6th Annual
Texas Hydro~Geo Workshop 2019

With hands-on experience in real-world field settings!
NSS membership offers worldwide caver camaraderie, the NSS Journal of Cave and Karst Studies, and more. 

we study

visit us at caves.org
Welcome to the 2019 Texas Hydro~Geo Workshop

The Texas Hydro~Geo Workshop was created to bring students, educators, and practitioners together in a field setting as a hands-on learning experience. Participants will have the opportunity to explore many different techniques for the collection and analysis of data from soil, rock, and water media. The workshop is structured to provide participants with the opportunity to work with leading researchers and practitioners from across the state and nation. Please make sure that you take full advantage of this unique, valuable opportunity.

This event has been made possible by the great generosity of our host, Tom Summers, owner of Cave Without a Name and his wonderful staff, including Jesse Hillger, Mike Burrell, and Mike Cunningham. They are stewards of an outstanding natural treasure – Cave Without a Name. Please treat the cave and property with great respect. We practice a “Leave No Trace” ethic for the event.

The Workshop is not possible without the many countless hours contributed by volunteers from the geoscience and environmental science and caving communities.

In addition, we must also thank our many sponsors that have stepped up with both financial support and contributions of in-kind services and equipment. Their involvement has provided a much richer and expanded experience while helping to keep costs low.

We have been amazed at the continued interest and response for the workshop; participants travel from across Texas and surrounding states, as well as internationally. We hope you find the event educational and fun. Make sure that you have an enjoyable and safe experience, and thank you for coming.

Geary M. Schindel, P.G.                                   Mike Harris
Co-Chair                                               Co-Chair
The Hydro~Geo Workshop Section                          The Hydro~Geo Workshop Section
President, National Speleological Society                Chair, Bexar Grotto
National Speleological Society                          National Speleological Society
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Events

Registration opens ..................................................................................................................Friday 4 pm
Module Sign-up ....................................................................................................................Friday 6 pm
Socializing, Lightening Talks (in the Pavilion) .................................................................Friday, 8 pm
Modules ...............................................................................................................................Saturday, 9 am-5 pm
  Sunday, 9 am-noon
Field Lunch Competition (in the Pavilion) .........................................................................Saturday, 12-1 pm
Rock Identification Contest (in the Pavilion) .................................................................Saturday 11-12, 1-2 pm
Group Photo (at the Cave Entrance) ...................................................................................Saturday, 6:47 pm
Yodeling & Hog Calling Competition (in the Cave) ............................................................Saturday, 7 pm
Keynote, Dr. Ralph O. Ewers, Ph.D (in the Cave) .............................................................Saturday, 7 pm
Lightening Talks (in the Pavilion) .....................................................................................Saturday, 9-11 pm
Workshop Ends ...................................................................................................................Sunday, noon
Dr. Ralph O. Ewers, Ph.D

Dr. Ewers obtained his bachelor’s and master’s degrees from the University of Cincinnati, and his doctoral degree from McMaster University in Ontario, Canada. He served as Professor Of Geology and Hydrogeology at Eastern Kentucky University, where he is Emeritus Professor, and at the University of Kentucky. For the past 30 years, he has engaged in consulting with 30 of his past and active graduate students. He has consulted for fortune 500 corporations, government agencies, and private citizens.

His research interests include the genesis of solution conduits in karst aquifers and their implications for contaminant transport. This work was recognized by the Geological Society of America with its E. B. Burwell Award in 1986. With his graduate students, he pioneered the use of digital data loggers and innovative tracing techniques in karst aquifer investigations. Dr. Ewers’ research and consulting experience has taken him throughout most of eastern North America, including the Edwards Aquifer region, the Canadian northwest, the Caribbean, the British Isles, and Europe. He has studied karst aquifers that range from alpine terranes to the tropics. The National Speleological Society elected him a Fellow and awarded him its Certificate of Merit in 1968 and Honorary Member, its highest award in 2019. He is also a Fellow of the Geological Society of America.

Contests

Field Lunch Contest (Pavilion at noon)

Contest for the best field lunch based on a number of criteria including nutrition, taste, preservation, presentation, and the whim of the judges. Please try to make it field applicable – Spartan may win over a French presentation. A prize will be presented to the winner (and the right to help serve breakfast on Sunday). Winner announced after the Keynote address. Noon - 1pm in the Pavilion.

Rock Identification Contest

Contestants identify a series of rocks. The winner – whomever identifies the most rocks in the least amount of time – will be awarded a prize and bragging rights. Winner announced after the Keynote address. Location J, from 11-12, 2-3, and 4-5.

Yodeling and Hog Calling Contest

This contest is back by popular demand. The winner(s) of the contest will be awarded a prize along with one year bragging rights as the Champion Workshop hog caller or yodeler. The Contest will follow the Keynote Speaker in the cave.
### Modules In Alphabetical Order

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Vendors/Exhibitors

Be sure to visit various vendors and displays
Bat Conservation International
Eureka Water Probes
ExLog - Excellence Logging
National Speleology Society

Check out Cave Without A Name's Mineral and Gift Shop. Store hours: 10 am - 5 pm

Steering Committee

Geary Schindel  Edwards Aquifer Authority
Mike Harris    Bexar Grotto of the NSS
Tom Summers    Cave Without A Name
Mike Burrell    Cave Without A Name
Jesse Chadwick Edwards Aquifer Authority
Alf Hawkins    Environmental Geophysics Associates
Brian Smith    Barton Springs Edwards Aquifer GCD
Calvin Alexander University of Minnesota
Eric Holman    Office of Homeland Security
Eric Wolff     DNA Geosciences, Inc.
Jack Sackrider Westward Environmental, Inc.
Jim Major      Terracon Environmental
Joe Yeldeeman  Baylor University
Kevin Bryant   Terracon Environmental
Kevin Urbanczyk Sul Ross University
Marcus Gary    Edwards Aquifer Authority, UT Austin
Mark Dobson    DNA Geosciences, Inc.
Mike Cheng     UT Rio Grande Valley
Mustafa Saribudak Environmental Geophysics Assoc.
Ron Green      Southwest Research Associates
Sriram Madabhushi Booz Allen Hamilton
Yongli Gao     UT San Antonio Center for Water Research
Important Information

