Contact with nitric acid or other strong oxidizers

Hazardous Decomposition Products: COx, NOx, SOx

7. HEALTH HAZARD DATA

Toxicity: Unknown

Primary Route of Entry: ☐ *Inhalation* ☒ *Inaestion* ☐ *Skin* ☐ *N/ A*

Carcinogenicity: ☒ *None* ☐ *OSHA* ☐ *NTP* ☐ *IARC*

Other Health Related Comments:

Target Organs: N/A

Signs and symptoms of exposure:
May be harmful if swallowed.

Medical Condition Aggravated by Exposure: N/A

8. EMERGENCY FIRST AID PROCEDURES

Eye Contact: Flush with water for 15 minutes. Consult a physician.

Ingestion: Induce vomiting. Give plenty of water. Consult a physician.

Inhalation:
N/A

Skin Contact:
Flush with water. Wash with soap and water.

9. SPILL AND DISPOSAL PROCEDURES

Spill and Leak:
Sweep up, dissolve in water. Wash down drain with excess water.

Disposal:
Dissolve in water. Wash down drain with excess water. Dispose according to federal, state and local regulations.

10. PRECAUTIONARY MEASURES

In Handling: ☒ *Gloves* ☒ *Eve Protection* ☐ *N / A* ☒ *Other:* Lab Coat

Ventilation ☒ *Normal* ☐ *Mechanical* ☐ *Respiratory Protection*

Work/Hygienic Practices: Avoid handling tablets.

11. SPECIAL PRECAUTIONS

Store cool, dry, away from heat & moisture

DATE: 7/15/99

The above information is believed to be correct but does not claim to be all inclusive and should be used only as a guide.

† This is a toxic chemical subject to reporting requirements of section 313 of EPCRA and 40CFR372.

RICCA CHEMICAL COMPANY

MSDS

For RICCA, SpectroPure, Red Bird, and Solutions Plus Brands
Emergency Contact(24 hr) -- CHEMTREC®
Domestic: 800-424-9300
International: 703-527-3887

BUFFER, REFERENCE STANDARD, pH 7.00; BUFFER, PRECISION REFERENCE STANDARD pH 7.000 (Color Coded Yellow)

Material Safety Data Sheet

Section 1: Chemical Product and Company Identification

Catalog Number:

1551, 1552, B-285, B017740, R1551300, S1551, SB017740

Product Identity:
BUFFER, REFERENCE STANDARD, pH 7.00; BUFFER, PRECISION REFERENCE STANDARD pH 7.000 (Color Coded Yellow)

Manufacturer's Name: RICCA CHEMICAL COMPANY LLC	**Emergency Contact(24 hr) --** CHEMTREC® Domestic: 800-424-9300 International: 703-527-3887
CAGE Code: 4TCW6, 0V553, 4XZQ2	
Address: 448 West Fork Dr Arlington, TX 76012	**Telephone Number For Information:** 817-461-5601
Date Prepared: 6/16/98	**Revision:** 7 Last Revised: 01/13/2006 Date Printed: 02/11/2008 3:44:23 pm

Section 2. Composition/Information on Ingredients

Component	CAS Registry #	Concentration	ACGIH TLV	OSHA PEL
Sodium Phosphate, Dibasic	7558-79-4	< 1	Not Available Not Available	Not Available Not Available
Water, Deionized	7732-18-5	Balance	Not Available Not Available	Not Available Not Available
Potassium Phosphate, Monobasic	7778-77-0	< 1	Not Available Not Available	Not Available Not Available
Inert Dye	proprietary	< 0.1	Not Available Not Available	Not Available Not Available
Preservative (No Mercury compounds or Formaldehyde)	pROPRIETARY	< 0.1	Not Available Not Available	Not Available Not Available

Section 3: Hazard Identification

Emergency Overview: Non-flammable, non-toxic, non-corrosive. Does not present any significant health hazards. May cause irritation. Wash areas of contact with water

Target Organs: eyes, skin

Eye Contact: May cause slight irritation.

Inhalation: May cause allergic respiratory reaction to those allergic to phosphates.

Material Safety Data Sheet
Sodium chloride

ACC# 21105

Section 1 - Chemical Product and Company Identification

MSDS Name: Sodium chloride
Catalog Numbers: AC207790000, AC207790010, AC207790050, AC327300000, AC327300010, AC424290000, AC424290010, AC424290030, AC424290250, AC424295000, S71988, S71989, S719891, S75209, S78446, S78449, S784491, S93361, S93362, BP358-1, BP358-10, BP358-212, NC9242252, NC9269808, NC9378584, NC9383755, NC93880133, NC9780594, NC9821620, NC9826699, NC9919051, NC9974906, S271-1, S271-10, S271-10LC, S271-3, S271-350LB, S271-50, S271-500, S271-50LC, S2711LC, S271J500, S640-10, S640-10LC, S640-3, S640-350LB, S640-50, S640-500, S640SAM1, S640SAM2, S640SAM3, S641-212, S641-350LB, S641-500, S641P350LB, S641P350LLC, S642-12, S642-212, S642-350LB, S642-500, S64212LC, S642350LBLC, S642SAM1, S642SAM2, S642SAM3, S671-10, S671-3, S671-500, XXS271150KG, XXS2714.5KG, XXS271ET3KG, XXS271PD250L, XXS271PD3150KG, XXS271PP412KG, XXS640PD100KG, XXS640PD50KG
Synonyms: Common salt; Halite; Rock salt; Saline; Salt; Sea salt; Table salt.
Company Identification:

Fisher Scientific
1 Reagent Lane
Fair Lawn, NJ 07410

For information, call: 201-796-7100
Emergency Number: 201-796-7100
For CHEMTREC assistance, call: 800-424-9300
For International CHEMTREC assistance, call: 703-527-3887

Section 2 - Composition, Information on Ingredients

CAS#	Chemical Name	Percent	EINECS/ELINCS
7647-14-5	Sodium chloride	>99	231-598-3

Section 3 - Hazards Identification

EMERGENCY OVERVIEW

Appearance: colorless or white solid.
Warning! Causes eye irritation. May cause skin and respiratory tract irritation.
Target Organs: No data found.

Potential Health Effects

Eye: Causes eye irritation.
Skin: May cause skin irritation.
Ingestion: Ingestion of large amounts may cause gastrointestinal irritation. Ingestion of large amounts may cause nausea and vomiting, rigidity or convulsions. Continued exposure can produce coma, dehydration, and internal organ
Inhalation: May cause respiratory tract irritation.

MATERIAL SAFETY DATA SHEET

LaMOTTE COMPANY
PO BOX 329 - CHESTERTOWN - MARYLAND - 21620
TELEPHONE # FOR INFORMATION 410-778-3100

24 Hour Emergency Number (CHEM-TEL) 800-255-3924

1. PRODUCT IDENTIFICATION

Sodium Thiosulfate, .025 N *Code Nr.* **4169**

2. HAZARDOUS INGREDIENTS

NAME	CAS #	TSCA #	%	PEL	TLV
Sodium Hydroxide	1310-73-2		<0.1	N/E	N/E

3. NON-HAZARDOUS INGREDIENTS EXCEPT WATER (7732-18-5)

NAME	CAS #	%
Sodium Thiosulfate, 5-hydrate	10102-17-7	<1
Water to 100%		

4. PHYSICAL DATA

Appearance: Clear Colorless Liquid

Solubility in Water: Soluble	*Odor:* None	*Boiling Point:* ca. 100 degC	*Melt. Point:* Unknown
Vapor Pressure: <17 @ 20 deg C	*Vapor Density:* <1 (Air=1)	*pH:* 12	

5. FIRE AND EXPLOSION DATA

Flash Point (method used) N/A | *Flammable Limit: LEL:* N/A | *UEL:* N/A

Extinguishing Media: Not a fire hazard

HMIS Hazard: Health - 1 *Flammability -* 0 *Reactivity -* 0 *Scale: 4 = Extreme, 3 = High, 2 = Moderate, 1 = Slight, 0 = Least*

Special Fire Fighting Procedures:
N/A

Unusual Fire & Explosion Hazard:
N/A

6. REACTIVITY DATA

Stability:
☒ *Stable*
☐ *Unstable*

Conditions to avoid: Heat, light

Incompatibility (Materials to avoid):
N/A

Hazardous Decomposition Products: N/A

7. HEALTH HAZARD DATA

Toxicity: Non-toxic

Primary Route of Entry: ☐ *Inhalation* ☒ *Skin* ☒ *Ingestion* ☐ *N/A*

Carcinogenicity: ☒ *None* ☐ *NTP* ☐ *OSHA* ☐ *IARC*

Other Health Related Comments:

Target Organs: N/A

Signs and symptoms of exposure:
Large doses by mouth can cause GI irritation. May cause skin irritation.

Medical Condition Aggravated by Exposure: N/A

8. EMERGENCY FIRST AID PROCEDURES

Eye Contact: Flush with water for 15 minutes.

Ingestion: Drink plenty of water. Consult a physician.

Inhalation:
N/A

Skin Contact:
Flush with water. Wash with soap and water.

9. SPILL AND DISPOSAL PROCEDURES

Spill and Leak:
Neutralize with vinegar or other dilute acid and mop up.

Disposal:
Neutralize with dilute acid and wash down drain with excess water.

10. PRECAUTIONARY MEASURES

In Handling: ☒ *Gloves* ☒ *Eye Protection* ☐ *N/A* ☐ *Other:*

Ventilation ☒ *Normal* ☐ *Mechanical* ☐ *Respiratory Protection*

Work/Hygienic Practices: Avoid contact with eyes or skin.

11. SPECIAL PRECAUTIONS

Store away from heat and light.

DATE: 3/1/02

The above information is believed to be correct but does not claim to be all inclusive and should be used only as a guide.

- This is a toxic chemical subject to reporting requirements of section 313 of EPCRA and 40CFR372.

MATERIAL SAFETY DATA SHEET

LaMOTTE COMPANY
PO BOX 329 - CHESTERTOWN - MARYLAND - 21620
TELEPHONE # FOR INFORMATION 410-778-3100
24 Hour Emergency Number (CHEM-TEL) 800-255-3924

1. PRODUCT IDENTIFICATION

Starch Indicator Solution *Code Nr.* **4170**

2. HAZARDOUS INGREDIENTS

NAME	*CAS #*	*TSCA #*	*%*	*PEL*	*TLV*
Salicylic Acid	69-72-7		0.13	N/E	N/E

3. NON-HAZARDOUS INGREDIENTS EXCEPT WATER (7732-18-5)

NAME	*CAS #*	*%*
Soluble Starch	9005-84-9	0.5
Water to 100%		

4. PHYSICAL DATA

Appearance: Colorless Liquid

Solubility in Water: Soluble | *Odor:* None | *Boiling Point:* ca. 100 degC | *Melt. Point:* Unknown

Vapor Pressure: <17 @ 20 deg C | *Vapor Density:* <1(Air=1) | *pH:* 3

5. FIRE AND EXPLOSION DATA

Flash Point (method used) N/A | *Flammable Limit: LEL:* N/A | *UEL:* N/A

Extinguishing Media: Not a fire hazard

HMIS Hazard:Health - 1 *Flammability -* 0 *Reactivity -* 0 *Scale: 4 = Extreme, 3 = High, 2 = Moderate, 1 = Slight, 0 = Leas*

Special Fire Fighting Procedures:
N/A

Unusual Fire & Explosion Hazard:
N/A

6. REACTIVITY DATA

Stability: ☒ *Stable* ☐ *Unstable*

Conditions to avoid: Heat, light

Incompatibility (Materials to avoid):
N/A

Hazardous Decomposition Products: N/A

7. HEALTH HAZARD DATA

Toxicity: orl rat LD50: 891 mg/kg for salicylic acid solid

Primary Route of Entry: ☐ *Inhalation* ☒ *Inaestion* ☐ *Skin* ☐ *N/ A*

Carcinogenicity: ☒ *None* ☐ *OSHA* ☐ *NTP* ☐ *IARC*

Other Health Related Comments:
Salicylic acid investigated as a possible mutagen.

Target Organs: N/A

Signs and symptoms of exposure:
May be harmful if swallowed.

Medical Condition Aggravated by Exposure: N/A

8. EMERGENCY FIRST AID PROCEDURES

Eye Contact: Flush with water.

Ingestion: Drink water or milk. Consult physician.

Inhalation:
N/A

Skin Contact:
Flush with water.

9. SPILL AND DISPOSAL PROCEDURES

Spill and Leak:
Mop up. Flush down drain.

Disposal:
Flush down drain with excess water. Dispose according to federal, state and local regulations.

10. PRECAUTIONARY MEASURES

In Handling: ☐ *Gloves* ☒ *Eve Protection* ☐ *N / A* ☐ *Other:*

Ventilation ☒ *Normal* ☐ *Mechanical* ☐ *Respiratory Protection*

Work/Hygienic Practices: N/A

11. SPECIAL PRECAUTIONS

Store at room temperature.

DATE: 5/6/99

The above information is believed to be correct but does not claim to be all inclusive and should be used only as a guide.

† This is a toxic chemical subject to reporting requirements of section 313 of EPCRA and 40CFR372.

MATERIAL SAFETY DATA SHEET

LaMOTTE COMPANY
PO BOX 329 - CHESTERTOWN - MARYLAND - 21620
TELEPHONE # FOR INFORMATION 410-778-3100

24 Hour Emergency Number (CHEM-TEL) 800-255-3924

1. PRODUCT IDENTIFICATION

Sulfuric Acid, 1:1 *Code Nr.* **6141**

2. HAZARDOUS INGREDIENTS

NAME	CAS #	TSCA #	%	PEL	TLV
• Sulfuric Acid	7664-93-9		64	1 mg/cubic m	1 mg/cubic m

3. NON-HAZARDOUS INGREDIENTS EXCEPT WATER (7732-18-5)

NAME	CAS #	%
Water to 100%		

4. PHYSICAL DATA

Appearance: Colorless Liquid

Solubility in Water: Soluble	*Odor:* None	*Boiling Point:* > 100 deg C	*Melt. Point:* N/A
Vapor Pressure: <1 @ 20 deg C	*Vapor Density:* >1 (Air=1)	*pH:* <1	

5. FIRE AND EXPLOSION DATA

Flash Point (method used) N/A — *Flammable Limit: LEL:* N/A — *UEL:* N/A

Extinguishing Media: Dry chemical or CO2, not water

HMIS Hazard: Health - 3 *Flammability -* 0 *Reactivity -* 2 *Scale: 4 = Extreme, 3 = High, 2 = Moderate, 1 = Slight, 0 = Least*

Special Fire Fighting Procedures:
Wear protective equipment and self-contained breathing apparatus.

