Water for People and the Environment

3rd Annual Regional Conference for South Central Texas

October 11, 2003
Smithson Valley, Texas

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Some of the speakers at the conference had PowerPoint presentations on some of the topics discussed in these proceedings. For information on obtaining a copy of a particular PowerPoint presentation, contact the Lone Star Chapter of the Sierra Club at lonestar.chapter@sierraclub.org

PROCEEDINGS
Water for the People & the Environment
A Regional Conference for South Central Texas
Smithson Valley (New Braunfels Area), October 11, 2003

Welcome: Ken Kramer, Director, Lone Star Chapter, Sierra Club

Ken Kramer, PhD. is the Director of the Lone Star Chapter of the Sierra Club and has been associated with the Sierra Club in different volunteer and professional capacities since 1978. Dr. Kramer has a B.A. in History from Texas Lutheran University, an M.A. in Political Science from Stephen F. Austin State University, and a Ph.D. in Political Science from Rice University. He has taught at El Paso Community College, Houston Community College, Angelo State University, and Texas A&M University. Dr. Kramer has served on numerous advisory committees to state and local agencies and officials, and he was recently selected by the Texas Water Development Board to serve on the new Water Conservation Implementation Task Force.

Two of the purposes of the Texas Living Waters Project, which started in 2000, are to educate Texas citizens about water issues and to shape government policies that affect these water issues. These issues include water quantity and quality as well as planning for future water supplies for people and the environment. Through these regional water conferences we hope to get more people involved in these water issues. This year the Lone Star Chapter of the Sierra Club will hold four regional water conferences – in Houston, Dallas, New Braunfels, and Midland.

This conference is the third annual regional water conference to be held in South Central Texas – the first one was in San Antonio in 2001, and the second one was in San Marcos in 2002. If funding for the project is continued, then the plan is to have just one regional conference each fall rotated around to different areas of the state over a three-year period, but there will also be some shorter workshops or forums as well.

As part of the Living Waters Project, the Lone Star Chapter of the Sierra Club has produced a *Facts about Texas Water* booklet as a basic educational publication on water. The booklet will be distributed to over 50,000 students in the Harris, Galveston, and Fort Bend County region, and 20,000 additional copies of the booklet are being distributed elsewhere, including at the regional water conferences. This booklet is available in Spanish as well. Copies of *Facts about Texas Water* are available at the conference, but additional copies of the booklet are available upon request.

A second publication, *Your Water Supply*, will be forthcoming later this fall. This booklet will provide information about water decision-makers in Texas at the state, regional, and local levels.

Keynote Address: "Meeting Future Needs for Water: New Approaches"
Dr. Peter Gleick, President, Pacific Institute for Studies in Development, Environment, and Security

Dr. Peter Gleick *is co-founder and President of the Pacific Institute of Oakland, California. Dr. Gleick is an internationally recognized expert on issues related to water and in 2001 was named a "Visionary on the Environment" by the BBC. His work on water scarcity and efficiency, water privatization, conflicts over water, and water and climate change has been quoted widely — most recently by The Economist Magazine for its global water survey. He serves on the boards of numerous journals and organizations and was elected an Academician of the International Water Academy, in Oslo, Norway, in 1999. In 2001 he was appointed to the Water Science and Technology Board of the National Academy of Sciences, Washington, D.C. Dr. Gleick is the author of many scientific papers and four books, including the biennial water report The World's Water published by Island Press (Washington, D.C.).*

Without a doubt, many of the world's water problems are getting worse. Many of these problems are international in nature, and many are local. Many are true in developing countries and in richer countries. Per capita water availability is decreasing because population is increasing and water is a fixed resource. Per capita *use* of water is growing especially in developing countries. Billions of people worldwide lack the most fundamental water services leading to diseases such as cholera, dysentery. There are opportunities to solve many water problems, and ways of thinking about a sustainable future in the water area.

Irrigated land worldwide is growing slowly. Per capita, it is decreasing. Therefore, if we want to keep food supply up with population worldwide, we're going to have to grow more food per acre of land. In many places in the world, the use of groundwater is unsustainable. We are pumping groundwater faster than nature can recharge it. This is unsustainable in the sense that eventually the cost of pumping gets too high and land goes out of production or the aquifer becomes contaminated by bad water. A large fraction of the agricultural production in the world comes from unsustainable water sources

Many species of fishes are endangered or extinct because of water withdrawal for human purposes. Some aquatic ecosystems have been completely destroyed. Climate change is evident and will have significant impacts of water. Competition for limited freshwater resources is growing leading to risk and violence over resources. All of these pieces together equal a disturbing picture.