Safety  Your safety is our most serious concern, and we have a Module specifically on Field Safety; however, you are responsible for your own safety and wellbeing while at the workshop. For those not familiar with the site, Cave Without A Name is located in the Texas Hill Country, and most of the property is undeveloped and maintained as a wildscape. Be aware of your surroundings and avoid hazardous plants or animals. Do not walk around at night without a flashlight. Note the location of the First Aid Station (H) on the map (page 18). The station is continually operated by Eric Holman.

Fire Ants  The pest that you are most likely to come across is fire ants. These imported beauties are very common and well named. Their sting burns like touching a hot poker and can ruin your day. Please watch where you are standing and observe your feet often. Anything that looks like an ant mound is a fire ant mound – give them plenty of room and don’t disturb them. To prevent potential bites, don’t store food in your tent and keep your tent flaps closed and secure. If bitten, brush ants off with your hands and remove trousers if necessary.

Snakes  This region of Texas is one of the few areas of the country home to all four venomous snakes – rattlesnakes, copperheads, water moccasins, and coral snakes. They are not aggressive but should be treated with respect. Point out any snakes to people near you and a volunteer or Module instructor as soon as possible. There is no upside to handling these animals, so don’t try to pick them up or play with them – even dead ones can bite. Leave all snakes alone.

Mammals  Other hazards in the area may include skunks, raccoons, porcupines, deer, wild hogs, and the rare mountain lion. While it is rare that you will see any of these animals, please give them plenty of room if you do.

Heat and Hydration  Heat and sun exposure are also a common problem. Drink plenty of water and stay hydrated. Watch for signs of dehydration: if you’re not urinating regularly, if your urine is a dark color, or if you develop a headache or dizziness. Seek shade and let a volunteer know. We will try and get you hydrated before it turns into heat exhaustion or heat stroke. Heat-related problems can be minimized by wearing a hat, thin, loose-fitting clothes, and use shade when available and drink plenty of water.

Recommended Items  Bring a folding chair for use at some modules, eating, and your campsite. In addition to regular camping equipment, bring a flashlight, field book for note-taking, pencils and pens, a small ruler or scale, and calculator. Be prepared for hot, cold, wet, or dry weather.

Water  The water in the campground is non-potable (NOT drinkable). Bring drinking water. Please try and minimize the waste of water. Reusable cups and water bottles are mandatory. Strenuous fieldwork may require as much as one gallon per day.
Food  There will be a Food truck on-site for Friday dinner and Saturday lunch. CASH ONLY; please note there is no ATM on-site. Breakfast on Saturday and Sunday is provided, as is dinner on Saturday night. If you bring a field lunch for Saturday, there will be a lunch contest for the best prepared, presented, and unique lunch. Also, bring reusable plates, cups, and utensils for meals. Washing stations provided with soap are set up at the Pavilion.

Sanitation  Please use the portable toilets. They are cleaned and stocked daily. Be careful with your phones and car keys when using the toilets. The liquid will stain most items brown, yellow, or blue. Anything you drop in the toilet is your responsibility to fish out – if you want to. Please don’t throw cans or bottles into the toilets. Hand sanitizers are strategically placed around the site for your use.

Camping  Cave Without A Name has made their property available at no cost to the Workshop. We’re trying to crowd a lot of happy campers into this finite spot. If your group spreads out too far, you will have people camping amongst you. Don’t Balkanize the campground. Please extend a hand and be aware that we’re all part of a close-knit family working in the geosciences. Share your campsite with others and trade experiences about your school and program. The Campground Marshall will be the final arbitrator to address any issues.

Behavior  We have a strict No Drama policy and expect participants to behave professionally during the entire event. If you have a High Maintenance personality, consider not attending (if in doubt, ask your friends or professors). Everyone is encouraged to have fun but obey Texas state laws. There are private residences on Cave Without A Name property; please be respectful of their privacy and don’t approach them unless invited. If you have any concerns, see the Campground Marshall. Please be kind and understanding as we work through any issues that may arise. Treat all volunteers with respect, they are cooking your food, cleaning John’s, and herding cats. If you are abusive to volunteers or other participants, or a danger to yourself or others, we reserve the right to ask you to leave or have you removed from the property. No guns or fireworks allowed. Remember, this is a rural county, and we’re friends with the sheriff. He is a nice guy and provides free accommodations upon demand, complements of Kendall County taxpayers. On-site speed limit is 3.14 mph.

Alcohol Policy  The Hydro~Geo Workshop recognizes that the use of alcoholic beverages by those of legal age is a matter of personal choice. However, students in attendance may ultimately be governed by the policies of their higher education institution. We require that those who choose to drink on the Cave Without A Name grounds while attending the Texas Hydro~Geo Workshop abide by state law, and expect that such individuals will conduct themselves responsibly, mindful of the rights of others. Campground Marshals reserve the right to request that law enforcement remove anyone in violation of the above requirements. No alcoholic beverages will be served or sold in conjunction with the Hydro~Geo Workshop.