Unusual Fire & Explosion Hazard:
A violent exothermic reaction occurs with water. Reacts with metals to form flammable, explosive hydrogen gas.

6. REACTIVITY DATA

Stability: ☒ *Stable* ☐ *Unstable*

Conditions to avoid: Moisture

Incompatibility (Materials to avoid):
Water, metals, organic or combustible materials, and strong bases.

Hazardous Decomposition Products: SOx, hydrogen gas

7. HEALTH HAZARD DATA

Toxicity: orl rat LD50: 2140 mg/kg for sulfuric acid

Primary Route of Entry: ☒ *Inhalation* ☒ *Skin* ☒ *Ingestion* ☐ *N/A*

Carcinogenicity: ☒ *None* ☐ *NTP* ☐ *OSHA* ☐ *IARC*

Other Health Related Comments:

Target Organs: Corrosive to all body parts, Skin,

Signs and symptoms of exposure:
Severe burns. Ingestion may be fatal. Inhalation can cause coughing, chest pains, damage to lungs.

Medical Condition Aggravated by Exposure: N/A

8. EMERGENCY FIRST AID PROCEDURES

Eye Contact: Immediately flush with water for 15 minutes. Call a doctor immediately.

Ingestion: Do not induce vomiting. Rinse mouth, drink plenty of water. Call a doctor immediately.

Inhalation:
Remove to fresh air. Give artificial respiration if not breathing. If breathing is difficult, give oxygen.

Skin Contact:
Immediately flush with water for 15 minutes while removing affected clothing. Consult physician.

9. SPILL AND DISPOSAL PROCEDURES

Spill and Leak:
Wear gloves & eye protection. Cover spill with sodium bicarbonate or soda ash/calcium hydroxide mixture. Mix and carefully add water to form slurry, avoiding heat, spattering, and fumes. Scoop up and flush to drain with excess water.

Disposal:
Add very slowly with stirring to a large volume of soda ash & calcium hydroxide. Pour neutralized solution down drain with excess water. Dispose according to federal, state and local regulations.

10. PRECAUTIONARY MEASURES

In Handling: ☒ *Gloves* ☒ *Eye Protection* ☐ *N/A* ☒ *Other:* Lab Coat

Ventilation ☐ *Normal* ☒ *Mechanical* ☐ *Respiratory Protection*

Work/Hygienic Practices: Avoid contact with skin and clothing and inhalation of vapor.

11. SPECIAL PRECAUTIONS

Store away from incompatible items (bases, metal powders, combustible materials).

DATE: 3/14/02

The above information is believed to be correct but does not claim to be all inclusive and should be used only as a guide.

• This is a toxic chemical subject to reporting requirements of section 313 of EPCRA and 40CFR372.

P.O. Box 329 - 802 Washington Avenue Chestertown, MD 21620 - USA
TELEPHONE # FOR INFORMATION 410 778-3100

MSDS

MATERIAL SAFETY DATA SHEET

24 HOUR EMERGENCY NUMBER (CHEM-TEL): USA, Canada, Puerto Rico 800-255-3924;
Outside North American Continent 813-248-0585 (call Collect)

1. Product Identification

Product Code: **2218**
Product Description: Wide Range Indicator

Manufactured By: LaMotte Company
802 Washington Avenue
Chestertown, MD 21620

2. Composition/Information On Ingredients

Hazard	CAS#/Name	%	PEL	TLV
Yes	64-17-5 Ethyl Alcohol	52	1900 mg/cubic m	1000 ppm
Yes	67-56-1 Methyl Alcohol	2	260 mg/cubic m	200 ppm
Yes	51-28-5 2,4 Dinitrophenol	0.05	N/E	N/E
Yes	1310-73-2 Sodium Hydroxide	0.5	C 2 mg/cubic m	C 2 mg/cubic m
Yes	77-09-8 Phenolphthalein	<0.1	N/E	N/E
Yes	76-59-5 Bromthymol Blue	<0.1	N/E	N/E
Yes	76-61-9 Thymol Blue	<0.1	N/E	N/E
No	493-52-7 Methyl Red	<0.1		
No	7732-18-5 Water	to 100%		

Notes

Preparing To Monitor

Before collecting water samples, it's important to make sure that sampling equipment is functioning properly and all reagents are fresh. If you are experiencing equipment failure or need replacement reagents, please indicate your need in the comment section on your data sheet. **(Data collected with un-calibrated meters or out-dated chemicals do not meet quality control standards and are of limited usefulness.)**

NOTE: If you are unable to collect other water quality parameters because the stream bed holds no water, record air temperature and time and date and indicate flow severity as dry.

Field Equipment Checklist

For field tests

- ☐ Data sheet, clipboard and pen or pencil
- ☐ Complete CRWN monitoring kit
- ☐ Waste container
- ☐ Bucket with rope (for collecting a sample using a bucket)
- ☐ One Whirl-Pak® bag for each *E. coli* sampling site
- ☐ Labeling pen
- ☐ Distilled water
- ☐ Transparency tube or secchi disk
- ☐ Cooler with ice (for bacteria sample transport)
- ☐ Camera (digital is preferred)
- ☐ Towel or paper towels

For safety

- ☐ Gloves
- ☐ Goggles
- ☐ Hand sanitizer
- ☐ Wading boots if appropriate

For creek sampling

Instruments to measure streamflow:

- ☐ Rope or string
- ☐ Floating object, such as a Ping-Pong ball or empty film canister
- ☐ Marked pole or measuring tape
- ☐ Stop watch

Calibration of Meters

Calibration of the meters is essential for maintaining quality data collection. The principle behind instrument calibration is to provide a reference point to the meters through the use of a known standard solution and to ensure that meters are working properly. Refer to the section for the parameter you are testing for calibration protocol. If using a pH pocket tester hydrate the probe in a beaker filled with tap water for at least 30 minutes prior to calibration.

Suggested Water Sampling and Procedures Order

All of the tests must be performed at the monitoring site unless noted otherwise. Please follow all safety precautions while performing the tests. Due to the time sensitivity of some of the tests, we recommend you perform the water quality tests in this order:

- ☐ If possible, calibrate pH and conductivity meters prior to traveling to the monitoring site.
- ☐ Hang thermometer in the shade.
- ☐ Collect water sample. Be sure to record the time you collected your sample. NOTE: If tests for *E.coli* are conducted, please refer to sample collection section on the following page.
- ☐ Collect the dissolved oxygen sample. Complete the dissolved oxygen analysis or fix sample for transport.
- ☐ Record air temperature.
- ☐ Place thermometer in water. Record temperature at 10 minutes.
- ☐ Measure and record pH and specific conductance.
- ☐ Measure water clarity with Secchi disk or transparency tube, if applicable.
- ☐ If possible, also measure total depth where sample was collected, with your Secchi disk or tape measure. Convert to meters prior to data submittal.
- ☐ Make careful field observations of the water and the area surrounding the water at your site.
- ☐ Complete all other remaining tests and record observations.
- ☐ Conduct post tests on meters.
- ☐ Check data sheet for completeness.
- ☐ Clean and store all equipment.
- ☐ Submit data online at http://crwn.lcra.org/

Sample Collection

It is important to follow proper protocol when collecting the water sample so it will be representative of your monitoring location. If you can safely enter the stream, you should do so just downstream of the actual sample collection location and obtain your sample at the midpoint where the main current is flowing. As you wade into the water try to disturb as little sediment as possible. If the stream site is curved, sample near the outside of the curve. If possible, do not take the sample at the stream bank's edge since the water may be stagnant or not well mixed with the rest of the water. If there is debris on the surface, attempt to clear it aside with the side of your hand before collecting the sample.

Container samples: You may directly fill the sample containers provided in the monitoring kit. The ideal sampling depth is approximately one foot (0.33 meters) below the surface. If the depth at your site is less than one foot, samples should be collected approximately midway from the surface to the bottom, taking care to not disturb the substrate or stream bottom. Please refer to each parameter section for specific sampling directions. All samples, except *E.coli* samples, should be collected at once. Throw the container rinse water far downstream or on the bank so that the rinse water will not contaminate your sample.

Bucket sample: A representative sample can be collected using a bucket if direct access to the center of flow is not possible. Buckets should be free of debris from storage or previous sampling events. Rinse the bucket twice with water to be sampled. Always throw rinse water far downstream or on the bank so that the rinse water will not contaminate your sample.

If sampling for *E.coli* from the bucket, collect the sample before other samples are collected. Place the Whirl-Pak bag into an ice chest with a water-tight bag of ice. This keeps the sample from being inadvertently contaminated with melting ice. Re-rinse bucket and collect sample for core parameters.

Always rinse the collection containers at least twice with the water to be tested. This washes away any residual trace from the last sampling event, preventing the contamination of your sample.

Notes

Temperature

Aquatic organisms are dependent on certain temperature ranges for their optimal health. Temperature affects many other parameters in a body of water, including the amount of dissolved oxygen available, the types of plants and animals present, and the susceptibility of organisms to parasites, pollution and disease. Causes of temperature changes in the water include weather conditions, shade or lack of shade, vegetation on the streambank, discharges into the water from urban sources, or groundwater inflows. Temperature in a stream will vary with stream width and depth; therefore it is important to measure water temperature at the same place at each monitoring event. Temperature is measured in degrees Celsius (°C). A conversion chart to degrees Fahrenheit is included on page 2.

Seasonal Trends: May to October: 22 to 35°C
November to April: 2 to 27°C

Air Temperature

1. Hang the thermometer in the shade and allow ten minutes for the reading to become stable. Measure air temperature before measuring water temperature, as moisture on the thermometer will affect the reading.

2. Once the thermometer reading has stabilized, record the air temperature to the nearest 0.5 degree C on your data sheet.

Water Temperature

1. Place thermometer in the water in the shade if possible at sample depth (usually one foot).

2. Wait ten minutes to allow thermometer to reach a stable reading.

If you are collecting samples from a bucket, you should take the temperature reading as soon as possible as the water sample will begin to adust to the temperature of its surroundings.

3. Read the thermometer while still in the sample water as exposure to air will alter the reading.

4 Record the reading to the nearest 0.5 degree C on your data sheet.

Celsius to Fahrenheit Conversion

°C	°F	°C	°F	°C	°F
0	32.0	15	59.0	30	86.0
1	32.0	16	60.8	31	87.8
2	33.8	17	62.6	32	89.6
3	35.6	18	64.4	33	91.4
4	39.2	19	66.2	34	93.2
5	41.0	20	68.0	35	95.0
6	42.8	21	69.8	36	96.8
7	44.6	22	71.6	37	98.6
8	46.4	23	73.4	38	100.4
9	48.2	24	75.2	39	102.2
10	50.0	25	77.0	40	104.0
11	51.8	26	78.8	41	105.8
12	53.6	27	80.6	42	107.6
13	55.4	28	82.4	43	109.4
14	57.2	29	84.2	44	111.2

THERMOMETER INFORMATION

Model 545 • Code 1066

This instrument contains a non-hazardous, biodegradeable liquid and green dye.

Keep away from open flames.

Flush with water if liquid makes contact with the skin, eyes, or body.

LaMotte Company
PO Box 329 • Chestertown • Maryland • 21620
800-344-3100 • 410-778-3100 (Outside U.S.A.)
Visit us on the web at www.lamotte.com

Thermometer care

The CRWN-issued thermometer contains a non-hazardous, biodegradable liquid and colored dye. Keep away from open flames. Flush with water if liquid comes into contact with skin, eyes or body.

Treat the thermometer with care! Fluid separation may occur if you drop or mishandle the thermometer, making the temperature-reading inaccurate.

Occasionally the fluid in the thermometer may separate. To prevent this separation thermometers may be stored in an upright position. The following method may reunite the fluid. Handle with care and wear safety glasses and gloves.

Cooling Method

1. Prepare a solution of shaved ice and salt.
2. Place the thermometer bulb in the solution, keeping the thermometer upright.
3. Allow the liquid column to retreat into the bulb.
4. Swing the thermometer (bulb down) in an arc, forcing the entrapped gas to rise above the column.
5. Allow the thermometer to warm slowly in an upright position.

Notes

Dissolved Oxygen (DO)

Dissolved oxygen is one of the most important water quality indicators for aquatic life. Oxygen is produced by plants during photosynthesis and consumed by both plants and animals during respiration. Oxygen is also introduced into a water body from the air through agitation or wave action. The expected levels vary widely depending on the depth of the sample, the time of day and the season. Since plants are dependent on the availability of light, DO producing processes typically only occur near the surface or in shallow, clear waters. As temperatures rise and fall over a 24 hour period, oxygen does also, with more being produced through photosynthesis during the afternoon. But because cold water generally contains more oxygen than warm water, water at a temperature of 31˚C (typical for Texas' summer days) will only hold about half as much as it might on a cold winter day.

A large drop in DO could be the result of the introduction of organic matter such as leaf litter, grass clippings, sewage, runoff from feedlots, etc., which require large amounts of oxygen for decomposition by bacteria. Different types of fish and other aquatic organisms are individually tolerant to different levels of DO. When oxygen levels fall below about 3-5 mg/L and remain at this low level, over time, aquatic organisms may have trouble successfully reproducing, feeding or surviving.

The DO test measures the amount of oxygen dissolved in the water. The amount of dissolved oxygen water is capable of holding is directly related to temperature. The table on page 2 illustrates the maximum dissolved oxygen concentrations at various temperatures. You may find it interesting to compare the maximum DO from the table versus the actual DO found in your sample, at a given temperature. Calculation of the percentage of saturation of oxygen in your sample (relative to the temperature) will give you a more accurate indication of the amount of oxygen available to the aquatic life. Percent saturation will be automatically calculated after data entry, but directions for calculating it manually may be found on pages 7 & 8. Dissolved oxygen is measured in milligrams per liter (mg/L).