There are a number of inequities in the world as they relate to water: We have failed to meet basic human needs and basic environmental needs. There are 1.1 billion people worldwide that do not have access to clean drinking water. There are 2.4 billion people

(40% of the world's population) that do not have adequate sanitation services. This failure to meet basic human needs is the greatest development failure of the 20th century. The consequences of this situation include hundreds of millions of cases resulting in two to five million deaths per year of the aforementioned water-related diseases. These deaths are preventable through bringing clean water and sanitation services to everyone on the planet.

To put it in perspective, tens of thousands of people contracted SARS during its recent outbreak – resulting in less than 1000 deaths. Although that is terrible, 10,000 people *per day* die from preventable water-related diseases. Yet, the media attention to that kind of problem is almost non-existent. The reasons it is non-existent are (1) It is hard to maintain interest in a problem that happens all the time. (2) The fact that the locations where these people are dying are remote and isolated contributes to low visibility in the media. This failure is the worst of the world's water problems in part because of the human toll, and in part because it is unnecessary given that we know how to solve the problem. Yet, we have failed to mobilize global attention and the will to address it.

We have failed to meet basic environmental/ecological needs for water. Many people do not understand the connection between healthy eco-systems and healthy human beings. Yet we have learned that if we don't have healthy eco-systems, we run the risk of not having healthy societies.

In the past, human use of water has come at the expense of the environment. Water development in the 20th century was building big dams, withdrawing water from lakes and rivers, and pumping groundwater aquifers. We did not understand the ecological implications of such actions. We modified rivers with dams, and we blocked habitats, We eliminated variable flows, creating low flows all the time, altering temperature regimes, and trapping sediments – keeping them out of deltas and rivers. All of these things had ecosystem effects. 27% of all aquatic fauna are now threatened with extinction. Some rivers no longer reach their deltas (e.g.: the Nile and the Colorado River). The Yellow River in China is now dry at its delta for hundreds of days per year. All 24 species of fish endemic to the Aral Sea in the former Soviet Union are now extinct because the Sea has become so salty it can no longer support them.

Part of the problem is that we've treated water as a free, unlimited resource. In places like Las Vegas or Disney World, water is treated like fantasy, the fountains and artificial lakes are part of the ambience of the park. But water is limited. It's vital for agricultural production, human and ecosystem health, production of energy, and a range of social, cultural and aesthetic values. But it isn't free.

There is good news, however. In many ways, we are in a period of opportunity. A lot more attention is being given to water as evident by 2003 being "The Year of Freshwater" – as proclaimed by the United Nations in part to recognize the severity of these problems and the possibility of moving forward and dealing with them, offering a possible vision of the future:

First, though, there are some dangers in prediction. If we make predictions based solely on the past and current trends, we get a future that looks a lot like the present – only often worse. However, if we peer into a future we don't like, that is an opportunity to change, an opportunity to do things differently. Instead, we can define a future that we like and then think about how to go about a path to that future.

We also know that we can learn from past mistakes. For example, the Cuyahoga River that caught fire in the 1960's led in part to the Clean Water Act. We've passed an international treaty to ban ozone-depleting chemicals. Our energy systems are more efficient. Industrial and environmental standards are better. In the face of predictions of mass starvations in the 60's, we launched the Green Revolution, which had some good and bad effects.

A vision of the future: All basic needs of water for humans are met. Water is properly priced and allocated. Food production increases without increases in water needs. Aquatic ecosystems are carefully and intentionally restored. Groundwater pumping is brought within sustainable limits. Water is monitored and protected.

A "soft path" for water –a fundamental rethinking of water – is needed. Six pieces of this rethinking:

1. *Meeting basic human needs for water*:

Government and private organizations have to join forces to meet this fundamental need. The economic costs of not meeting this basic need are so much larger than meeting the need for water. One of the UN's "Millennium Development Goals" is to cut in half the proportion of people in the world who do not have access to clean water and sanitation services by 2015. The bad news is we are not going to meet that goal, but it is an indication that the world community understands the importance of these issues.