Waste  If you brought it with you, take it home. This includes all of your trash.
Module Descriptions

Basic Outdoor Skills

Field Safety
1 hour / Limit 20 participants / Location H
Considering field work may be in remote locations and in weather extremes, this Module discusses issues ranging from safety, personal hygiene, common first aid issues in the field, wild animals, weather, dehydration, being stranded overnight, personal locator beacons, and wild or stupid people. Presented by Eric Holman, Department of Homeland Security; Evan Holman, Unites States Army.

Camping – A field-camp survival guide
1 hour / Limit 15 participants / Location H
If attend summer field camp or camping related to field trips, this is your module. We will discuss tent types, sleeping bags and pads, how to set up and take down and store your gear, and types of boots commonly used in camping/hiking/field work. If you’re going to be car camping, there are some other items which you’ll find convenient to bring such as a folding chair. We’ll also discuss where to find the gear and get expert advice. Presented by Jason Rodriguez, Eric Holman, Garry White, Mike Polembo, and Kathy Lee, Bexar Grotto of the NSS.

Know Not No Knot - or Knots for Every Occasion
1 hour / 10 participants / Location Pav-3
Knots have multiple uses in the outdoors. From lashing your gear to a pack, setting up your tent, hanging a bear bag in a tree, etc. This module will show you how to tie several basic knots: Square, Sheet Bend, Bowline, Figure Eight family, and Clove Hitch, and Tautline Hitch. Ropes provided. Presented by Gary White, Bexar Grotto of the NSS.

PREREQUISITE: You need to be able to tie your own shoes. If you haven’t mastered the shoe knot, most of these knots will be way over your skill level.

Field Techniques and Career Development

How to Collect Field Locational Data Using GPS
1 hour / Limit 10 participants / Location 10
The Global Positioning System is a space-based navigation system that provides time and location information and has revolutionized how we collect locational data in the field. Data can now be collected on hand held units or even your cell phone. Collecting GPS data involves both hardware and software that must be understood to obtain the best results (or repeatable results). This Module is designed to help you understand and get the most out of your GPS system or cell phone in the field and discusses GPS selection, use of datums and coordinate systems, how to mark waypoints and tracks, how to navigate to a fixed point, and how to transfer data from the GPS unit to your computer. Presented by Grant Snyder, GLS Solutions, Inc., and P.B. Snyder, Lamar University.

NOTE: If you have a GPS unit, please bring it along with your user’s manual. Some GPS units will be available for use in the Module.
FLIR Infrared Camera and Radon Analysis
2 hours / Limit 15 participants / Location L

The use of a FLIR infrared Camera will be demonstrated. The camera can be used to find cave entrances, springs discharging below stream surfaces, and contrast between different soil types, depth to bedrock, etc. Presented by Joe Yelderman and Stephanie Wong, Baylor University.

Developing Scientific and Field Notebooks
1 hour / Limit 20 participants / Location A

Instructions and guidance on the preparation of scientific and field notebooks. Using well-documented and comprehensive notebooks to support analysis, laboratory experiments, and field surveys will greatly facilitate successful completion of modest-sized to the most complex projects. Well-prepared and documented notebooks will also provide defensible records for future recall and to support quality record management. This Module will provide hands-on guidance and suggestions to the preparation of defensible and useful documentation. Presented by Rick Klar, Raba Kistner Environmental; Ron Green, Southwest Research Institute.

Data Presentation for Best Management Decisions
2 hours / Limit 15 participants / Location Pav-2

Good decision making requires well presented data-geologic, hydrologic, geophysical, boring logs, groundwater, chemical, biological, aquifer, modeling, etc. But we do not always present data in a way that allows public stakeholders, regulators, and other agency representatives to make the best decisions possible. The vital link between the excellent field skills we learn in data gathering, the analytical techniques we use to process and reduce the data, and the presentation of the data that facilitates decision making is often missing. As data gathering capabilities increase exponentially in the future, we will continue to be challenged to reduce, process, analyze, interpret, and extract useful information that helps stakeholders make appropriate and timely decisions. This hands-on session addresses some solutions that connect the data we gather with optimizing management decisions. Presented by Sriram Madabhushi, P.G., Booz Allen Hamilton.

Field Instruments (map, compass, rock hammer)
2 hours / Limit 25 participants / Location 6

Participants will utilize maps and Brunton Compass to collect basic data including location, strike and dip, basic field surveying, sample collection, and descriptions. Presented by Grant Snyder, GLS Solutions, Inc. and P.B. Snyder, Lamar University.

ESRI Collector for ArcGIS Mobile App
2 hours / Unlimited participants / Location Pav-3

Participants will be introduced to Collector for ArcGIS, a mobile app offered through ESRI software. Participants must bring an Android or Apple mobile device (including smart phones and iPads) to participate. This program is becoming the standard for field data collection, including locational data, observational data, and photo documentation. Presented by Taylor Bruecher, Edwards Aquifer Authority.

NOTE: Download the free app beforehand at http://www.esri.com/products/collector-for-arcgis
### MODULE SCHEDULE

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#### Introduction (8:30-9:00) 0.5 Pav