Expected Levels: 4.0 to 12.0 mg/L

Temp. (°C)	Maximum DO(mg/L)	Temp. (°C)	DO (mg/L)
0	14.60	23	8.56
1	14.19	24	8.40
2	13.81	25	8.24
3	13.44	26	8.09
4	13.09	27	7.95
5	12.75	28	7.81
6	12.43	29	7.67
7	12.12	30	7.54
8	11.83	31	7.41
9	11.55	32	7.28
10	11.27	33	7.16
11	11.01	34	7.05
12	10.76	35	6.93
13	10.52	36	6.82
14	10.29	37	6.71
15	10.07	38	6.61
16	9.85	39	6.51
17	9.65	40	6.41
18	9.45	41	6.31
19	9.26	42	6.22
20	9.07	43	6.13
21	8.90	44	6.04
22	8.72	45	5.95

Maximum dissolved oxygen concentrations vary with water temperature.

Dissolved Oxygen Test Procedure - Winkler Titration Method

For quality assurance purposes, two DO samples should be collected at a time. Review Sample Collection on page 3 of Preparing to Monitor. Also, dissolved oxygen water samples can change quickly due to the production of additional oxygen or decomposition of organic material; therefore, we ask that you collect your sample and continue in a timely fashion through Step 8 while at your site.


Figure 1


Figure 2


Figure 3


Figure 4

Collecting the water sample

1. Rinse two water sampling bottles twice with sample water, collected from the same depth as the actual sample. Replace cap loosely, shake and discard rinse water downstream and well away from the collection area to prevent agitation of the water or substrate.
2. Collect the samples one foot from the surface (typically, elbow deep). Submerge the bottles upside down into the water to be tested (Figure 1). Turn the bottles right side up, letting the water fill the bottles so that no air bubbles remain (Figure 2, 3).
3. Replace the caps while the bottles are submerged (Figure 4). Remove the bottles from the water.
4. To ensure that no oxygen has been introduced into the sample, invert each sample bottle a couple of times and observe if any bubbles are present. If bubbles are present, repeat the collection procedure from Step 2 for both samples.

Make sure that no air bubbles are present!

NOTE: As part of the CRWN quality control program, it is necessary to run separate DO tests on each sample. This means you will fix each sample and run a titration from each sample bottle. The following steps 5 to 19 are instructions for each individual sample bottle. For best results, complete steps 5 to 9 on both DO samples at the same time, then proceed with one sample at a time for the remainder of the procedure.


Figure 5

Be sure to wear goggles and gloves for the remainder of this procedure

Fixing the water sample

5. Remove the cap. Hold bottle of Manganous Sulfate vertically and add eight drops to each sample. Next add eight drops of Alkaline Potassium Iodide. It is important to **hold dropper bottles vertically to ensure that drops are of a consistent size. Do not allow the reagent bottle tips to come in contact with sample water.** See Figure 5.
6. Carefully cap and gently invert 25 times. Make sure that no air bubbles are present. If there are, repeat from Step 2.

Figure 6

7. A yellow-brown color and precipitate (floc) will form. This floc indicates the presence of oxygen. Allow the precipitate to settle below the shoulder of the bottle (Figure 6). If it is not settled after two minutes, shake ten times and wait another two minutes. Then proceed, settled or not.

8. Uncap the bottle. Add eight drops of Sulfuric Acid to the solution. The reagents sink to the bottom, so anything that spills over at this point will not affect the test. A rust-colored precipitate or flecks should form. Cap and invert until all of the precipitate is dissolved. This step may take up to 10 minutes.

NOTE: A clear yellow to brown-orange color will develop, depending on the oxygen content of the sample. The amount of oxygen in the water is directly related to the color (amount of free iodine formed) of the sample at this stage. If there is a lot of oxygen, the sample will appear a dark yellow-brown. If there is very little oxygen the sample will appear almost clear.

9. Check the sample. If any flecks remain are they brown or rust colored? If not, it's possible that suspended sediment or organic matter like bits of leaves or pollen are present in your water sample. If the solids are organic matter, ignore them and continue the test. When pouring sample out of the bottle info the titration vial, avoid pouring out the organic matter.

   a.) If the flecks are brown or rust colored, after 10 minutes of inverting, add 2 additional drops of sulfuric acid to the sample, then cap and continue inversions for 2 more minutes. If the precipitate remains, you can add additional sulfuric acid one drop at a time, inverting the sample for 2 minutes between drops. Do not add more than 8 total additional drops.

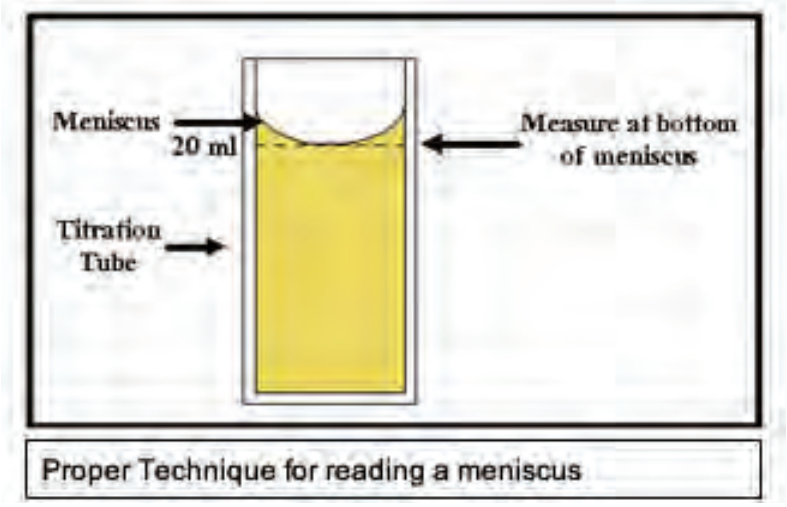
   b.) If the precipitate remains after step a, the reagants may not be viable. Reagents should be stored at 25°C (room temperature) and away from moisture or direct sunlight. Reagent lids should be replaced after each use.

   c.) Also check the expiration date. If any of the reagents have expired, indicate this and request the reagents needed on the data sheet.

10. The sample is now "fixed". If testing conditions are unfavorable, you may leave the test site and resume the test at another location. The remainder of the procedure may be completed up to four hours from this point without affecting DO levels. In this case, the samples should be refrigerated until you are ready to finish the procedure.

11. Rinse the titration vial twice with 5 to 10 mL of the fixed (yellow-brown) sample. See Figure 7. Discard rinse into waste container. Fill the vial with the sample to the 20-mL mark, making sure that the bottom of the meniscus (curvature of the liquid) is sitting on top of the white line.

Figure 7



12. Cap the bottle and the titration vial. KEEP THE REMAINING FIXED SAMPLE; it might be needed for another titration if there is a mistake running the first one. The other full sample bottle will be used for the duplicate titration.

Figure 8

Figure 9

Figure 10

Titration

13. Fill the titrator (plastic syringe) with 10 mg of Sodium Thiosulfate.

    a) Insert the titrator in the Sodium Thiosulfate bottle and invert the bottle. See Figure 8.

    b) Draw the titrator's plunger out slowly. See Figure 8. The large ring on the plastic titrator should touch the zero mark. See Figure 9.

    c) Make sure that there are no air bubbles in the titrator. If there are, push the plunger in quickly (while still inserted in the Sodium Thiosulfate bottle), returning the contents to the bottle, and then refill.

14. Turn the Sodium Thiosulfate bottle right side up and remove the titrator. Insert the titrator firmly into the center hole of the glass titration vial cap. See Figure 10.

15. Gently press the plunger down, adding one drop at a time and swirling thoroughly after each drop, until the sample becomes several shades lighter than the original fixed sample. Any drop hanging on the outside of the titrator must be added to the solution, as it has reduced the remaining amount in the titrator. Do not allow the solution to become clear. If this occurs, you must begin with fresh fixed sample at Step 10. Be careful not to swirl so vigorously that solution is splashed on the tip of the titrator or on the lid.

NOTE: This is a critical step. Do not allow the solution to become clear. If it does, you must begin at step 10 again.

Figure 11

Figure 12

16. Carefully remove the cap with the titrator still attached WITHOUT DISTURBING THE PLUNGER. You may want to record the value of the Sodium Thiosulfate added at this point. **If you disturb the plunger and lose titrant, you must start over at Step 10.** See Figure 11.

17. Add eight drops of the Starch Indicator to the solution in the titration vial. See Figure 12. The sample should turn blue.

18 Recap the vial with the titrator attached. Swirl the sample to mix the solution well and continue adding the *Sodium Thiosulfate* drop by drop, **mixing after each drop,** until the blue color begins to disappear. It is important to mix well as you titrate the entire sample. Be careful not to splash sample onto the lid. Mix longer rather than more vigorously. The color change will occur only in the top layer unless you mix thoroughly. The sample should eventually turn completely clear. Do not continue adding the Sodium Thiosulfate once the solution has turned clear.

TIP: Hold the titration vial against white paper to see the color change more accurately. Look for a blue tinge in the meniscus. At this point, a half drop may be all that is needed to reach the end point.

19. If you reach the 9.0 mL mark of the titrator, proceed slowly. If the 10 mL mark is reached and the color is still blue, STOP and read and note the result. Empty any remaining Sodium Thiosulfate from the titrator into the waste container. Rinse the tip well with distilled water over the waste container. Refill the titrator up to the 0.0-mL mark (check for bubbles) and continue titrating until the color is clear.

20. To read the results, find where the large ring on the plastic titrator meets the titrator barrel (Figure 13). Each mark equals 0.2 mg/L. Estimate to the nearest tenth (0.1). Record the result on your data sheet.

21. If you had to refill the titrator in Step 20, add the number that you jotted down at that point to the number now shown on the titrator and record on the data sheet.

22. Repeat the procedures from Step 10 for the duplicate reading. If the two values are within 0.5 mg/L of each other, record the average of the two values. Average to no more than 2 decimal places.

23. If the difference between the two titration vial results is greater than 0.5 mg/L, run a third titration (steps 10-21) from the first of the previously fixed sample bottles. If the third titration falls within 0.5 mg/L of either of the first two titrations, record and average all values within 0.5 mg/L of each other. If the third titration does not fall within 0.5 mg/L of the first two titrations, a fourth must be run from the second bottle.

Figure 13 - Read result as 7.2 mg/L

24. To prevent cross contamination DO NOT return any remaining Sodium Thiosulfate in the titrators to the Sodium Thiosulfate bottle. Empty the titrators and any remaining sample from the bottles and titration vials into the waste container. Rinse glassware, caps and titrator tips twice with distilled water.

NOTE: Dissolved Oxygen Titration Averaging

If a third titration is necessary, and the results are all within 0.5 mg/L of each other, record and average all values within 0.5 mg/L. (This could possibly be all three. Ex: sample 1=6.0 mg/L, sample 2=7.0 mg/L, sample 3=6.5 mg/L. In this case all three values should be averaged, resulting in 6.5 mg/L.) If the range between the two fixed sample bottles is still more than 0.5 mg/L, repeat the titration on the remaining sample bottle. If a fourth titration is necessary, again record all values within 0.5 mg/L of each other. If the readings from the two fixed sample bottles are still greater than 0.5 mg/L apart, record the four values online, but do not enter the average.

DON'T LEAVE A BLANK IF THE VALUES ARE OUT OF BOUNDS. Include a note in the comments section. If this occurs two sampling trips in a row, notify your CRWN support staff.

Dissolved Oxygen Percent Saturation

Percent Saturation will be automatically calculated after data entry, but one can determine the dissolved oxygen percent saturation of a water sample using a simple mathematical formula. This "test" compares the amount of oxygen in the water relative to the water temperature. The saturation point indicates the level at which water will not generally hold any more oxygen at a given temperature. Super-saturation occurs when the water holds more oxygen molecules than usual for a given temperature. Sunny days with lots of photosynthesis or turbulent water conditions can lead to super-saturation. A water sample is "saturated" at 100% and "super-saturated" above 100%. Saturation greater than 100% is not un-common. Readings below 90% may be caused by the presence of decay organisms breaking down organic material. Bacteria associated with the decomposition of organic matter consume oxygen and can account for a decrease in oxygen saturation.

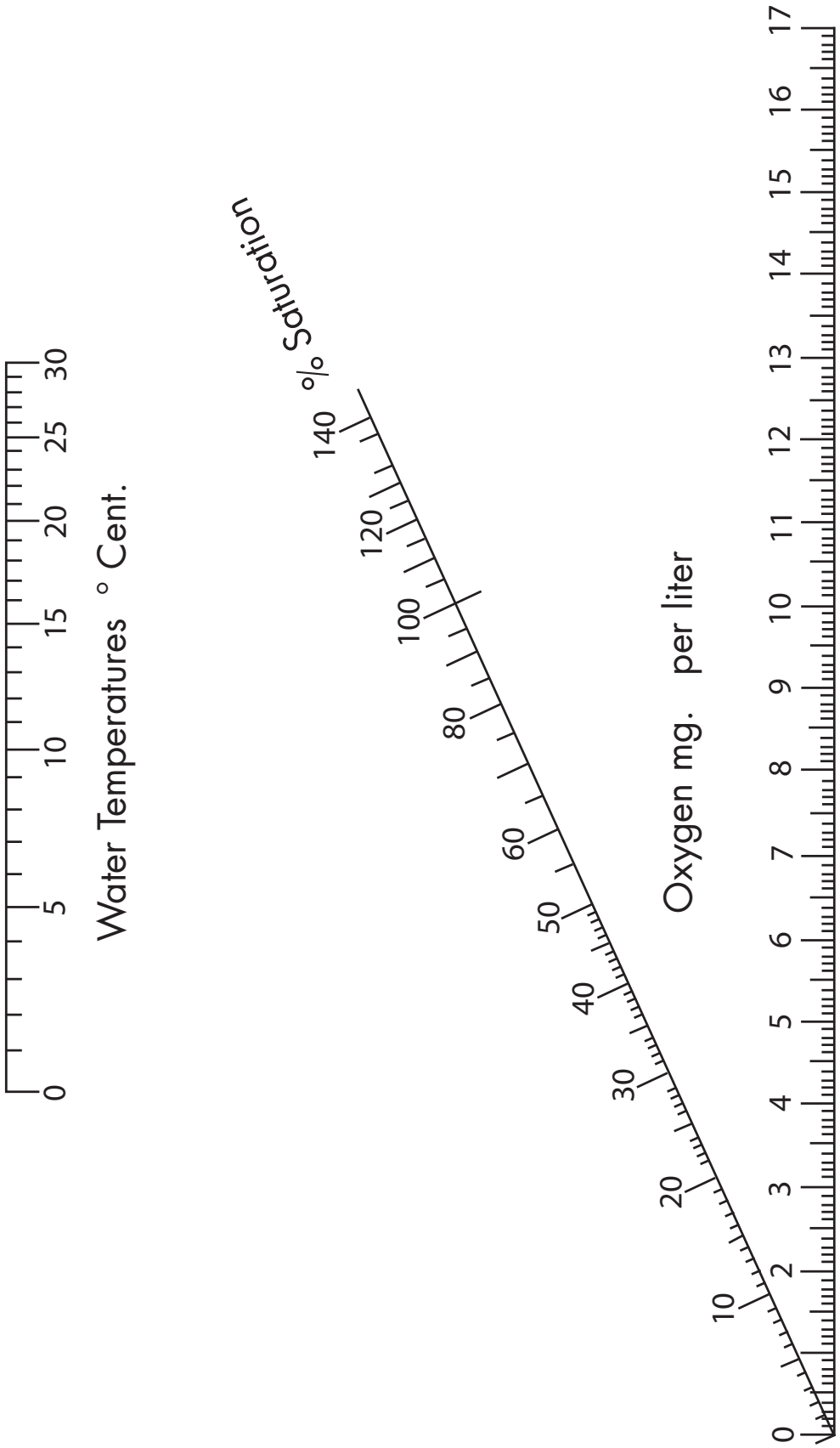
$$\frac{DO}{500 / (T + 35)} \times 100 = \text{Percent Saturation}$$

Or for an easier method to determine an approximate percent saturation, the following nomogram will permit you to quickly approximate oxygen saturation values.