2. *Meeting basic environmental needs for water*:

We must provide minimum flow commitments, minimum temperature commitments, and overall ecosystem commitments. There are efforts to do this: Eight billion dollars are going into restoring the Everglades. The Everglades is a good example of the economic costs of our failure to meet basic environmental needs for water. There are guarantees in the new South African constitution for water for basic human and ecosystem needs.

3. *Focusing on efficiency and conservation together with new supply.*

In the United States today, we use less water for all purposes than we used in 1980. Texas is using less water today than it was in 1974. Without knowing it, we have broken the connection between growing populations/economies and the idea that we have to grow our resource use exponentially. We can become much more efficient in our water uses and still have economic/population growth.

4. *Integrating water quality into our discussions about water quantity.*

We've tended to treat all of our water uses the same even though different uses of water require different qualities of water. As a result, we use very high quality, potable drinking water to water our lawns and flush our toilets. This is very expensive to bring such water to drinking standards for such uses. There are efforts underway to take reclaimed water (treated waste water) and use it on golf courses or municipal irrigation. Let's treat these lesser quality waters as an asset.

5. *Integrating climate change into long-term planning policy.*

There is a very strong consensus in the scientific community that climate changes are happening now and in the future. The hydrologic cycle is directly tied to the climate in the processes of evaporation, precipitation, runoff, storm patterns, droughts, etc. Water managers are not trained to think about this. The American Water Works Association released a white paper in 1996 saying climate change is a problem and needs to be addressed by water managers, so the problem is receiving attention.

6. *Redesigning and updating our water institutions.*

Changing our focus away from water supply to a reevaluation of what we really need water for (water use). In the 20th century, our attitude was about finding sources of supply rather than integrating water use in the equation. Supply is important too though, as in tapping into recycled water, or smart use of surface water and ground water together. Don't over pump the aquifers endlessly unless there's a plan to recharge them when you have a surplus. Treat ground water as a reservoir. There are other ways of thinking about supply that don't involve building new infrastructure. It also means bringing all parties to the table. The most effective management occurs at the community level. Not bringing the stakeholders in on the discussion results in controversial decisions and, often, faulty decisions.

One of the reasons why there's a growing interest in water conservation in the Western US, is that it is becoming economically, politically, and environmentally hard to build supply projects. Because it's hard to build these projects now, it makes it easier for water policy makers to think of alternatives.

What will the future bring? The answer depends on choices individuals make: the farmers, engineers, educators, politicians, and etc. make choices that affect the path we take. But everything we do makes a difference in the water decisions. So as we reach the limits of our water supply, we have to focus on a new way of thinking about water.

Water is a precious, scarce and vital resource. Our use of it has to be careful, thoughtful, sustained and planned.

Water Conservation in Texas: Progress, Challenges, Prospects
Moderator: Chris Brown, Chris Brown Consulting (San Antonio)

Chris Brown is principal of Chris Brown Consulting, a multifaceted water resource and conservation consultancy. Chris earned an M.S. in Water Resources Management at UNLV and a B.A. in Theology at Oberlin College. He is the former Director of the Water Conservation Department, San Antonio Water System; researcher, Center for Urban Water Conservation; and Executive Director, Citizen Alert, Nevada. The author of numerous water conservation planning documents, Chris has presented papers at numerous conferences around the US on water conservation and drought planning.

Carole Baker, Harris-Galveston Coastal Subsidence District
"New State Water Conservation Laws and the Water Conservation Task Force"

Carole Baker *is the Director of Intergovernmental Affairs at the Harris-Galveston Coastal Subsidence District. She is Director of the Board of the Texas Water Conservation Association and Chair of the American Water Works Association Legislative Committee. She is a member of the Water Conservation Implementation Task Force mandated by the 78th Legislature. She was a recipient of the Special Service Award for 2001 from the Lone Star Chapter of the Sierra Club.*

This presentation is based on the paper "Water Conservation Legislation & Initiatives 2003" included in the conference packet.

A number of new water conservation laws were enacted in the regular session of the 78th Texas Legislature in the spring of 2003. Indeed about 70% of the bills on water conservation that were introduced in the 2003 regular session passed. Following is a brief description of each new law enacted:

HB 645 – relating to the creation or enforcement of certain restrictive covenants that undermine water conservation; a property owners' association may not pro-

hibit or restrict a property owner from:

- implementing measures promoting solid waste composting of vegetation;
- installing rain barrels or a rainwater harvesting system;
- implementing efficient irrigation systems.