#### Field Lunch Contest 1 Pav

#### Rock Identification Contest 1 J

#### Yodeling Contest 0.5 CV

#### Lightening Talks 0.15 Pav

#### Keynote Address 1 CV

#### Basics of Geologic Modeling 3 Pav-1

#### Career Development 1 VR-2

#### Cave Biological Inventory 2 1 (OS)

#### Cave Geology 3 2-CV

#### Cave Mapping 3 3-CV

#### Data Presentation for Best Management Decisions 2 Pav-2

#### Developing Scientific and Field Notebooks 1 A

#### Edwards Plateau Freshwater Fish and Mussel Biology 3 4 (OS)

#### Emerging Chemicals of Concern in Water 1 Pav-2

#### Environmental Drilling, Logging, and Sampling 3 5 (OS)

#### ESRI Collector for ArcGIS Mobile App 2 Pav 3

#### Field Instruments (map, compass, rock hammer) 2 6

#### Field Safety 1 H

#### Field Trip to a Wild Cave 3 7 (OS)

#### Field Trip to Herff Falls at Cibolo Preserve (Sunday) 3 1 (OS)

#### FLIR Infrared Camera and Radon Analysis 2 L

#### Green New Deal: An Open Discussion 2 Pav-2

#### Ground Penetrating Radar 2 VR-3

#### Groundwater Conservation Districts and Pump Tests 3 11 (OS)

#### Groundwater Investigation Methods 4 C

#### Herpetological Field Survey Techniques 2 ea 9 (OS)

#### High Resolution 3D Resistivity Imaging - Canceled

#### How to Collect Field Locational Data Using GPS 1 10

#### Introduction to Mudlogging 2 D

#### Karst Feature Evaluation Using the TCEQ Forms 3 12

#### Know Not No Knot - or Knots for Every Occasion 1 B

#### Low Impact Development 1 13

#### Macroinvertebrates as Water Quality Indicators 2 14 (OS)

#### Water Monitoring with Eureka Manta Plus Sondes 1 VR-1

#### Potentiometric Surface Mapping 2 Pav-4

#### Rainwater Harvesting and Design 2 Pav-WT

#### Riparian Functional Assessment 3 22 (OS)

#### Rock Identification 1 J

#### Safety in the Vertical Environment 2 F

#### Stalagmites as Paleoclimate Archives 2 G

#### Stream Gauging 3 15 (OS)

#### Surface Geophysics (Natural Potential) 3 17

#### Surface Water Quality Sampling 2 18 (OS)

#### TLS LIDAR Scanning for Geomorphology 3 19 (OS)

#### Tracer Testing in Karst 4 E

#### UAV (drone) Mapping and RTK GPS 3 20 (OS)

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Meeting Locations: Pav = Pavilion  VR = Vendors Row  CV = Cave  OS = Off-site
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**Saturday**

- **Breakfast**: 8:30-9:00
- **Introduction (8:30-9:00)**
- **Field Lunch Contest**: 1 Pav
- **Rock Identification Contest**: 1 J
- **Yodeling Contest**: 0.5 CV
- **Lunch**: 11:30-12:30
- **Lightening Talks**: 0.15 Pav
- **Keynote Address**: 1 CV
- **Basics of Geologic Modeling**: 3 Pav-1
- **Camping – A field-camp survival guide**: 1 H
- **Career Development**: 1 VR-2
- **Cave Biological Inventory**: 2 1 (OS)
- **Cave Geology**: 3 2-CV
- **Cave Mapping**: 3 3-CV
- **Data Presentation for Best Management Decisions**: 2 Pav-2
- **Developing Scientific and Field Notebooks**: 1 A
- **Edwards Plateau Freshwater Fish and Mussel Biology**: 3 4 (OS)
- **Emerging Chemicals of Concern in Water**: 1 Pav-2
- **Environmental Drilling, Logging, and Sampling**: 3 5 (OS)
- **ESRI Collector for ArcGIS Mobile App**: 2 Pav 3
- **Field Instruments (map, compass, rock hammer)**: 2 6
- **Field Safety**: 1 H
- **Field Trip to a Wild Cave**: 3 7 (OS)
- **Field Trip to Herff Falls at Cibolo Preserve (Sunday)**: 3 1 (OS)
- **FLIR Infrared Camera and Radon Analysis**: 2 L
- **Green New Deal: An Open Discussion**: 2 Pav-2
- **Ground Penetrating Radar**: 2 VR-3
- **Groundwater Conservation Districts and Pump Tests**: 3 11 (OS)
- **Groundwater Investigation Methods**: 4 C
- **Herpetological Field Survey Techniques**: 2 ea 9 (OS)
- **High Resolution 3D Resistivity Imaging - Canceled**
- **How to Collect Field Locational Data Using GPS**: 1 10
- **Introduction to Mudlogging**: 2 D
- **Karst Feature Evaluation Using the TCEQ Forms**: 3 12
- **Know Not No Knot - or Knots for Every Occasion**: 1 B
- **Low Impact Development**: 1 13
- **Macroinvertibrates as Water Quality Indicators**: 2 14 (OS)
- **Water Monitoring with Eureka Manta Plus Sondes**: 1 VR-1
- **Potentiometric Surface Mapping**: 2 Pav-4
- **Rainwater Harvesting and Design**: 2 Pav-WT
- **Riparian Functional Assessment**: 3 22 (OS)
- **Rock Identification**: 1 J
- **Safety in the Vertical Environment**: 2 F
- **Stalagmites as Paleoclimate Archives**: 2 G
- **Stream Gauging**: 3 15 (OS)
- **Surface Geophysics (Natural Potential)**: 3 17
- **Surface Water Quality Sampling**: 2 18 (OS)
- **TLS LiDAR Scanning for Geomorphology**: 3 19 (OS)
- **Tracer Testing in Karst**: 4 E
- **UAV (drone) Mapping and RTK GPS**: 3 20 (OS)
TLS LiDAR Scanning for Geomorphology
3 hours / Limited to 15 participants / Location 19
This module will introduce LiDAR Terrestrial Laser Scanning using a Riegl VZ-400 scanner. LiDAR is an active scanning technique that uses laser pulses to create 3D terrain models. The module will take place at the Guadalupe river and participants will learn the process to conduct multiple overlapping scans in order to create a high resolution Digital Terrain Model of the geomorphology of the river area. Presented by Justin Mondrick and Kevin Urbanczyk from Sul Ross State University.