Chart/Nomogram Directions to determine level of oxygen saturation

Locate the test site's water temperature on the chart. Using a ruler, place one edge at the temperature and angle it to line up with the dissolved oxygen measurement on the chart. The oxygen saturation should be read at the intercept on the sloping scale in the middle of the chart.

Level of Oxygen Saturation Chart



DISSOLVED OXYGEN WINKLER TITRATION: CHEMICAL REACTIONS

The first step in a DO titration is the addition of Manganous Sulfate and Alkaline Potassium Iodide Azide. These reagents react to form a white precipitate, or floc, of manganous hydroxide, Mn(OH)2.

$MnSO_4 + 2KOH$	→	$Mn(OH)_2 + K_2SO_4$
Light + Carbon Dioxide + Water	→	Manganous Hydroxide + Potassium Sulfate

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.

$4Mn(OH)_2 + O_2 + 2H_2O$	→	$4Mn(OH)_3$
Manganous Hydroxide + Oxygen + Water	→	Manganic Hydroxide

When sulfuric acid 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.

$2Mn(OH)_3 + 3H_2SO_4$	→	$Mn_2(SO_4)_3 + 6H_2O$
Manganic Hydroxide + Sulfuric Acid	→	Manganic Sulfate + Water

Simultaneously, iodine from the potassium iodide in the Alkaline Potassium Iodide Azide is oxidized by manganic sulfate, releasing free iodine into the water. 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 yellow-brown.

$Mn_2(SO_4)_3 + 2KI$	→	$2MnSO_4 + K_2SO_4 + I_2$
Manganic Sulfate + Potassium Iodide	→	Manganous Sulfate + Potassium Sulfate + Iodine

When sodium thiosulfate is added it reacts with the free iodine to produce sodium iodide. A starch indicator is added, turning the sample dark blue to enhance the final endpoint. When all the iodine has been converted the sample changes from blue to colorless.

$2Na_2S_2O_3 + I_2$	→	$Na_2S_4O_6 + 2NaI$
Sodium Thiosulfate + Iodine	→	Sodium Tetrathionate + Sodium Iodide

Specific Conductance

The specific conductance test measures the ability of water to pass an electrical current. The conductivity meter measures how well the water you're testing conducts an electrical current. Conductivity in water is affected by the presence of inorganic dissolved solids such as chloride, sulfate, sodium, calcium and others.

Conductivity in streams and rivers is affected by the geology of the area through which the water flows. Streams that run through granite bedrock will have lower conductivity because granite is composed of materials that do not dissolve into ionic components as water flows over it. Limestone and clay soils, on the other hand, contain materials that will ionize when washed into the water thus raising the conductivity values of that water.

High specific conductance readings can also be the result of industrial pollution or water running off of streets, buildings and parking lots (urban runoff). Extended dry periods and low flow conditions also contribute to higher specific conductance readings due to evaporation and concentration of dissolved solids. Because an organic compound like oil does not conduct electrical current very well, an oil spill would tend to lower the conductivity of the water.

Temperature also affects conductivity: warmer water has a higher conductivity. Your conductivity meter has an automatic temperature compensation feature to adjust for temperature variations. Creeks tend to be more variable and demonstrate a broader range of values than the larger water bodies in our basin. Specific conductance is measured in microsiemens per centimeter (µS/cm). Water with specific conductance values greater than 1,000 microsiemens can harm plants if used for irrigation.

Expected Levels: 300-700 µS/cm in most of the river watershed; higher near San Saba and the coast

Perform the following steps before testing conductivity

Calibration compares the meter reading in a known standard value solution to the value of that solution and allows the meter to be adjusted as necessary. This ensures that the conductivity test result is accurate. Conductivity meters may be calibrated up to 24 hours in advance of sampling. CONDUCTIVITY STANDARD SHOULD BE STORED AND CALIBRATION CONDUCTED AT ROOM TEMPERATURE.

Conductivity Meter Calibration

OAKTON TDSTestr 3™

Figure 1

Figure 2

1. Record the value of the conductivity standard (600 µS/cm) in the Conductivity Standard Value box in the Meter Calibration Log of the data sheet.
2. Remove the meter's protective cap. Rinse the tip of the meter and the plastic conductivity beaker twice with the conductivity standard solution. Do not turn the meter on at this time.
3. Fill the plastic beaker with 40 - 50 mL of conductivity standard solution and fully immerse the meter in the solution. Turn the meter on and gently stir the meter; do not let it rest on the bottom or on the sides of the container. Dislodge any air bubbles that may be present on the electrode. See Figure 1.
4. Wait two minutes for display to stabilize. Once the display has stabilized, read the meter and record the value in the "Conductivity, Initial Meter Reading" box in the calibration log on your data sheet.
5. If initial reading is different from the standard value, remove the battery compartment lid and use the small screwdriver to adjust the "trimmer" until the display matches the conductivity standard solution value. See Figure 2. Replace lid.

Do not use excessive force while adjusting the screw. Insert the screwdriver directly into the "trimmer," not at an angle.

6. Press the ON/OFF button to turn the meter off. Rinse the electrode and beaker with distilled water. Allow to drain, and then replace the cap.

Perform the following steps before testing conductivity

Calibration compares the meter reading in a known standard value solution to the value of that solution and allows the meter to be adjusted as necessary. This ensures that the conductivity test result is accurate. Conductivity meters may be calibrated up to 24 hours in advance of sampling. CONDUCTIVITY STANDARD SHOULD BE STORED AND CALIBRATION CONDUCTED AT ROOM TEMPERATURE.

Conductivity Meter Calibration

OAKTON ECTestr low™

1. Record the value of the conductivity standard (600 µS/cm) in the "Conductivity, Standard Value" box in the Meter Calibration Log of the data sheet .
2. Remove the meter's protective cap. Rinse the tip of the meter and the plastic conductivity beaker twice with the conductivity standard solution. Do not turn the meter on at this time.
3. Fill the plastic beaker with 40 - 50 mL of conductivity standard solution and fully immerse the meter in the solution. Turn the meter on and gently stir the meter; do not let it rest on the bottom or on the sides of the container. Dislodge any air bubbles that may be present on the electrode. See Figure 1 on previous page.
4. Wait two minutes for display to stabilize. Once the display has stabilized, read the meter and record the value in the "Conductivity, Initial Meter Reading" box in the calibration log on your data sheet.
5. If initial reading is different from the standard value, remove the battery compartment lid. Press the INC or DEC keys (located next to the batteries) until the display matches the conductivity calibration standard value. See Figure 2.
6. Wait 3 seconds without a key press; the display flashes 3 times and then shows "ENT". This means the meter accepts the calibration value and returns to measurement mode. Do not press any keys at this time. Replace battery compartment lid.
7. Rinse meter's electrode with distilled water. Press the ON/OFF button to turn the meter off. Allow to drain, then replace the cap.

Figure 1

Figure 2

Perform the following steps before testing conductivity

Calibration compares the meter reading in a known standard value solution to the value of that solution and allows the meter to be adjusted as necessary. This ensures that the conductivity test result is accurate. Conductivity meters may be calibrated up to 24 hours in advance of sampling. CONDUCTIVITY STANDARD SHOULD BE STORED AND CALIBRATION CONDUCTED AT ROOM TEMPERATURE.

Conductivity Meter Calibration

OAKTON ECTestr 11™

1. Record the value of the conductivity standard (600 µS/cm) in the "Conductivity, Standard value" box in the Meter Calibration Log of the data sheet.
2. Remove the meter's protective cap. Rinse the tip of the meter and the plastic conductivity beaker twice with the conductivity standard solution. Do not turn the meter on at this time.
3. Fill the plastic beaker with 40 – 50 mL of conductivity standard solution and fully immerse the meter in the solution. Turn the meter on. The LCD display shows the power-up sequence. Make sure the tester is in measuring mode (MEAS should display in top left corner. See Figure 1.)

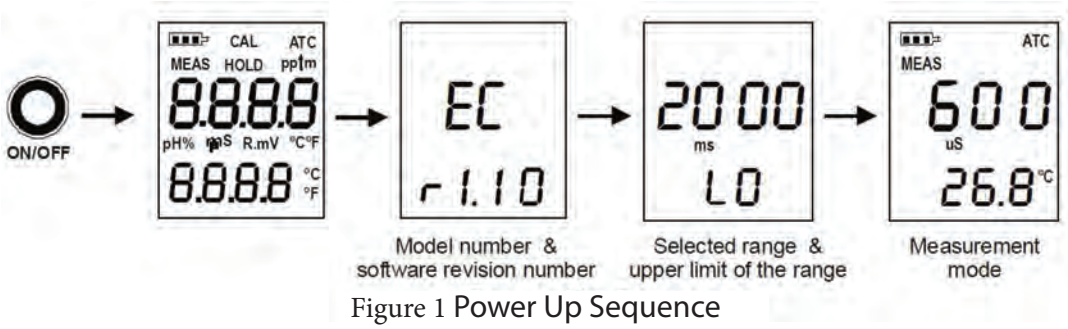


Figure 1 Power Up Sequence

NOTE: When the tester is on, if you do not press a key for 8.5 minutes, the tester automatically switches off to conserve batteries.

4 Gently stir the meter; do not let it rest on the bottom or on the sides of the container. Dislodge any air bubbles that may be present on the electrode. Wait two minutes for display to stabilize.

5. Record the value in the "Conductivity, Initial Meter Reading" box in the calibration log on your data sheet.

6. If value recorded is different from the standard value, remove the battery compartment lid. Press INC or DEC key to enter calibration mode. (See Figure 2) The meter briefly displays the 'CAL' indicator and the number of points the tester will be calibrated to. Your tester is set to only one standard.

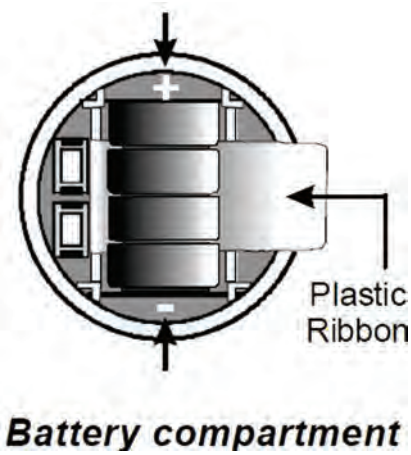


Figure 2 INC and DEC Keys

7. The upper display will then show the measured conductivity reading of the solution based on previous calibration and the lower display shows the uncalibrated conductivity reading. Press INC or DEC keys again to adjust the upper display to the correct conductivity value (600 µS/cm).
8. Wait for five seconds for the tester to show the confirmation 'CO' and return to measurement mode. The meter is now calibrated. Turn meter off and rinse meter's electrode with distilled water. Allow to drain and replace cap. (NOTE: If INC or DEC key is not pressed within 5 seconds after entering CAL mode, the meter will display 'CO' and return to measurement mode but the meter will not be calibrated to new values. Simply press INC or DEC key again, then use INC or DEC keys as above.)

Meter Maintenance Tips

OAKTON TDSTestr 3™, ECTestr low™ or ECTestr 11™

To improve performance, clean the stainless steel electrodes by periodically rinsing them in alcohol for 10-15 minutes.

Replace all four batteries if the display becomes faint or disappears, or if the readings are unstable or constant, or about every six months. ECTestr 11 ™ features a low battery indicator in the upper left corner.

NOTE: Tester life is dependent on meter and electrode care. If the electrode is exposed to materials that contaminate the reference junction, electrode life will be shortened.

Changing Batteries

1. Open battery compartment lid.
2. Remove old batteries; replace with fresh ones. Note polarity (shown in battery compartment).
3. Recalibrate Tester after battery change.

Conductivity Test

TDSTestr 3™, ECTestr™ or ECTestr 11™

1. If a bucket sample is used, the meter may be immersed directly into the bucket and all other steps from #4 through #9 may be followed. If sampling directly from the body of water, follow steps #2 through #9.
2. Rinse the beaker and the meter probe twice with sample water, discard downstream of the sample area. Collect a sample of water at your site and return to your testing area.
3. Submerge the meter into the sample to be tested so bottom of probe rests at 15 mL. Make sure sensor is fully submerged.
4. Press the ON/OFF button to turn on the meter.
5. Hold the beaker up and carefully look at the meter from below- check to make sure there are no air bubbles trapped on the probe. If bubbles are present around the probe, swirl the meter.

Meter should not touch sides or bottom of beaker.

6. Wait 2-3 minutes for the automatic temperature compensation to correct the readings for solution temperature changes, and to stabilize the reading. NOTE: ECTestr 11™ also features a temperature function. The upper display shows the conductivity reading. The lower display shows the temperature. When the temperature reading

stabilizes, the conductivity reading may be recorded. Do not allow the meter to touch the bottom or the sides of the beaker. HOLD function (EC testr only): Press HOLD key to freeze display. Press HOLD again to release.