HB 3338 – relating to the performance of a water audit by a retail public utility providing potable water; requires water utilities to perform water audits in order to increase water conservation in Texas; every five years a retail public utility providing potable water shall perform and file with the board a wate audit computing the utility's most recent annual water system loss.

HB 2660 – relating to the establishment of minimum levels of wate conservation in water conservation plans;

- beginning May 1, 2005 all water conservation plans must include specific, quantified 5-year and 10-year targets for water savings;
- the entity preparing the plan shall establish the targets;
- targets must include water loss programs and goals for municipal use in gallons per capita per day.

HB 2663 – relating to the establishment of quantifiable goals for drought contingency plans;

- by May 1, 2005, a drought contingency plan must include specific, quantified targets for water use reductions to be achieved during periods of water shortages and drought;
- TCEQ and TWDB shall identify quantified target goals for drought contingency plans that entitities may use as guidelines;
- TCEQ and TWDB shall develop model drought contingency programs for different types of water suppliers.

HB 2661 – relating to the use of graywater;

- graywater is household wastewater from clothes washing machines, showers, bathtubs, handwashing lavatories, and sinks;
- the use of graywater can produce approximately 100 gallons of excess water per day;
- this bill requires TCEQ to adopt and implement minimum standards for the use of graywater for certain purposes.

SB 1094 – relating to the creation of a task force to evaluate matters regarding water conservation;

HB 1152 – relating to the authority of certain nonprofit water supply corporations and sewer service corporations to establish and enforce customer water conservation matters; amends the Texas Water Code to provide nonprofit water supply corporations the statutory authority to enforce reasonable water conservation practices and prohibit wasteful or excessive water use.

Three important water conservation bills from the 2003 legislative session that did not pass floor action were the following:

- HB 487 – requiring the TCEQ to adopt standards for requiring newly installed or modified irrigation systems to have a rain shut-off device;
- HB 488 – relating to performance standards for toilets sold in the state;
- HB 489 – relating to water and energy saving performance standards for commercial clothes-washing machines.

The Water Conservation Implementation Task Force created under Senate Bill 1094 has the following responsibilities:

- identify, evaluate, and select best management practices for municipal, industrial, and agricultural water uses and evaluate the costs and benefits for the selected best management practices;
- evaluate the implementation of water conservation strategies recommended in regional and state water plans;
- consider the need to establish and maintain a statewide public awareness program for water conservation;
- evaluate the proper role, if any, for state funding of incentive programs that may facilitate the implementation of best management practices and water conservation strategies;
- advise TWDB and TCEQ on a standardized method for reporting and using per capita water use data and establishing per capita water use targets and goals, accounting for such local effects as climate and demographics; and evaluate the appropriate state oversight and support of any conservation initiatives adopted by the Legislature.

As required by SB 1094, the TWDB selected task force members recommended by and representing the following entities and interests: TCEQ, TDA, Parks & Wildlife Department, State Soil & Water Conservation Board, municipalities, groundwater conservation districts, river authorities, environmental groups, irrigation districts, industries, institutional water users, professional organizations focused on water conservation, and higher education.

The Task Force had its first meeting on September 29 and will work at on a fast schedule to complete its assignments.

Ken Kramer, Lone Star Chapter, Sierra Club
“Water Loss in Texas”

Water loss (also called unaccounted-for water) is the difference between the amount of water a utility purchases or produces and the amount of water that it can account for in sales and other known uses for a given period. Simply put, it is the water that a utility cannot account for. It is often attributable to inaccurate or incomplete record keeping, meter error, unmetered uses such as fire-fighting, line flushing, public use and wastewater treatment plants, leaks and water theft.

Comparing water loss in Texas with other states is difficult due to lack of consistent terminology and standards. Lack of standard terminology and measures are at the center of the water loss penumbra.

How much water loss is acceptable in a system? The TWDB recommends immediate action if the unaccounted for water is above 15% for municipal systems and 15-18% for widespread rural systems. The International Water Association recommends looking at water loss in volume.

The water audit is the first step to understanding water loss. In the typical water audit you record the total amount of water produced or purchased, total amount of water sold and a breakdown of where the remaining water is. There is variability in the types of water audits.