UAV (drone) Mapping and RTK GPS
3 hours / Limited to 15 participants / Location 20
This module will introduce UAV mapping for the purpose of creating high resolution orthophotographs and Digital Elevation Models (DEMs). Participants will assist in deploying visual targets for ground coordinate control using RTK GPS (Spectra Precision SP80), then assist in the drone flight using a DJI Matrice 600 Pro equipped with a multispectral camera and Drone Deploy flight planning software. The collected imagery will then be processed into an orthophoto and a DEM of the flight area (the Guadalupe river) using Agisoft Photoscan and ArcGIS Pro. Presented by Carolina “Lina” Medina-Nava and Kevin Urbanczyk from Sul Ross State University.

Career Development
1 hour / Unlimited participants / Location VR-2
Come discuss important aspects of career development from the beginning of your academic program to your professional career. This will include the importance of networking, mentors, continuing education, and staying active in your professional association. Presented by various professionals representing the fields of geology, hydrology, environmental science, and the petroleum industry. Presented by Tom Fett, Pat Frost, Grant Snyder, John Casiano, and Rusty Branch.

Well Drilling and Environmental Monitoring

Environmental Drilling, Logging, and Sampling
3 hours / Limit 25 participants / Location 5-Off Site
Introduction to environmental sampling of soil using manual methods and drilling rigs. Topics will include an overview of drill rig capabilities, soil sampling methods and equipment, sample collection, soil boring logging and monitoring well installation. Samples will be collected for students to observe and classify. A drilling rig will be on site to demonstrate drilling techniques. The module will be presented by Kevin Bryant, Jim Major, and Justin Turknett of Terracon Consultants, Inc.; Juan Martinez, Steven Stackhouse, Vortex Drilling.

Introduction to Mudlogging
2 hours / Limit 25 participants / Location D
Mudlogging is commonly the first position that many geologists obtain in the oil and gas industry. This module will introduce you to the basic concepts of drilling, how a mudlogger plays a part on a drilling rig and how they examine rocks to determine if they contain oil & gas, as well as other characteristics. Presented by Sandy Dylka, Keaton Fornes, Ben Branam, EXLOG.

Surface and Borehole Geophysics
Ground Penetrating Radar
2 hours / Limit 20 participants / Location VR-3
Demonstration of ground penetrating radar (GPR), a commonly used near-surface geophysical method. Information regarding applications, instrument operation and interpreting GPR data will be presented. GPR data will be acquired and interpreted by the participants from both known and unknown features. GPR can be used to detect sinkholes, pipes, archaeological features, graveyards, shallow caves, UST. Presented by Kevin Bryant and Jim Major, Terracon Consultants.

Surface Geophysics (Natural Potential)
3 hours / Limit 20 participants / Location 17
Introduction of the Natural Potential (NP) surface geophysical method for the location of subsurface voids. NP will be conducted over known portions of Cave Without a Name or other karst features to demonstrate how this surface geophysical method is useful in delineating the subsurface in a karst terrain. Mustafa Saribudak and Alf Hawkins, Environmental Geophysical Associates; Sebastian Taylor, Avia Enviro.

High Resolution 3D Resistivity Imaging to Locate Caves and Voids
4 hours / Limit 20 participants / Location 9
Provides hands-on training by deploying the SuperSting resistivity imaging system in high resolution 3D resistivity imaging surveys that are ideal for locating caves, voids, depth to bedrock and other geotechnical targets. Data will be comprised of tightly spaced lines and then inverse modeled with the EarthImager 3D Inversion Software for a quick and accurate representation of the subsurface. 3D models will be rapidly collected with single lines of resistivity data that complete in 7 minutes and data will be displayed in real time on the Android App. Presented by Jason Greenwood and Markus Lagmanson of Advanced Geosciences, Inc. Austin, Texas, and Mauricio Flores, Southwest Research Institute.

Resource Management
Green New Deal: An Open Discussion
2 hours / No limit / Location Pav-2
Opportunities and Challenges to Practicing Environmental Scientists. In this session, we will summarize and highlight some of the environmental and hydrogeology-related elements of the Green New Deal. We will also discuss what are the challenges from the GND for our specific community of scientists. What, if any, actions we can take in short term and long term to respond to these specific items. How much of it is realistic and how much of the GND is beyond our reach? Open discussion to distinguish between practical and implementable elements of GND and elements beyond our reach at this time. Presented by Sriram Madabhushi, P.G., Booz Allen Hamilton.

Groundwater Investigation Methods
3 / 4 hours / Limit 20 participants / Location C
Introduction to the technologies typically used for groundwater resource investigations. Students will be introduced to: 1) drilling methods, 2) the role of the geologist in the field during drilling, 3) downhole video and electric logging tools (downhole camera, Optical Borehole Imager (OBI), resistivity, gamma, caliper, fluid sampler, and flow tools), and 4) e-log interpretation. There will be a live demonstration of video and geophysical logging in an onsite water well during the Module. Example e-logs will be reviewed and interpreted. At the end of the Module, students will have an opportunity to correlate borehole cuttings and an e-log from a 1150’ deep well in West Texas. Presented by Mark Dobson and Eric Wolff, DNA Geosciences, Inc., Ed Miller and Mike Miller, GeoCam, Inc.
Stream Gauging
3 hours / Limit 40 participants / Location 15 Off Site
Meets 15 minutes before at the Pavilion to coordinate carpool to Kreutzberg Canyon Natural Area.*
This Module will introduce students to the fundamentals of stream gauging on the nearby Guadalupe River. Participants will set up a stream transect, measure a stream profile and perform discharge measurements of the river. Participants will use a variety of acoustic velocity meters, incorporating wading and current profiling techniques. Calculated stream flows will be compared to upstream and downstream USGS stream gauges. Participants should bring clothing and sturdy shoes for wading in the river. Presented by Marcus Gary, Edwards Aquifer Authority; Kevin Urbanczyk, Sul Ross State University; and Justin, Camp, Barton Springs Edwards Aquifer GCD.