7. Record the specific conductance reading in the "core tests" section of the data sheet.

8. Complete a post test calibration check by first rinsing the probe with the conductivity standard and then placing it in a beaker with the same standard you used for calibration. Allow the reading to stabilize and then record it in the "Post Test Reading" blank in the calibration log on the data sheet. **DO NOT ACTUALLY CALIBRATE THE METER AT THIS TIME!!!**

9. Press the ON/OFF button to turn the meter off. Rinse the meter and beaker with distilled water. Allow to drain, and then replace the protective cap. Dispose of conductivity standard solution by emptying into clearly labeled waste container for later disposal.

If the post test reading is not within 30 µS/cm of the conductivity standard value, please note this on the data sheet. Refer to Meter Maintenance Tips (above). If the problem continues, contact CRWN for a replacement meter.

NOTE: Turning the meter off saves the batteries.

Notes

pH

A pH test measures the alkalinity or acidity concentration of a solution on a scale of 0 to 14 standard units (SU). A pH of 7 is neutral (hydrogen ion (H+) and hydroxide ion (OH-) concentrations are equal), below 7 is acidic (more H+ than OH-), and above 7 is basic or alkaline (more OH- than H+). Acid rain resulting from auto exhaust or coal-fired power plants can cause a drop in pH in a body of water. Human activities such as accidental spills, agricultural runoff (pesticides, fertilizers, animal wastes), and sewer overflows may change the pH. Buffering capacity is the water's ability to resist changes in pH. It is critical to aquatic life. Limestone soils act to neutralize these acids and often result in a more basic pH. While many insect larvae and young fish are sensitive to a low pH (acid), extreme values on either end of the scale can be lethal to most organisms.

Expected Levels: 6.5-9.0 SU

Some pH values of common substances

Battery acid	0.3 SU
Lemon juice	2.1 SU
Vinegar	3.0 SU
Orange juice	4.3 SU
Pure rain	5.8 SU
Milk	6.9 SU
Seawater	8.0 SU
Ammonia	11.4 SU
Bleach	12.7 SU
Lye	13.6 SU

The River Watch utilizes two test procedures for determining the value of pH; a pH meter or a color comparator.

If the water is strongly colored or extremely turbid, the use of a meter is recommended.

pH Meter Conditioning

OAKTON pHTestr 2™

The electrode in the pH probe must be re-hydrated prior to calibration and use.
To keep the probe hydrated:

Remove the protective cap from the pH meter. With the meter turned off, soak the probe in a beaker half-filled with tap water or pH standard for at least 30 minutes or preferably, overnight.

pH Meter Calibration

Perform the following steps before testing pH

Calibration compares the meter reading in a known standard value solution to the value of that solution and allows the meter to be adjusted as necessary. This ensures that the pH test result is accurate. pH meters may be calibrated up to 24 hours in advance of sampling. pH STANDARD SHOULD BE STORED AND CALIBRATION CONDUCTED AT ROOM TEMPERATURE.

1. Record the value of the pH calibration standard (7.0 SU) in the "pH, Standard Value" box listed in the Meter Calibration Log of the data sheet.
2. Remove the protective cap. Rinse the tip of the meter and plastic pH beaker twice with the calibration standard solution. Do not turn on the meter.
3. Submerge the meter 1/2 to 1 inch into beaker containing 40-50 mL of pH standard. Do not let the meter rest on the bottom or sides of the beaker. Check for air bubbles on the probe; if they are present, gently stir the probe until the bubbles are dislodged.
4. Press the ON/OFF button to turn on the meter. Wait at least one minute until the meter stabilizes and record this value in the "pH, Initial Meter Reading" blank in the meter calibration log on your data sheet.
5. With the meter still submerged in the pH standard, press the CAL button to begin calibration mode. "CA" flashes on the display. Then, a pH value close to the pH standard value will flash repeatedly.
6. Wait at least 30 seconds for the display to stabilize to one value (the display will flash continuously during this step). After the meter has stabilized, press the HOLD/CON button to confirm and complete the calibration. The display should show "CO" and then switch to the standard value reading.

The meter should read the value of the standard solution. If this is not the case, or if the meter does not hold the calibration, change the batteries in the meter. If you do not see any improvement after changing the batteries, contact a CRWN staff member for a replacement meter.

7. Press the ON/OFF button to turn the meter off and rinse the meter and beaker with distilled water. Allow to drain, and then replace the cap.

Self-diagnostic Messages

ER 1- Batteries are low - replace. Batteries should be replaced every six months, regardless.

ER 2- Electrode contamination or wrong standard solution (too high or low for conditions) was used during calibration.

OR- Signal is out of range, electrode is not in contact with solution or electrode is failing.

Changing Batteries

1. Open battery compartment lid.
2. Remove old batteries; replace with fresh ones. Note polarity (shown in battery compartment).
3. Recalibrate tester after battery change.

Meter Maintenance Tips

ALWAYS KEEP METERS TURNED OFF WHEN NOT IN USE

- Rinse the electrode with distilled water after each measurement.
- In aggressive chemicals, dirty or viscous solutions, and solution with heavy metals or proteins, take readings quickly and rinse electrode immediately afterward.

NOTE: Meter life is dependent on meter and electrode care. If the electrode is exposed to damaging materials, electrode life will be shortened.

pH Meter Conditioning
OAKTON pHTestr 20™ double junction

The electrode in the pH probe must be re-hydrated prior to calibration and use.
To keep the probe hydrated:

Remove the protective cap from the pH meter. With the meter turned off, soak the probe in a beaker half-filled with tap water or pH standard for at least 30 minutes or preferably, overnight.

pH Meter Calibration

Perform the following steps before testing pH

Calibration compares the meter reading in a known standard value solution to the value of that solution and allows the meter to be adjusted as necessary. This ensures that the pH test result is accurate. pH meters may be calibrated up to 24 hours in advance of sampling. pH STANDARD SHOULD BE STORED AND CALIBRATION CONDUCTED AT ROOM TEMPERATURE.

1. Record the value of the pH standard (7.0 SU) in the "pH, Standard Value" box listed in the meter calibration log of the data sheet.
2. Remove the protective cap. Rinse the tip of the meter and plastic pH beaker twice with the calibration standard. Do not turn the meter on.
3. Submerge the meter 1/2 to 1 inch into beaker containing 40-50 mL of pH standard. Do not let the meter rest on the bottom or sides of the beaker. Check for air bubbles on the probe; if they are present, gently stir the probe until the bubbles are dislodged.
4. Press the ON/OFF button to turn on the meter. Wait at least one minute until the meter stabilizes and record this value in the "pH, Initial Meter Reading" blank in the meter calibration log on your data sheet.
5. With the meter still submerged in the pH standard, press the CAL button to begin calibration mode. The 'CAL' indicator will be shown. The upper display will show the measured reading based on the last calibration while the lower display will indicate the pH standard buffer solution.
6. Allow about 2 minutes for the tester reading to stabilize before pressing the HOLD/ENT button to confirm the calibration point. The upper display will be calibrated to the pH standard buffer solution and the lower display will then be toggling back and forth between 2 other possible calibration points. (NOTE: Buffers used should frame the range of pH for the samples being tested. pH ranges within the Colorado River Basin typically range from 6.5-8.2 SU, so CRWN protocol uses 7.0 SU for calibration standard.)
7. Exit to measurement mode by pressing the CAL button. Press the ON/OFF button to turn the meter off and rinse the meter with distilled water. Allow to drain, and then replace the cap.

Calibration Troubleshooting

Failure to press HOLD/ENT to confirm calibration. Pressing the CAL button will resume measuring mode but will not enter the calibration value.

Insufficient sampling time. If the meter is not exposed to the buffer for the recommended time, a stable calibration point will not be reached. Wait at least 2 minutes before pressing HOLD/ENT.

Failure to rehydrate the electrode. A dry electrode will give fluctuating readings while it rehydrates in a buffer, causing errors. (See pH meter conditioning, page 2).

Self-diagnostic Messages

Low Bat Indicator: 3 bars = full battery, 2 bars = 50%, blinking battery case = no charge
OR/UR still: electrode may not be in contact with solution
ATC/OR/UR blinking: temperature sensor may have short circuited
Er.1: pH calibration error

Meter Maintenance Tips

ALWAYS KEEP METERS TURNED OFF WHEN NOT IN USE

- Rinse the electrode with distilled water after each measurement.
- In aggressive chemicals, dirty or viscous solutions, and solution with heavy metals or proteins, take readings quickly and rinse electrode immediately afterward.

NOTE: Meter life is dependent on meter and electrode care. If the electrode is exposed to damaging materials, electrode life will be shortened.

Changing Batteries

1. Open battery compartment lid.
2. Remove old batteries; replace with fresh ones. Note polarity (shown in battery compartment).
3. Recalibrate Tester after battery change.

pH Test
OAKTON pHTestr 2™, 20™

1. Rinse the glass beaker and the meter probe twice with sample water, discarding the water downstream of the sample area. Then collect a sample of water filling the glass beaker 1/2 to 3/4 full and return to your testing area. The pH meter may also be placed directly into the water body or bucket if a bucket sample is used.

2. Remove the meter's cap. Submerge the meter 1/2 to 1 inch into the beaker containing sample. Press the ON/OFF button to turn on the meter.

3. Hold the beaker up and check the meter from below to make sure there are no air bubbles trapped inside the probe.

4. Gently stir the meter for one minute until the reading stabilizes, being careful not to allow the meter to rest on the bottom or on the sides of the container. Record the pH on the data sheet in the "Core Tests and Measurements" section.

5. Press the HOLD/ENT button if you wish to hold the reading (to show others, for example); press it again to release the reading. If beaker was used, pour out the sample water and rinse the beaker with distilled water.

6. As a post-test "check" after sampling, place the meter in a beaker containing the same standard you used for calibration. Turn the meter on and allow the reading to stabilize then record it in the "pH post" test reading box in the calibration log on your data sheet. DO NOT ACTUALLY CALIBRATE THE METER AT THIS TIME!!! If the value is not within 0.2 SU of the standard value, please note this on the data sheet and try rinsing the probe well with tap water and clean with an ear swab before your next monitoring event. If the problem continues try changing the batteries. If problems persist contact CRWN for a replacement meter.

7. Press the ON/OFF button to turn the meter off. Rinse the electrode with distilled water. Allow to drain. Replace the meter in the kit. NOTE: After post-test dispose of standard solution by emptying into clearly labeled waste container for later disposal, and rinse the beaker with distilled water.

pH TEST
Wide Range Comparator

If the water is strongly colored or extremely turbid, do not use the pH color comparator.

1. Rinse plastic water sample bottle and cap twice with water to be tested.
2. Rinse square test tube and cap twice with water to be tested.
3. Fill test tube so bottom of meniscus sits on the 5 mL line.
4. While holding dropper bottle vertically, add 10 drops of Wide-Range indicator solution, cap and mix well.
5. Insert test tube into pH comparator. Position the comparator between the operator and a light source. To avoid being influenced by an irregular background or the color of trees or sky, hold the white side of your clipboard at an angle under the comparator.
6. Match sample color to a color standard. The comparator color may be more intense than the liquid sample color. Look for whether or not the sample contains more of a yellow hue or more blue when making a value determination. Record one value to the nearest 0.5 SU (7.0, 7.5, 8.0, etc) Record as pH, and select the pH comparator box.
7. Empty waste into waste container. Rinse test tube and cap twice with distilled water, scrub with test tube brush, and rinse again. Air dry. Store test tube and cap separately.

Interpretation of results:

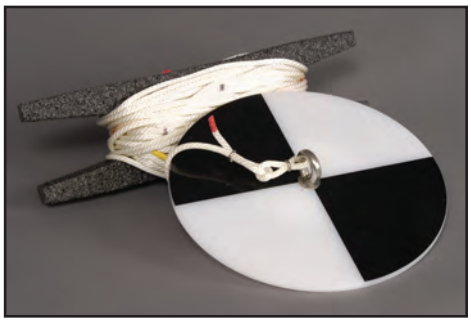
Interpolation (estimating a value between two known values) is not required and readings are matched most closely based on tint, e.g., the presence of blue or yellow. The best match is then determined to 0.5 SU (7.0, 7.5, 8.0, etc.). Please choose only one value to report.

Notes

Transparency

Transparency, an important indicator of the health of a stream or river, measures how far light can penetrate a body of water. Sunlight provides the energy for photosynthesis and determines the depth to which algae and other plants can grow, defining the ecological make-up of a water body. A change in water clarity may be noticed after heavy rains, as silt and debris can run off into water bodies causing the visibility to decrease. Transparency usually decreases in the summer when plankton, silt and organic matter are more likely to be prevalent.

Secchi Disk



The Secchi Disk measures the transparency, or clarity, of the water at a sampling location. Secchi measurements are most useful when used at a lake, reservoir or slow moving river. The Secchi Disk provides an easy, convenient method for measuring how far light penetrates below the water surface determining the limit of visibility of the water, an important factor for the measure of productivity in a lake. The value obtained is directly related to the amount of silt, algae, or total suspended solids in the water. Each half meter of line is marked in black and each meter is marked in red lines.

1. If you are wearing sunglasses, remove them and lower the Secchi Disk into the water at your site in an area shielded from direct sunlight.
2. Lower the disk into the water until it just disappears. You may mark the rope at the water level at this point. Take the reading of depth and note it as "d1".