There were three sources of information for the Sierra Club water loss research. The Sierra Club survey sent out to 1000 water suppliers in Texas (those serving the largest number of customers). The survey requested information on annual water loss, cost of the lost water, whether water audits are completed on a regular basis, how water loss is addressed by the utility and whether their water conservation plan addresses the issue of water loss. The second piece of information came from the Water and Wastewater Utilities Annual Report. This is required of all investor-owned utilities and filed with the Texas Commission on Environmental Quality. It has a section about annual water loss. The third piece or information came from the survey of ground and surface water use. This is a yearly report required of all governmental water systems and is filed with the TWDB.

Response to the Sierra Club survey was dismal. Only 67 out of 1000 survey were returned. Possible causes of this low rate of return are outdated addresses, lack of information available, lack of desire to answer questions, lack of understanding and lack of one person in charge of the information. From the returned surveys there is a water loss rate of 10.2%.

There were over 12 billion gallons of water lost in just 67 water utilities (these are the ones that returned the Sierra Club survey). There are thousands of water suppliers in Texas. None of the larger water suppliers responded to the survey. The total population served by those who responded is roughly 800,000. Water suppliers in Texas serve over 20 million people.

According to the surveys tuned in to TCEQ, there is a water loss rate of 14.7%. There are 661 investor-owned utilities in the State of Texas. Out of the 4,144 water systems that report to the TWDB, only 399 reported how much water they sold and 1085 reported how much they lost. It is difficult if not impossible to gauge water loss from this data.

The bottom line is that the current data on water loss in Texas is neither accurate nor complete. The State Water Plan proposes to spend billions of dollars to increase the water supply in Texas, but Texans have no idea how much water we waste.

As a result of the research the Sierra Club makes three major recommendations:
-Texans should aggressively monitor water loss.
-The State of Texas should require water providers to reduce water loss.
-Texas should make reduction of water loss a priority for meeting future water demands.

Sam Godfrey, SAMCO Leak Detection
"Leak Detection and Repair"

Sam Godfrey is the owner of SAMCO Leak Detection Services, Inc., located in Austin. He has 20 years of experience locating leaks in water distribution systems. He has worked extensively with sonic leak detection equipment and water conservation procedures. Mr. Godfrey coordinates and performs all aspects of leak detection in Texas water systems ranging in size from municipal utility districts to large rural water systems. Prior to opening SAMCO, he was employed by the Lower Colorado River Authority and served as Leak Detection Program Coordinator for fourteen years. Mr. Godfrey presently serves on the Texas Water Utility Association Education Committee.

One form of conservation is avoiding the loss of already usable water through the distribution system. This requires a total system audit, to identify the unaccounted-for water and its value. Sam reminds us that water is liquid money. Conducting a leak detection audit requires: Accounting for all water that is produced (by metering all water); Testing all large meters; Performing an assessment of customer meters; Auditing accountability records; and Inspecting the system equipment.

Source meters (large utility meters), if inaccurate, are a big revenue drain. Utilities need to have meter change-out programs – the lifespan of the meters is 10 years or about one million gallons.

For a number of reasons, leaks often do not show themselves by surfacing as noticeable surface water. For example, the pipes can be in sandy or porous soil, or under several layers of road surface. The task of actually locating leaks in a water distribution system requires specialized techniques. Sam uses sound. The sound of water escaping from pipes is the basic tool of acoustic leak detection, but making use of that tool requires both quality equipment and a skilled, experienced technician to be able to pinpoint the location of a leak. Exactly locating leaks is necessary because you don't want to be digging lots of holes in order to fix the problem, especially when having to go through asphalt or concrete. The acoustic

equipment would be used to listen at all service connections at a meter box, in order to find small leaks (that could become big leaks in time) and even hear leak sounds on plastic pipe material that does not resonate well. Listening at fire hydrants is also necessary, not only to find leak sounds in the system, but also to check for leaks in the hydrants themselves. When the hydrant has a leak sound, it has to be flushed and reseated in order to tell if repairs are necessary.

Finding leaks in rural and remote areas is another matter. Some techniques are: visual inspection of lines (on foot), testing unusual standing water for chlorine or fluoride, investigating indicative vegetation (like cattails or unusually green) near water lines. Leak detection can also identify instances of water theft and, if used preventively, avoid emergency repairs with their associated water loss, damage to property, and lawsuits.

John Kight: Rainwater Harvesting

John Kight has been the Precinct 1 County Commissioner in Kendall County, Texas since 1997. He is a member of the South Central Texas Regional Water Planning Group (Region L) and a member of the Kendall County and Cow Creek Groundwater Conservation District Special Committee. He has been an Independent Consultant Engineer since 1993 and previously was the Director of Transportation Planning and Development with the Texas Department of Transportation – San Antonio District.