Tracer Testing in Karst
4 hours / Limit 20 participants / Location E
Introduces participants to the fundamentals of groundwater tracer test design and execution. This includes field preparation, dye selection, dye injection, water and charcoal packet collection and laboratory and field analysis. Samples will be collected using an automatic water sampler and analyzed in the field using a filter fluorometer. Students will also process charcoal packets and analyze eluant for dye. Presented by Ralph Ewers, Ewers Water Consultants; UT San Antonio; and Geary Schindel, Roger Andrade, Edwards Aquifer Authority; and Chris Russoniello, West Virginia University.

Surface Water Quality Sampling
2 hours / Limit 15 participants / Location 18 Off Site
Meets 15 minutes before at the Pavilion to coordinate carpool to Kreutzberg Canyon Natural Area, map page 18. This Module will cover water quality sampling. Topics covered will include parameter selection, sampling equipment selection, sample collection, field parameters (pH, temperature, conductivity, dissolved oxygen (DO), turbidity, and alkalinity), Chain of Custody (COC), packing and shipping samples, and personal protective equipment. Historical laboratory data will be presented and compared to current Maximum Contaminant Levels (MCL). Participants will get wet and should bring appropriate footwear and a change of clothes. Presented by Phil Pearce, Debbie Duran, Jennifer Gonzalez, and Ben Dilly, SWCA, Inc.

Low Impact Development
1 hour / Limit to 15 participants / Location 13
This module will discuss Low Impact Development (LID), it’s importance, types of LID (bioswales, permeable surfaces, etc.) and include some hands-on demos and a list of resources. Presented by Jason Rodriguez and Jess Mayes, Eco-Centro, Alamo Colleges.

Groundwater Conservation Districts and Pump Tests
3 hours / Limit 15 participants / Location 11 Off Site
This module will provide an overview of the history and role of groundwater conservation districts (GCDs) in the state of Texas, as well as an overview of the planning and implementation of pump tests on new and established wells. The purpose of this module is to present attendees with an account of the history of Texas GCDs and the role GCDs play in regulating and conserving groundwater resources. In addition, participants will learn the procedures behind planning and implementing a pump test utilizing groundwater monitoring equipment, as well as water quality instrumentation. Data collected from pump tests conducted throughout Texas will be presented in order to illustrate the valuable data that can be gleaned from conducting constant-rate pump tests and step-drawdown tests. Presented by Brandon Wilcox, Westward Environmental, Inc.; Micah Voulgaris, and Heath Hoffman, Cow Creek Groundwater Conservation District.
Potentiometric Surface Mapping
2 hours / Limit 20 participants / Location Pav-4
Participants will use synthetic data and create a potentiometric surface map. This is an important first step in conducting a groundwater investigation. The data will be used to calculate the direction of groundwater movement and contaminant transport. Additional data will be presented that will be used to calculate the apparent groundwater velocity in a sand and gravel aquifer. Presented by Mike Cheng, UT Rio Grande Valley, Yongli Gao, UT San Antonio.

Water Monitoring with Eureka Manta Plus Sondes
1 hour / 10 participants / Location VR-1
A hands-on introduction to sensor technologies available for multi-parameter water quality sondes; navigating the multi-probe control software; operating control devices; including a hand-held field PC with Windows Mobile; calibration of pH, conductivity and optical DO, depth and turbidity sensors; spot checking or profiling (site to site) and unattended logging; care and maintenance of water quality sondes; and managing data from real-time telemetry stations. Presented by Joanna Howerton, of Eureka Water Probes.

Riparian Functional Assessment
3 hours / Limit 30 participants / Location 22 Off Site
This module will introduce students to on-site riparian functional assessments involving a variety of field survey techniques. Students will examine the longitudinal, lateral, and vertical connectivity of the stream and riparian corridor; survey riparian vegetation composition and structure; measure woody debris in the channel and riparian area; and characterize riparian geomorphology and soils. This module will take place at two field sites to illustrate the variability of riparian functionality and the significance of different valley- and local-scale controls on riparian patterns and processes. Participants should be prepared to wade in the water and walk through riparian vegetation. Presented by Kimberly Meitzen, Aspen Manning, Texas State University, and Walt Meitzen, Cox McClain Environmental Consulting.

Rainwater Harvesting and Design
2 hours / Limit 20 participants / Location Pav-Water Tank
Rainwater Harvesting is an ancient technique used by many past civilizations who didn't have ready access to potable water. Integrating these simple ideas have come back into favor in the 21st century due to changing weather patterns and conservation values. This module will be geared toward both beginners and experts about the many designs and uses of rainwater and will include system design techniques, case studies, and product reviews. The materials were donated by the Cow Creek Groundwater Conservation District as an educational installation. The system will be adjacent to the presentation area providing a 'real world' example. Presented by Wade Kolb, Westward Environmental, Inc.

Emerging Chemicals of Concern in Water
1 hour / Limit 15 participants / Location Pav-2
Water resources are constantly being exposed to new and emerging chemicals. Many of these synthetic or man-made chemicals, have long-term consequences as they enter the environment. As we understand more about these toxic chemicals, their potential harmful effects on the human health and the environment are being brought into light. In this Module, we discuss physical and chemical properties of some of these chemicals, their use and prevalence in the industry, health effects and emerging regulations. We will also discuss release of these chemicals into the environment, detection and investigation techniques, their nature and behavior in the environment. Some challenges of delineation and remediation of these contaminants will also be offered. Presented by Sriram Madabhushi, P.G., Booz Allen Hamilton.
Karst and Geologic Evaluations

Cave Geology
3 hours / Limit 20 participants / Location 2-CV

An introduction to the process of cave and karst geology using Cave Without A Name as an example. Discussions will include cave initiation and destruction, cave formations, caves as part of the geologic record, cave data and climate change, cave hydrology, and methods for cave and karst research. Presented by Brian Smith, Barton Springs Edwards Aquifer GCD.