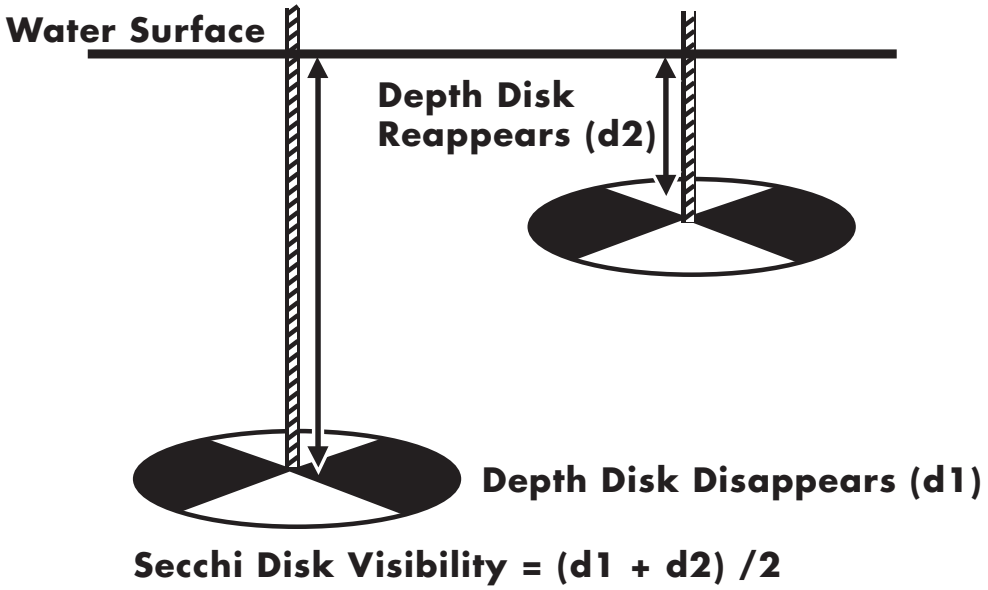
If your Secchi Disk reaches the bottom of your sampling location and is still visible, simply record the depth on the Secchi line and record this value in the Secchi Disk area on the data sheet. Place a "greater than" symbol, >, in front of the value. For example, if your Secchi Disk is on the bottom of the lake or river and the water depth at that point is 2.13 meters the value you write in the box is ">2.13".

3. Drop the Secchi Disk in the water a few centimeters further.
4. Draw it up and note the depth at which it just barely becomes visible. This is "d2".
5. Add d1 and d2.
6. Divide the sum by 2 and record the result on your data sheet. The formula is:

Secchi Disk Visibility = (d1 + d2) /2

Monitoring from a bridge or dock

1. If the secchi line is long enough, lower the secchi disk until the surface of the disk is even with the water surface. Record the distance from that height reference point using the secchi disk line.
2. Lower the disk into the water until it disappears from view. At that point, mark the line at the bridge height reference point with a wooden clothespin.
3. Follow directions as above in part 2 - 6, marking the line with a wooden clothespin at each point.
4. Calculate the average of the last two depths marked (when the disk disappeared and reappeared).
5. Subtract the difference from the water's surface to the bridge height reference point.
6. The remaining value is the secchi disk visibility value you record on the data sheet.



Total Depth

1. To measure total depth with the secchi disk, lower the disk until you see or feel the line go slack. Pull up on the line gently to straighten the line.
2. Read the measured line attached to the disk at the water level. Record the total depth in meters.

Transparency Tube

The transparency tube is used to measure the transparency of lotic systems (running water) from a sample taken from just below the surface. The transparency tube can be used in places where the secchi disk can't.

Safety Considerations

Do not wade into a fast-moving stream or an area of unknown depth. If you cannot sample safely, only record visual observations (clear, cloudy or turbid).

Sample Collection

1. If collection midstream is possible and safe, wade into the middle of the stream or as far from the shoreline as possible, just downstream of the sample location so the substrate is not disturbed.
2. Collect the sample directly into the tube. As an alternative, you may use a large plastic measuring cup, pitcher or bucket. Avoid collecting sediment from the bottom or materials floating on the surface.

Reading Results

1. Hold the tube in shady but open space.Position the tube so that it is shaded by your body. Do not wear sunglasses. (Figure 1)
2. Swirl the water in the tube so that materials do not settle on the bottom, but take care not to produce bubbles.
3. If the black and white pattern (Figure 2) is visible when the tube is completely full, record as "greater than 1.22 meters" (122 cm) if you have a 122 cm tube or "greater than 0.60 meters" if you have a 60 cm tube.
4. If the pattern is not visible, slowly release water from the tube until you can see the black and white pattern at the bottom. Depending upon the design of the tube, release water by opening the clamp at the bottom (Figure 3 following page) or by turning the handle 90 degrees to the side (Figure 4). It may be necessary to swirl the water occasionally to prevent sediments from being sucked down and obscuring the pattern.

Figure 1

Figure 2

Figure 3

Figure 4

5. Note the depth at which the pattern becomes visible and **record as meters**, e.g., "0.61 m," in the "Transparency tube" box under "Core Tests and Measurements" on the River Watch data sheet. **Remember to circle either "greater than" or "=".**

When entering transparency tube measurements convert centimeters to meters.

Care of Transparency Tube

1. Rinse the tube with clear tap water after each use.
2. Protect it from scratches.
3. Fully release the clamp between uses to avoid crimping.
4. Frequently change the location of the clamp on the release-valve tubing.
5. If you put weight on the tube the bottom might crack.

Nitrates

Nitrogen is a nutrient necessary for the growth of all living organisms. In water, nitrogen occurs in many states and combinations with other elements. For maximum data compatibility, CRWN monitors test for nitrate nitrogen (NO_3-). In excess amounts, nitrates can cause an increase in algae growth, which can eventually lead to decreases in dissolved oxygen and subsequent fish kills (as the bacteria associated with the decomposition of organic material consumes oxygen from the water). Nitrates dissolve readily in water and thus serve as an indicator of the possibility of a source of sewage or manure pollution even during dry weather. Sources of nitrates may include human and animal wastes, industrial pollutants, and non-point source pollution runoff from heavily fertilized croplands and lawns. Under certain conditions, high levels of nitrates (10 mg/L or more) in drinking water can become toxic to warm-blooded animals. This level of nitrates in drinking water also has been linked to a serious illness in infants if the water is used in preparation of their formula or otherwise consumed. Nitrates are measured in milligrams per liter (mg/L).

Expected Levels: < 1.0 mg/L to 4 mg/L.

Under some circumstances (i.e., downstream of a wastewater treatment plant or after heavy rainfall) levels can range from 1.0-4.0 mg/L or higher.

Grab sample for nutrients (Nitrates)

1. Standing slightly downstream (water flowing toward you) of the site, rinse your plastic water sample container(s) and cap(s) twice with the water to be tested (collected at approximately one foot below the surface). Review sample collection in the Preparing to Monitor section on page 3.

2. Discard the rinse water on the ground or downstream of your monitoring location so you will not contaminate your sample.

3. Submerge the plastic sample container approximately one foot below the surface of the water with the mouth of the bottle facing down.

4. Once you have reached the ideal sampling depth, turn the container upright and allow the bottle to fill.

5. Avoid disturbing the sediment so you will not collect a sample that does not accurately represent stream conditions.

Wear safety goggles and gloves during this procedure.

Nitrates Test

LaMotte Color Comparator

1. Rinse the test tube and cap twice with the water sample to be tested. Discard water away from monitoring location.
2. Fill one test tube to the 5 mL line with sample water (Figure 1).
3. Without touching the tablet add one nitrate #1 tablet. Cap and mix until tablet disintegrates (Figure 2). Slip the foil cover onto the test tube from the bottom.
4. Without touching the tablet add one nitrate #2 tablet. Cap and mix slipping the foil cover off occasionally to see if the tablet has disintegrated. Wait 10 minutes.
5. Insert Nitrate-Nitrogen Octa-Slide into the Octa-Slide viewer. Insert test tube into Octa-Slide viewer (Figure 3). Match sample color to a color standard (a white background reflecting indirect light may help you determine the exact color).
6. If the sample color lies between two values, record the higher value and circle "less than" on the data sheet. If there is an exact match, record the value and circle "=". Zero should not be recorded as a value due to the detection limits of the test. If it appears to match zero, record as 1mg/L and circle "less that".
7. The waste from this test should be placed in the waste container for proper disposal according to the methods outlined in "Proper Waste Disposal" in the safety section of this manual on page 4. Rinse test tube and cap twice with distilled water. Scrub with test tube brush. Rinse again. Air dry. Store test tube and cap separately.

Figure 1

Figure 2

Figure 3

Nitrate Test
CHEMets® Colorimeter

Safety Information

Read MSDS before performing this test procedure. **Wear safety glasses and disposable gloves.**

Note: Store kit at room temperature and keep color comparator inside kit to ensure color retention until expiration date.

1. Rinse the reaction tube (green screw cap tube) twice with the sample to be tested then fill to the 15 mL mark. *If you expect your site's test results to be greater than 3 mg/L,a dilution may be utilized. **Please see NOTE at end of directions.**

2. Empty the contents of one Zinc Foil Pack into the reaction tube (Figure 1). Cap the reaction tube and shake it vigorously for exactly 2 minutes.

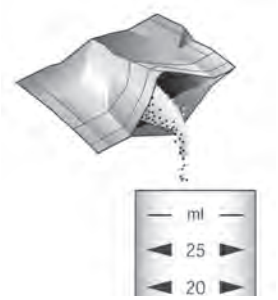


Figure 1

3. Add 10 drops of A-6901 Acidifier Solution to the empty 25 mL sample cup (Figure 2).

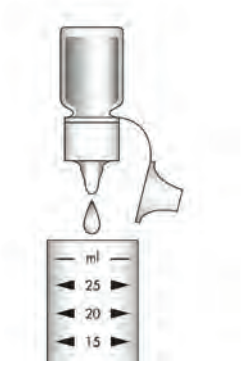


Figure 2

4. Pour the treated sample from the reaction tube into the sample cup, being careful not to transfer the solid material to the sample cup.

NOTE: Getting a small amount of solid material into the sample cup will not affect test results.

5. Place the CHEMet glass ampoule in the sample cup. Snap the tip by gently pressing the ampoule against the side of the cup (Figure 3). The ampoule will fill leaving a small bubble to facilitate mixing.

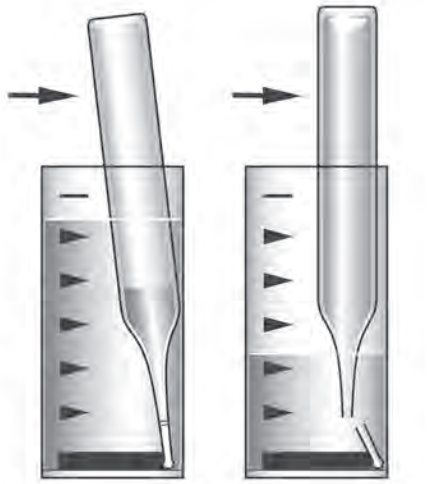


Figure 3

6. Mix the contents of the ampoule by inverting it several times, allowing the bubble to travel from end to end. Dry the ampoule and wait 10 minutes for color development.

7. Hold the comparator box in a nearly horizontal position while standing directly beneath a source of light. Place the glass test ampoule between the color standards moving it from left to right along the comparator until the best color match is found.

8. If the ampoule color is darker than 3 mg/L, repeat the test using a diluted sample. Follow steps 11 and 12, then start at step 1 again. **Please see NOTE at end of directions.**

9. If the match is between two color standards, choose the color the reacted sample most closely resembles and report "=" that value. If no color match is observed and the sample is lighter in color than 0.25 mg/L, report "<" 0.25 mg/L.

10. Record the test result in mg/L in the "nitrate nitrogen" section of your data sheet. If a diluted test was performed, multiply results by the appropriate dilution factor. **See NOTE at end of directions.**

11. Empty all liquid contents (including solid precipitate) into your CHEMets nitrate test waste bottle. DO NOT PLACE IN THE WASTE BOTTLE CONTAINING WASTE PRODUCTS FROM YOUR OTHER TESTS*. Rinse the sample cup and the reaction tube with distilled water and pour into the nitrate test waste bottle.

12. Thoroughly wrap glass ampoule in paper towel or other disposable absorbent material. Place in sealed plastic bag. Discard in trash. Do not pour contents of your CHEMets nitrate test waste bottle down the sink. Keep the bottle at room temperature until your annual CRWN staff QC visit. Staff will collect your CHEMets nitrate waste for proper disposal.

* Mixing the waste products from the DO test with the CHEMets nitrate test may create gas products with an unpleasant odor and/or could potentially chemically react. Please keep nitrate waste in a separate sealed waste bottle.

NOTE:At certain times of the year, values at some sites may be greater than the detection limit of 3 mg/L. A dilution may be warranted if the previous month's or this test's results were greater than 3 mg/L. The previous year's test results from the month may also provide guidance about whether to use a diluted sample.

- If the previous month's results were greater than 2, but less than 6 mg/L rinse the reaction tube twice with the sample then fill to the 7.5 mL mark. **Add distilled water to the 15 mL mark. Proceed with step 2. Multiply results by 2.**

- If the previous month's results were greater than 6, but less than 10 mg/L rinse the reaction tube twice with the sample then fill to the 5 mL mark. **Add distilled water to the 15 mL mark. Proceed with step 2. Multiply results by 3.**

Notes

Streamflow

Estimation:

To estimate stream flow severity use previous observations as comparisons or note high-water marks on stream banks, etc. This result is recorded in "Field Observations". Lake sites should record "N/A".

Calculation:

To calculate stream flow in cubic feet per second (cfs), you can multiply width (feet) by depth (feet) by velocity (feet/second).

Use the following instructions for each section:

Width of stream: Measure across the stream where the riffle runs.

Depth of stream: Measure the depth at regular intervals across the stream at the riffle. Average the measurements.

Average velocity (in feet/second): Measure off 10 feet in the stream, parallel to the current and including the sample area. Choose a spot where a float will not hit rocks or other obstructions. Have one person stand at the upstream end of the 10 feet and drop a floating object (you can use s ping-pong ball or an empty plastic film container) into the current. Another person should stand at the downstream end and note the time it takes the float to travel the 10 feet. If you are sampling by yourself, a small dry stick or orange peel may be used to note the float time. Repeat the process three times and average the time. Divide distance (10 feet) by the average time. Record velocity in feet per second.

Trial 1 time + Trial 2 time + Trial 3 time / 3 = Average time

Distance (10 feet) / Average time = Average velocity ft/sec

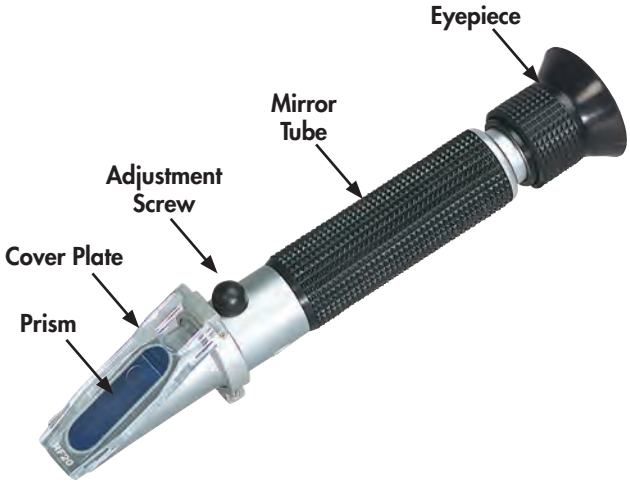
Note: As a general safety rule, never try to measure stream flow in swiftly moving water or in water that is more than knee-deep. Use common sense--it is always better to estimate than to endanger yourself or others!!!