The first thing people say about rainwater collection is that it costs so much. Where I live on top of a hill, a well would have to be 900 feet deep; this would cost slightly over $26,000. The rainwater collection system that I designed and installed myself cost me $14,500. Cost isn't necessarily the determining factor. Well water is hard with a lot of iron and sulfur in it, and it requires treatment. Rainwater is high quality water that does not need to be treated.

I went back and looked at rainfall in my area for about the last one hundred years and figured out the average rainfall for each year. It averaged about 35 inches annually. My system is designed based on 30 inches. The average household water use is 6000 gallons a month (less in the winter and more in the summer.) My design is based on 200 gallons a day. During the worst drought on record in the 50's they got 10 inches of rainfall in a year. Each inch of rain produces roughly 4,000 gallons, which is 48,000 gallons. Added to the 30,000 that can be stored, you could use 150 gallons a day and still have water left.

The rainwater collection system uses gravity to collect water from the roof. It is a first flush system with two tanks. The first tank catches and screens out debris such as oak blooms and pollen. Then the water goes to the pump house where the water is filtered for either the yard watering system or the house water system.

We installed our system in August 2002, and our total water usage was highest in August (9,766 gallons). In the winter, water use goes way down. This can be divided into the

use of potable water, which stays fairly constant, and non-potable water, whose use increases during summer months because of yard watering. Our water usage in one year averaged out to 4,000 gallons a month or 132 gallons a day.

Through rainwater harvesting you can enjoy quality water in a sustainable volume that will meet domestic needs and allow maintenance of a nice landscape. The system is designed for home use with low flush toilets, water saving showerheads, etc. Rainwater collection generates more water than a well, and during a drought, with a rainwater collection system, there will be excess water, while a well would run dry. I have got a more sustainable water supply than you would ever have with a well. We have a year and a half of water if it never rained again, so this is something I think people are missing the boat on. Rainwater harvesting is not that expensive; you get excellent water; and you get a sustainable water supply.

Protecting Environmental Flows: Science, Economics, Policy
Moderator: Sheril Smith, Lone Star Chapter, Sierra Club

Sheril Smith is currently the volunteer Water Resources Chair of the Lone Star Chapter and works for the University of Texas as a Manager. Prior to working at UT she worked over 20 years in nursing and health care. She has a BA in Political/Environmental Science and is doing graduate work in water supply studies at UT-Austin. Sheril lives in Lee County and raises Longhorns and horses in her spare time.

Dr. Paul Montagna: UT Austin Marine Science Institute, Port Aransas
Paul Montagna is a professor of marine science and senior research scientist at The University of Texas at Austin, Marine Science Institute in Port Aransas, where he has worked since 1986. Dr. Montagna is a marine-ecosystem ecologist who focuses on benthic processes. His expertise ranges from freshwater-inflow effects in estuaries to deep-sea ecology. Dr. Montagna has worked in the Pacific, Atlantic, Arctic, and Antarctic oceans. Much of his current work has focused on inflow-needs assessments of the Lavaca-Colorado, Guadalupe, and Nueces estuaries.

An estuary is where the river meets the sea. The mixture of salt and fresh water creates diverse habitats for many species. Many species have an estuarine dependent lifestyle, and they use the salinity gradient to know where to go. Estuaries also have many human uses with 60% of the population living within 60 kilometers of the coast. Estuaries have an environmental importance because they buffer the coastline during storms, store freshwater in the marshes, create habitats and filter waste.

The economic value of an estuary is high because of commercial and recreational uses. Our coastline is one of the most pristine, healthy, and abundant coastlines in the US because we have low population density on the coastline and water still flows into it.

Altered freshwater inflows affect hydrology, nutrients, sediment and salinity, and they can cause loss of habitat and productivity. In Texas, we typically see reduced inflow due to impoundments. Reduced flow changes the hydrology of nutrients. Dams trap sediments and cause erosion. Salinity is extremely important to estuarine habitats.