Karst Feature Evaluation Using the TCEQ Forms
3 hours / Limit 20 participants / Location 12

Participants will utilize Texas Commission on Environmental Quality (TCEQ) field evaluation forms to document and evaluate karst features. This process is performed on properties being developed on the recharge zone of the Edwards Aquifer. Karst features on Cave Without A Name property will be located and evaluated. Advanced evaluation techniques that complement TCEQ requirements will also be presented. Presented by Phil Pearce, Debbie Duran, and Ben Dilly, SWCA, Inc.

NOTE: Participants should arrive with their notebooks, pens, and whatever field equipment they deem useful for evaluating karst features. They should also visit the TCEQ website to download and bring one copy of the TCEQ assessment table (https://www.tceq.texas.gov/assets/public/compliance/field_ops/eapp/F-0585_geologic_assessment_table.pdf), and instructions for geologists (https://www.tceq.texas.gov/assets/public/compliance/field_ops/eapp/F-0585_geologic_assessment_instructions.pdf). Some forms will be available at the Module.

Stalagmites as Paleoclimate Archives
2 hours / Limit 20 participants / Location G

Stalagmites are arguably the best archives of terrestrial climate change over time and as such, have been increasingly utilized for scientific study over the past few decades. This Module will introduce students to the concept of speleothems as recorders of paleoclimate information, with topics covering conservative sample collection, age dating, methods of geochemical analysis, and age model construction. Discussions will include the use of in situ sampling techniques as well as ways in which to strike a balance between maximizing the information gained from the geochemical analysis of stalagmites and the conservation of irreplaceable cave formations. Stalagmite samples used for paleoclimate reconstructions will be available for the students to examine. Presented by Chris Ray, and Lijun Tian, UT San Antonio.

Field Trip to Herff Falls at Cibolo Preserve (Sunday)
3 hours / Limit 14 participants / Location 1 Off Site

Meets 15 minutes prior to start at the Pavilion. This Module will visit the Herff Falls, a narrow canyon through a large exposure of caprinid rudist reef, located at Cibolo Preserve. Cibolo Preserve is a 644-acre natural habitat laboratory located just east of Boerne. A uniquely preserved cross-section of history and nature in central Texas, the land is notable for its beauty, variety of flora and fauna, geological features and areas of archaeological interest. One and a half miles of Cibolo Creek bisects the Cibolo Preserve, before entering the Herff Falls, where shortly thereafter the water sinks in a series of swallets downstream. Participants should wear proper footwear for walking on the karst surface and bluffs. Presented by Donna Taylor, Cibolo Nature Center and Farm.
Basics of Geologic Modeling
3 hours / Limit 18 participants / Pav-1
This module will discuss the general process involved in collecting, analyzing and applying subsurface geologic data. Module participants will be introduced to the basics of 3D model planning, design, interpolation methods, and application of the results. Following the presentation, participants will collaborate to build block models out of Legos using simplified geologic logs and a topographic data. Presented by Jack Sackrider, Westward Environmental, Inc.

Rock Identification
1 hour / Limit 15 participants / Location J
This Module will present methods to identify rocks that are common to Texas and the western United States. Here is a good opportunity to refresh your skills and learn some of the tricks of the trade for field identification. Presented by Richard Silver, Trinity University, Jesse Chadwick, Edwards Aquifer Authority.

Field Biology

Macroinvertebrates as Water Quality Indicators
2 hours / Limit 15 participants / Location 14 Off Site
This module will introduce students to the fundamentals of stream and pond biomonitoring techniques and includes a survey activity using aquatic macroinvertebrates as water quality indicators. Students will capture and identify macroinvertebrates within provided substrates and use datasheets to calculate and determine water quality. Supplementary discussion topics include: biosurvey methodologies, general aquatic ecology, and applications of survey results. Presented by Whitney Schwope of Westward Environmental, Inc.

Cave Biological Inventory
2 hours / Limit 15 participants / Location 1 Off Site
The majority of this module will occur within an undeveloped cave. Participants will receive an introduction to commonly encountered cave life, with an emphasis on Texas' cave fauna. Participants will learn basic/standard methods of cave biological inventory and conduct an inventory within the cave. Presented by Benjamin Hutchins, Texas State University.

NOTE: Transport to and from cave. Participants need basic personal caving gear including durable, close-toed shoes, clothes that will get dirty, helmet, 2 sources of light, gloves, water bottle, and FULL change of clothes (including shoes). Participants will need to abide by USFWS WNS decontamination procedures. Heavy duty plastic garbage bags will be provided.

Edwards Plateau Freshwater Fish and Mussel Biology
3 hours / Limit 5 participants / Location 4 Off Site
Biologists will present an overview of commonly employed freshwater fish and mussel collection and survey techniques in Texas streams and rivers. Techniques will include seining and electrofishing for fish and tactile surveys including snorkel and hooka for mussels. General descriptions of habitats sampled and biology of organisms collected will be discussed followed by an open question / answer period. Presented by Brad Littrell, Kyle Sullivan, and Jube Guajard, Bio-West Environmental Consultants.