Notes

Coastal Measurements
Salinity

In seawater or brackish water Total dissolved solids (TDS) concentration or specific conductance is approximated by the salinity of the water. The term salinity is typically used as an indication of how salty the water is in bays and estuaries. Strictly speaking, salinity describes the relative amounts of certain salts, especially chloride, that are in the same ratio to each other as they occur in seawater.

A salinity refractometer is provided for volunteers who monitor tidally influenced coastal areas. The instrument measures the refractive index of the sample and displays the result in parts per thousand (0/00) and specific gravity (d 20/20).



Calibration or Zero Adjustment

1. Place a few drops of distilled water on the measurement prism. Ensure that enough distilled water is added to cover the entire prism.
2. Close the cover plate and rotate the adjusting screw so that the light/dark boundary line (the shadow-line) evens up with the zero line.
3. After the zero adjustment, clean the prism with the soft cloth provided with your refractometer.

Sample Preparation and Reading

1. To take a reading, place a few drops of a sample liquid on the measurement prism. Ensure that enough solution is added to cover the entire prism.
2. Close the prism so that the liquid spreads across the entire surface of the prism without air bubbles or dry spots. Allow the sample to remain on the prism for approximately 30 seconds.

3. Hold the instrument under and perpendicular to a light source and look through the eyepiece. The salinity concentration is determined by the intersection of the boundary of the light and dark fields (the shadow line) on the printed scale. The left side of the scale indicates the specific gravity and the right side, parts per thousand.

If the scale appears out of focus, the eyepiece may be adjusted by rotating the knurled portion. The instrument also features an eye guard to prevent stray light from entering the eyepiece and causing reflections. It may be necessary to adjust the position of the light source to maximize the contrast of the shadow-line.

4. Read the results from the right side of the scale and record as "Salinity" in parts per thousand under "Additional Tests Conducted" in the "Coastal Area Salinity Tests". The Salinity Refractometer is equipped with automatic temperature correction, but you may record "Sample temp." also.

5. Once a reading has been taken, wipe the instrument dry with a clean cloth (do not wash or rinse) and place in the supplied plastic case. Store the instrument in a safe, dry environment.

Tide Stage

You should leave this box blank unless the body of water you are sampling is on the Gulf coast and influenced by the tides. Tidal conditions can greatly influence salinity levels. Record a value of 3 if the tide is in a slack stage (neither rising nor falling).

Escherichia coli *(E. coli)*

E. coli is a species of fecal coliform bacteria that is specific to fecal material from humans and other warm-blooded animals. The Environmental Protection Agency (EPA) recommends *E. coli* as the best indicator of health risk from water contact in freshwater recreational waters. The presence of *E. coli* in water bodies, especially at elevated levels, indicates the possible presence of disease-causing bacteria, viruses and protozoans. Natural bacteria levels in streams can vary greatly and rain events usually increase the bacteria levels found in the water. This is why it is advisable to stay out of the water after rain events in the watershed. *E. coli* is measured in number of colony-forming units (cfu's) /100 mL.

The EPA established contact recreation water quality standard single grab sample for E. coli bacteria is 394 cfu's / 100 mL.

Coliscan Easygel™ Procedure

Plug in incubator prior to sampling to allow temperature to stabilize. Remove Coliscan Easygel™ from freezer at least one hour prior to plating of samples.

Whirl-Pak® sampling for the E. coli test

Allow incubator temperature to stabilize and thaw Coliscan Easygel™ prior to sampling. Review sample collection in Preparing to Monitor Section on page 3. Collect one Whirl-Pak® sample for each site.

The sample bags for this test have been sterilized. Therefore, it is important that you do not touch the inside of the bag. If you accidentally contaminate the sterile bag by touching the lip of the perforation or the inside of the container, discard the Whirl-Pak® and resample.

Do not rinse the Whirl-Pak® bag with sample water!

1. Pull off the top of the Whirl-Pak® using the perforated line. Do not touch the inside of the bag. See Figure 1.
2. Gently pull the mouth of the bag apart with the white tabs, again making sure not to touch the top or the inside of the bag. See Figure 2.

Figure 1

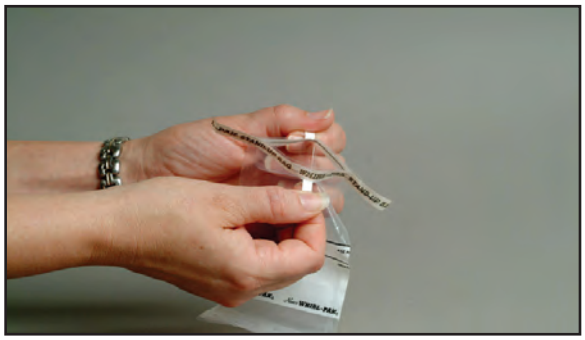


Figure 2

3. Face upstream or the direction from which the water flows in the center of flow. Collect your sample from a depth of one foot (if your sample site has less than two feet of water, collect your sample at the midpoint of the water column). Be careful not to disturb the substrate before or during sample collection and avoid contamination by surface scums.

Important Note!!

Bacteria may begin replicating within ten minutes. Water samples should be kept on ice until plated (up to six hours).

4. With one swift motion, immerse the bag in the water, fill (leaving at least 1/2 inch air space at the top of the bag). Make sure the water is above the 100 mL line. Draw the bag out of the water, and quickly flip twice to secure. Twist the ties to close.
5. If you have another test site, be sure to clearly mark on each bag the name of each sample location and time collected.
6. Place the Whirl-Pak® bag in a cooler with ice for transport.

Plating and Incubating

1. Shake Whirl-Pak® bag vigorously, then carefully open without touching the lip of the bag. Bacteria tend to clump together so it's important to distribute the bacteria evenly throughout the sample. Use two disposable pipettes to simultaneously draw the appropriate sample size from the Whirl-Pak® container (1 mL, 3 mL, or 5 mL) (Figure 3). Deposit sample into Coliscan Easygel™ bottle, cap, and swirl GENTLY (Figure 4).

Figure 3

Figure 4

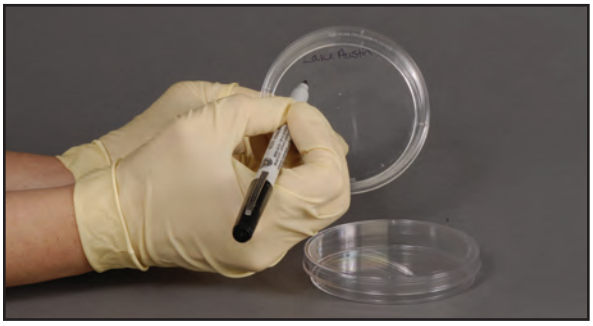


Figure 5

Figure 6

Two plated samples should produce similar results, and, like the dissolved oxygen test, the duplicates reinforce the validity of the findings. If significant rain has occurred in the past 24 hours, or if bacteria readings at your site have historically been high, plate 1 mL or 3 mL samples. Otherwise, 2-5 mL samples should be plated.

2. Using a permanent pen, label outside of each petri dish with the following information: Site name, date, volume of sample, and time **sample is poured** into the petri dish. (Figure 5). Then pour the prepared sample (the Easygel solution with the stream water mixed in) slowly into the petri dish (Figure 6).
3. Swirl gently until there is a smooth coating of solution across the bottom of the petri dish. CRWN supplies *E. coli* monitors with an incubator and thermometer. Make sure the temperature is holding at 35° C.
4. Place the petri dishes on a level location out of direct sunlight for 45 minutes, until gelled, then place in the incubator. If incubator is on a level surface, petri dishes may be immediately placed into the incubator. It's important that no sloshing or swirling occur after the plates have begun to gel.
5. **Colonies should be completely developed at 24 hours. Plates should be counted at this time.**
6. Count all the colonies with dark blue or dark purple centers (Use a light or magnifying glass if necessary to confirm the color intensity) and record the results on the CRWN data sheet (see example results calculation on following page). Do not count pin-sized colonies. Call CRWN for assistance if there is uncertainty in interpreting results.
7. *E. coli* are recorded as cfu's/100 mL (or colony-forming units per 100 mL) of water. Therefore, multiply the sample size by the appropriate dilution factor to determine how many cfu's/100 mL your results represent. Record the product on the data sheet under "*E. coli* bacteria." Record in cfu's/100 mL.
8. If there are more than 200 colonies per plate, record as TNTC (too numerous to count).

Use the following formula to calculate colonies/100mL:

Reading (colonies counted) x (dilution factor*) = E. coli **colonies/*dilution factors:** 5 mL sample dilution factor = 20

3 mL sample dilution factor = 33.3

1 mL sample dilution factor = 100

Example:

Two 5 mL samples were drawn from the water sample. After incubation, 8 E. coli colonies were counted on one petri dish and 11 E. coli colonies on the other petri dish. Calculate results like the sample below:

Reading #1:

sample size 5 mL–8 (colonies counted) x 20 (dilution factor) = 160 cfu's/100mL*

Reading #2:

sample size 5 mL–11 (colonies counted) x 20 (dilution factor) = 220 cfu's/100mL*

9. Dispose of the bacteria-containing petri dishes by placing about one teaspoon of bleach or alcohol onto the surface of the medium of each plate. Allow to sit at least five minutes, then pour off excess. Place in a watertight bag, seal and discard in trash.

NOTE: If plates are to be retained for a quality assurance visit or for count verification, DO NOT USE BLEACH! Use alcohol instead to stop the culture process but keep the distinct colonies intact. Plates may then be placed in a water tight bag, and stored in the freezer until they can be reviewed. After review, the plates may be disposed of as above.

10. WASH HANDS AFTER HANDLING SAMPLES AND PLATES.
11. When computing average cfu's, round the result to the nearest whole number.

E.coli **Incubator tips**

Location: The location of the incubator is important to successful operation. A room temperature from 70° to 80° F is ideal, and fresh air without drafts is necessary. Be sure no direct sunlight strikes the incubator and that it is level. A consistent room temperature within a few degrees is preferable.

Operation: Turn adjusting screw counter-clockwise to increase temperature or clockwise to decrease temperature. Tighten wing nut to secure the setting. The light will come on when the heat is on. After each temperature adjustment allow ample time for temperature to stabilize. Do not bother the thermostat unless it is absolutely necessary. The incubator may be affected if the thermostat is tampered with excessively. Allow the incubator to operate for at least 1/2 day to stabilize the setting before incubation time begins. If the incubator does not heat, check to ensure that all connections have been made properly.

Field Observations

In addition to chemical and biological tests, field notes and general observations about your site help track the water quality of your sampling location. It is important that the physical condition of your site is recorded and communicated to CRWN staff each time you monitor. You should always be aware of any potential impact on water quality in your area.

Examine the water at your site to determine the characteristics described on your data sheet under "Field Observations". Choose all descriptors that apply to your location for each category (water color, water clarity, surface and odor). There is additional space for comments on the data sheet.

Flow Severity – See table below. Once you become familiar with the flow conditions at your sampling point, assess your site, and record the estimated flow relative to the "normal" conditions. You may also calculate flow according to the formula provided in the "Additional Tests" section of the data sheet. (See "Streamflow") **Flow is not applicable on a lake or reservoir and should not be recorded.**

Table: Flow Severity Values

Severity Value	Description
1 No Flow	Situations where the stream has water visible in isolated pools. There should be no obvious shallow subsurface flow in sand or gravel beds between isolated pools. No flow not only applies to streams with pools, it also applies to long reaches of bayous and streams that may have water from bank to bank but have no detectable flow.
2 Low Flow	Use a stick or other light object to verify the direction of water movement. Make sure the movement is downstream and not the effect of wind. What is low for one stream could be high for another.
3 Normal Flow	Normal is highly dependent on the stream. Like low flow, what is normal for one could be high or low for another stream.
4 Flood Flow	Flows that leave the confines of the normal stream channel and move out on to the flood plain (either side of the stream).
5 High Flow	Flows that leave the normal stream channel but stay within the stream banks.
6 Dry	Completely dry with no visible pools.

Algae cover – Look first at the water surface. Next, assess the algae coverage on the substrate. (The substrate is the bottom of the stream or lake.) Estimate the total coverage on substrate and surface by imagining a quadrant placed over the immediate monitoring area. If you cannot see the substrate, you may note this in the comment section. Don't mistake aquatic plants for algae. Aquatic macrophytes, plants with vascular tissue, have roots, stems, and leaves. Any examples observed should be included in the comments section.

Apparent Water Color (in stream) – View the water at your site in its natural setting, and select the most appropriate choice. It may help as a reference to compare the apparent water color to the surrounding vegetation (especially when distinguishing between "light green" and "dark green").

Actual Water Color – Collect a water sample in a clean glass beaker and view it against a white background. Record the most appropriate choice.

Water Clarity – Water that is cloudy will typically appear milky. Turbid water will appear as green or brownish murky water. Record 1 if the water is clear, 2 if the water is cloudy, (not uniformly turbid) and 3 if the water is very turbid. The inverse of turbidity is transparency, which may also be measured using a secchi disk or transparency tube. (See Transparency section).

Water Surface – Select the most predominant water surface condition that applies to your site. If more than one descriptor is evident note that in the "Comments" section. For instance, there may be scum (small particles of decaying matter, debris or pollen) and larger pieces of debris overall on the surface and there may be a sheen or foam near the shoreline or on the edges of the stream.

Water Conditions - Although this parameter is intended primarily for lakes, ponds and bays, you can record a value if you are sampling a river or creek. For example, if you are sampling in a riffle, you may want to write a value of 2 or 3 for ripples or waves. Increased aeration caused by ripples, rapids and waves can also increase DO levels in surrounding waters.

Water Odor - When you determine actual water color in the beaker, check water odor by wafting your hand over the sample towards you.

NOTE: DO NOT DO THE SNIFF TEST IF THERE IS A STRONG CHEMICAL ODOR!

Present Weather - Report a value of 1 if the sky is completely clear. Write a value of 2 if there are clouds, but you can still see some blue sky. If you cannot see any blue between the clouds record a value of 3. If it is raining, record a value of 4.

Days since last significant precipitation (runoff) – Record the date of the last significant precipitation upstream of your site in your watershed. This information is extremely useful when analyzing your data. It can be used to determine if nonpoint source pollution runoff, associated with significant rain events, is adversely affecting the water quality at your site.

Rainfall in Past Three Days – Record the amount of rain, in inches, which has fallen in your watershed or upstream of your site for the past three days preceding your monitoring event. Log rainfall dates (see above) and amounts as they occur in a journal. You may also be able to reference the nearest hydromet station at http://hydromet.lcra.org/index2.shtml.

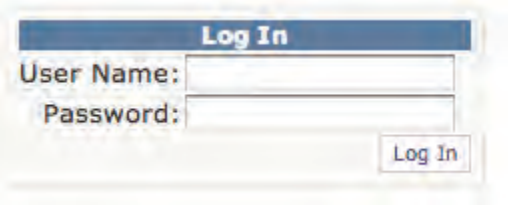
Comments - Be sure to record anything that you notice at your site that can influence the water quality, i.e., animal waste, a recent fish kill, unusually heavy rains, lack of rain, etc. **This is the location where you should record any additional information like the occurrence of aquatic plants, macroinvertebrates, fish or other biological observations. You may also include communiqué to CRWN staff in this section.**

Notes

DATA MANAGEMENT

Online Data Entry

After all the data has been documented, data can be entered online at the CRWN website. Staff will provide each monitor with a user name and password which can be written in the boxes below.



- To enter data go to:
  http://www.lcra.org/water/quality/crwn/index.html
- Enter your login and password. Please contact CRWN staff if you need this information.
- You may want to download and/or print the directions and frequently asked questions because after logging in, several minutes of inactivity will cause the system to "time-out" and data will need to be re-entered.
- It is best to use the tab key to advance from one section to the next.

Required fields are highlighted in red below. These fields must be complete before data can be submitted. A yellow * indicates there is an error.

Monitors: When logged in, you are automatically associated with the monitoring event and do not need to include your name here. If more than one certified monitor took part in monitoring, add their complete name here. Separate additional participating certified monitors with a comma and space.

Site Name: Scroll through the alphabetical site name list and click on the site name that corresponds to the data you are entering.

Sample Date: Click on the calendar and then select the date. The date will automatically populate.

Sample Time: Must be entered in military time (HH:MM). For example 8:35 a.m. would be 08:35 and 1:45 p.m. would be 13:45.

Sample Depth: Must be entered in meters. NOTE: Metric conversions may be found at http://www.onlineconversion.com/. If the site is dry, enter zero.

Total Depth: Must be entered in meters. If the site is dry, enter zero.

Meter Calibration Log: Scroll to yes or no to answer this question. If you use a pH or conductivity meter, enter calibration values. These fields do not allow text. If you have a comment or a problem calibrating, note this in the comments section.

Reagents Expired: Select yes or no. This is a very important field to answer. List any expired supplies or any other supply needs. Items will be provided as requested in this section.

Core Tests and Measurements:

Air Temperature: Record in degrees Celsius.

Water Temperature: Record in degrees Celsius.

Dissolved Oxygen average: You must enter two values from different fixed sample bottles that are within 0.5 mg/L of each other, as well as the average of the values. If the first two values are not within 0.5 mg/L, enter the third titration run from the first of the previously fixed samples. If the range between the two fixed sample bottles was still more than 0.5 mg/L, enter the fourth titration run on the remaining fixed sample bottle. If the results from the two fixed sample bottles are within 0.5 mg/L average all values that are within 0.5 mg/L. If the four readings from the two sample bottles are still greater than 0.5 mg/L apart, do not average the results. Average to no more than two places past the decimal by rounding if necessary.

Specific Conductance: Record the specific conductance reading from the TDS Tester or EC Tester.

pH: After entering the value, select if you used a comparator or meter to obtain the results.

Transparency Tube and Secchi Disk: Enter in meters. Don't forget to enter =, Less Than, or Greater Than.

Nitrate Nitrogen: Select = or Less Than. Remember that this test's detect limits are not sensitive enough to report =0; instead if there is no color change record the result as Less Than 1.

Flow: Enter the value for CFS. Enter how value was determined (gage site data or on site assessment) in the comments section. Or skip this section if you do not collect flow.

Field Observations: You can simply enter the number for each field and then tab to advance to the next field.

Flow Severity: Enter as dry or no flow if the water is nonexistent or too stagnant to monitor. Leave blank if site is on a lake or reservoir.

Algae Cover: Be sure to assess both surface and substrate algae for the combined percent algae cover. Include additional information in the comments section if needed.

Present Weather: Considered cloudy if more than 10% of the sky is cloudy.

Days since Last Significant Rainfall: Only enter numerical values such as: 3, .75, 2. Additional information such as 7+ or >10, will not be accepted. If it was raining while sampling, enter 0 for days since last significant rainfall, and record present weather as rain. Visit http://hydromet.lcra.org/ to view historical rainfall levels throughout the basin. If you are not sure please estimate the number of days and explain in the comments section.

Inches of Rainfall: Visit http://hydromet.lcra.org for rainfall information.

Comments: Please add any comments from your data sheet here. Enter additional observations for water surface here.

Minutes Sampling and Traveling: Make sure to record the number of minutes, not hours.

Miles Traveled: Total roundtrip miles per monitor/s vehicles. If you traveled less than one mile enter 1 mile. The system will not accept a value less than one.

Number of Participants: Include certified and noncertified participants.

E.coli: Enter all the information as you would normally on the data sheet. If the value is too numerous to count (200 colonies), enter a value of 4000 (value for a 5 mL sample is the default value in cfu/100 mL) and enter TNTC reference in the comments section. Average and round the result to the nearest whole number to remove decimals.

Two photographs may also be uploaded for each data sheet. The photo must be 640X480 or smaller and be in jpeg format. Refer to FAQ's for more directions.

Before submitting your data sheet make sure to review all the information entered for accuracy. CRWN staff will review the data before final submittal to the online database.

- Keep your data sheets. If entering data online, you no longer need to send in a copy of your data sheet. CRWN staff will contact you with any questions regarding the data.

If you are unable to enter data online, we will still accept the data sheet submitted by mail or fax to 512-473-3379. If you choose the mail option, you may request carbon copy data sheets and postage paid envelopes from your support staff.

COLORADO RIVER WATCH NETWORK

DATA SHEET

SUBMIT ONLINE AT: https://crwn.lcra.org/data_entry/
OR SEND TO: CRWN at LCRA
P.O. Box 220
Austin, TX 78767-0220
1-800-776-5272

MONITOR NAME(S) (print): _____ CRWN SITE # _____

SITE NAME: _____ SAMPLE DATE: _____

SAMPLE TIME _____:_____ (military) SAMPLE DEPTH _____._____ *not total depth* (meters) TOTAL DEPTH _____._____ (meters) TCEQ ID #: _____

Meter Calibration Log: Store and calibrate standard at room temperature.
Calibrated within 24 hours of sampling? ❑ Yes ❑ No

Meter Type	Standard Value	Initial Meter Reading	Post Test Reading
Conductivity			
pH 7.0			

Core Tests and Measurements:

☐ AIR TEMPERATURE (°C)

☐ WATER TEMPERATURE (°C)

☐ AVERAGE DISSOLVED OXYGEN (all values within 0.5 mg/L)
1st titration _____ 2nd titration _____
3rd titration _____ 4th titration _____

☐ SPECIFIC CONDUCTANCE ❑ TDS Tester 3 ❑ EC Tester

☐ pH (standard units) ❑ pH tester 2 ❑ comparator

greater than / = **(circle one)** ☐ Transparency Tube (meters)

greater than / = **(circle one)** ☐ Secchi Depth (meters)

Field Observations:

☐ FLOW SEVERITY (N/A for lake sites) 1-no flow 2-low 3-normal 4-flood 5-high 6-dry

☐ ALGAE COVER: 1-absent 2-rare (<25%) 3-common (26-50%) 4-abundant (51-75%) 5-dominant (>75%)

☐ APPARENT WATER COLOR: (in stream) 1-no color 2-light green 3-dark green 4-tan 5-red 6-green/brown 7-black

☐ ACTUAL WATER COLOR: (in beaker) 1-no color 2-light green 3-dark green 4-tan 5-red 6-green/brown 7-black

☐ WATER CLARITY: 1-clear 2-cloudy 3-turbid

☐ WATER SURFACE: 1-clear 2-scum 3-foam 4-debris 5-sheen

☐ WATER CONDITIONS: 1-calm 2-ripples 3-waves 4-white caps

☐ WATER ODOR: 1-none 2-oil 3-acrid (pungent) 4-sewage 5-rotten egg 6-fishy 7-musky

☐ PRESENT WEATHER: 1-clear 2-cloudy 3-overcast 4-rain

☐ DAYS since last significant precipation (runoff)

☐ INCHES of rainfall accumulation (in last 3 days)

Reagents: Are any reagents about to expire? ❑ Yes ❑ No
List needed supplies: _____

Additional Tests Conducted:

1. Nitrate Nitrogen: **(circle one)** less than / = ☐ mg/L

2. Flow:
Width_____ft. X Depth_____ft. X Avg. velocity _____(ft/sec)=_____cfs

(1)_____secs + (2)_____secs + (3)_____secs/3=_____Avg.Time

Distance (10 ft) Avg. Time = Avg. velocity in ft./sec.

Coastal Area Salinity Tests:

1 . 0 __ __ __ = initial reading - . 0 0 1 0 Water temp. = _____°C

__ . __ __ __ __ (+ or -) __ __ correction factor Table 210:I

1 . 0 __ __ __ = corrected density, nd salinity in Table 210:II

_____ Sample temp. (°C) _____ Salinity (ppt)

☐ TIDE STAGE: 1-low 2-failing 3-slack 4-rising 5-high

Comments, Supply Needs, Field Observations:

_____
_____
_____
_____
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_____
_____

***E. coli* bacteria** (Coliscan Easygel unless otherwise specified.)

Reading #1: Sample size _____ mL (colonies counted) _____x _____ (dilution factor*) = ☐ cfu/100mL ☐ average *E. coli*

Reading #2: Sample size _____ mL (colonies counted) _____ x _____ (dilution factor*) = ☐ cfu/100mL

*dilution factor = 100 divided by volume of sample processed (e.g. 1 mL sample = dilution factor 100, 5 mL sample = dilution factor 20)

☐ MINUTES sampling and traveling ☐ MILES traveled (round trip) ☐ Number of participants

Two photographs can be uploaded with each data sheet entered online. All fields IN RED are required fields.

_____ CERTIFIED MONITOR'S SIGNATURE _____ DATE _____ DATA ENTERED BY (CRWN STAFF) _____ DATE

Document Revised 12/2011

Glossary

Calibration - Fine-tuning of an instrument to meet a specific standard value. This helps to ensure data accuracy.

Comparator - An instrument with a calibrated color wheel used to determine the concentration of various parameters.

Concentration - Amount of material dissolved in a solution; a common unit is mg/L (milligrams of dissolved material in a liter of solution).

Dilution - Process of adding a known amount of a solvent (usually water) to another solution to make it less concentrated. This is often done when working with *E.coli* samples to ensure proper and readable colony development.

Distilled Water - Dissolved materials are removed from water through a purification process so as not to interfere with chemical reactions. Monitors use distilled water for all rinsing needs.

mg/L - milligrams per liter; see CONCENTRATION.

Precipitate - Floc: material which is insoluble in water and will settle out over time.

Productivity - The time rate of production of biomass for a given group of organisms; essentially the net growth rate of organisms.

Reagent - Chemical added to a sample; may be in tablet or liquid form.

Standard - A premixed solution with a known amount of material to be tested; can be used for calibration but also to check monitoring accuracy.

Substrate - Attachment surface or bottom material in which organisms can attach or live-within; such as rock substrate or sand or muck substrate or woody debris or living macrophytes.

Titrant - A solution of known strength or concentration; used in titration.

Titration - A process whereby a solution of known strength (titrant) is added to a certain volume of treated sample containing an indicator. A color change shows when the reaction is complete.

Titrator - An instrument, usually a calibrated cylinder (tube-form), used in titration to measure the amount of titrant being added to the sample.

References

American Public Health Association. Standard Methods for the Examination of Water and Wastewater. 16th ed. Baltimore; Port City Press, 1985

LaMotte Company. The Monitor's Handbook. Chestertown, MD; LaMotte Co., 1992.
www.lamotte.com

Texas Stream Team. Water Quality Monitoring Manual. Austin, TX; Texas Natural Resources Conservation Commission, 2010.

Mitchell, Mark K. and William B. Stapp. Field Manual for Water Quality Monitoring. Dexter, MI; Thomson-Shore, 1988.

United States Environmental Protection Agency, Office of Water, Volunteer Stream Monitoring: A Methods Manual. 1997

Wetzel, Robert G. Limnology. Philadelphia; W.B. Saunders Co., 1975.

Other Resources

Field Manual for Water Quality Monitoring: An Environmental Education Program for Schools.
by Mark K. Mitchell, et al (Paperback - January 2000) readily available from Amazon.com, etc.

http://waterontheweb.org/ a Website offering online primers in water quality topics such as instrumentation, lake ecology, stream ecology, watersheds and GIS.

Water Quality Factors page hosted by HACH labs, geared for teachers and students. Simple descriptions of water quality parameters and what they mean at the following address:
http://www.hach.com/h2ou/h2wtrqual.htm

Water Quality: Management of a Natural Resource by James Perry and Elizabeth Vanderklein 1996. Blackwell Scientific, Cambridge, MA.

Sources for Test Kits

LaMotte Company, P.O. Box 329 Chestertown MD 21620
Toll Free 1-800-344-3100
www.lamotte.com

Hach Company, P.O. Box 389 Loveland CO 80539
Toll Free 1-800-227-4224
www.hach.com

Lower Colorado River Authority
P.O. Box 220
Austin, Texas 78767-0220
1-800-776-5272
www.lcra.org

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