NOTE: This is a hands on exercise, so please be prepared to get wet.
Herpetological Field Survey Techniques
2 hours each Part / Limit 15 participants / Location 4 Off Site
An introduction to the process of generalized herpetological field survey methods. Module will include discussion of trapping and collection methodology, tool/equipment considerations, specimen identification (visual and auditory where applicable) and a hands-on in-field survey. Presented by Jenny Blair, CWB and Tony Blair, CWB Blair Wildlife Consulting

NOTE: This module is split in two parts: Part 1 on Saturday morning, Part 2 on Sunday morning.

Caving and the Cave Environment

Safety in the Vertical Environment
2 hours / Limit 15 participants / Location F
 Discusses safety for working above, below and on cliff faces and around vertical caves, and includes demonstrations on safety, equipment, minimum skills, and training and resources. Presented by Christopher Franke, Steve Gutierrez, and Ross Webb, Bexar Grotto of the NSS.

Cave Mapping
3 hours / Limit 10 participants / Location 3-CV
Discussion on cave surveying and resource documentation and participants will survey a cave or portion of cave passage on the property using a field book, compass, and clinometer. On display will be an existing cave sketch, survey notes, and cave survey programs used to reduce the field data. Presented by Marvin Miller and Tom Rogers, Bexar Grotto of the NSS.

Field Trip to a Wild Cave
3 hours / Limit 15 participants / Location 7 Off Site
Meets 15 minutes before at the pavilion. Visit to a wild cave within walking distance of CWAN property. The cave is mostly a walking stream cave and you will get wet up to your waist and muddy so it may not be for everyone. Presented by Jon Cradit, Edwards Aquifer Authority and Mike Harris, Tom Florer, Jason Rodriguez, Steve Gutierrez, Mio Kitano, Kathy Lee, Michael Polendo, Christopher Franke, Ross Webb, MJ Gibbons, and Leia Hill, Bexar Grotto of the NSS.

NOTE: Bring gloves and wear sturdy, closed toe shoes. Sandals or flip flops are not acceptable and will not be allowed in the cave. Helmet with mounted light will be provided or you may bring your own. You will also need a change of clothes and shoes for after the trip and a plastic bag for your wet items.

NOTES
Module Presenters

Alf Hawkins
Ben Branam
Ben Dilly
Benjamin Hutchins
Brad Littrell
Brandon Wilcox
Brent Doty
Brian Smith
Chris Ray
Chris Russoniello
Christopher Franke
Debbie Duran
Donna Taylor
Ed Miller
Eric Holman
Eric Wolff
Evan Holman
Garry White
Geary Schindel
Grant Snyder
Heath Hoffman
Jack Sackrider
Jason Greenwood
Jason Rodriguez
Jennifer Gonzalez
Jenny Blair
Jess Mayes
Jesse Chadwick
Jim Major
Joanna Howerton
Joe Yelderman
John Casiano
Jon Cradit
Juan Martinez
Jube Guajardo
Justin Camp
Justin Mondrick
Justin Turknett
Kathy Lee
Keaton Fornes
Kevin Blackwood
Kevin Bryant
Kevin Urbanczyk
Kimberly Meitzen
Kyle Sullivan
Lea Hill
Lijun Tian
Lina Medina-Nava
Marcus Gary
Mauricio Flores
Mark Dobson
Markus Lagmanson
Marvin Miller
Micah Voulgaris
Michael Polendo
Mike Cheng
Mike Harris
Mike Miller
Mio Kitano
MJ Gibbons
Mustafa Saribudak
P.B. Snyder
Phil Pearce
Ralph Ewers
Richard Silver
Rick Klar
Roger Andrade
Ron Green
Ross Webb
Sandy Dylka
Sebastian Taylor
Sriram Madabhushi
Stephanie Wong
Steve Gutierrez
Steven Stackhouse
Taylor Bruecher
Tom Fett
Tom Rogers
Tony Blair
Wade Kolb
Walt Meitzen
Whitney Schwope
Yongli Gao

Volunteers

Co-Chair .................................. Geary Schindel
Co-Chair .................................. Mike Harris
Treasurer ................................. Sue Schindel
Secretary ................................. Tom Florer
Logistics ................................. MJ Gibbons
Sanitation ................................. Mike Harris
Campground Marshall ............... Mike Harris
Safety ................................. Eric Holman
Volunteer Coordinator ............ Jesse Chadwick
Food and Promos Coord ............ Sue Schindel
Web Developer ....................... Randy Baker
Web Registration ................. Jesse Chadwick
Program & Graphic Design ........ Jill Orr
T-shirt Design ........................ Don Arburn

David DeLuna
David Murley
Eleida Webb
Eric Holman
Garry White
Geary Schindel
Grace Garner
Jesse Chadwick
Jesse Hillger
Joann DeLuna
Kathy Lin
Kori Dunaway
Kurt Menking
Lea Hill
Michael Harris
Michael Polendo
Michael Cunningham
Mike Burrell
Mio Kitano
MJ Gibbons
Nate Clark
Randolph Baker
Ross Webb
Ruben Andrade
Steven Gutierrez
Susan Schindel
Tom Kartrude
Off-site modules meet at the Pavilion.

Kreutzberg Canyon Natural Area
143 Mark Twain Road, Boerne, TX 78006

Head west onto Cave Without A Name Rd. 0.4 miles
Slight left onto Kreutzberg Rd 0.7 miles
Turn right onto Mark Twain Dr.
Turn right into Kreutzberg Canyon Natural Area.
Follow this road north 1 mile to the river-side parking area.
DED icATED TO THE DEVELOPMENT AND IMPLEMENTATION OF SOLUTIONS TODAY THAT CONSERVE AND PROTECT LAND, WATER & WILDLIFE FOR TOMORROW.

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Terracon Consulting Engineers and Scientists
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UT San Antonio Center for Water Research
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