There are seven estuaries on the Texas coast that are named for rivers, not bays. These estuaries cover about 1 million acres. State agencies have collaborated to make minimum flow rules based on seven key species. The determination of inflow needs is based on models of harvest. Bays with less natural flow have less harvest. The southwestern estuaries, such as Nueces, are already showing signs of stress, and salinity levels are a main concern. The most stunning thing about Texas Estuaries is their climactic and soil gradient. The estuaries vary greatly form East to West. There is extreme year-to-year variability and water allocation is a problem where it is scarce. We basically live in an arid environment punctuated by huge flood events and other global weather patterns. There is no such thing as average here.

We know that the climate is changing. It is in the record. Corpus Christi Bay has increased its temperature by 1.7 degrees. The effects of this are that the bays are saltier, and that is without altered inflow. If you look at the two major climate change models for Texas they predict exact opposite scenarios for Texas. One predicts over the next 20-50 years is that Texas will be hotter and drier; the other predicts cooler and wetter.

Both of these models are right. This is a region that is not characterized by means but by great extremes. That means the weather in Texas is highly unpredictable and is characterized by great extremes. Our wetter periods are going to be wetter and our drought periods are going to be longer. Floods and droughts are going to be record setting. Every single event we have had in the last 15 years has been record setting for 1500-year rains and floods. The drought in the ‘90’s was a drought of record too. We had a drought between 1989-1992 that was deeper than the drought of record that all our water resource planning is based on today.

Todd Chenoweth: Texas Commission on Environmental Quality

Todd Chenoweth is the Manager of the Water Rights Permitting and Availability Section for the Texas Commission on Environmental Quality. He has an education in law and public administration, with degrees from Texas A&M and the University of Texas at Austin and a Master of Public Administration from the John F. Kennedy School of Government at Harvard University. Mr. Chenoweth worked for the Texas Water Development Board from 1989 to 1992. He joined the Texas Commision on Environmental Quality staff in 1996. At TCEQ, Mr. Chenoweth worked in water policy before becoming the manager of the Water Rights Permitting & Availability Section in December 1999.

At the Texas Commission on Environmental Quality (TCEQ) we issue permits for surface water rights. If you want to use surface water in Texas you have to come to us for a permit. There are a couple of uses that do not require a permit. Those are domestic and livestock use. When you come to TCEQ to get a permit you have to show that there is water available for the permit and that the water will be put to a beneficial use. Your water right will come with a priority date. During a drought, when there is less water, it is best to have an earlier priority date. These older rights are generally held by agricultural interests, and the newer ones are held by municipalities.

How do we integrate environmental considerations into the water rights permit process? Since 1985, we have been routinely including in all our water rights special conditions to protect the environment. We will place a special condition on the right that says “you may take X amount of water as long as there is Y amount of water in the river”. The older water rights (before 1985) do not have these special conditions.

How do we determine the cutoff point for water rights to protect the environment? We look at gage flows and use a desktop methodology that requires us to preserve 60% of the flow during summer months and 40% of the flow during winter months. We can also look at freshwater inflows to the bays and estuaries systems within 200 miles of the coast. The statute says we can place special conditions on our permits to maintain beneficial inflows to the bays and estuaries. We can look at salinity, nutrients etc. The statute also says that we have to look at the needs of the people to be served by the applicant. That means that we try to balance the needs of the environment (as established by the TWDB and TPWD) with people who will get the water. We do this on a case-by-case basis.

The next critical piece of information is to understand how we look at environmental needs when a water right holder seeks an amendment to their water right. A water right holder needs an amendment to their water right when they want to change the amount of water in the permit, where they pick that water up from the stream, or how they use that water right. Right now about half of our permits are water rights amendments. These

water rights holders want to change how they use their water right. For example, there are agricultural water rights holders wanting to change to municipal use. We only place environmental restrictions on the change in use in the amendment, not on the whole water rights. For example, an agricultural water right holder has 5,000 acre feet per year (AFY) of water and wants to change it to 5,000 AFY for municipal use. There would not be any environmental restriction put on this water right. If they wanted to increase it to 10,000 AFY then the extra 5,000 AFY would be subject to environmental restrictions.

Many of you have heard of the water rights application by the San Marcos River Foundation. They applied for a water right for the environment. There were six of these kinds of applications filed with the TCEQ as of last year. This scared quite a few municipalities and others that thought they would apply for a water right in the future. That concern led to the passage of SB1639 which told TCEQ to put a moratorium on issuing these kinds of permits for two years while the Legislature appoints a study committee to look at the larger issue of how Texas is going to provide water for its environment. In the next two years the committee will be looking at the issue of how to provide water for the environment and balance those need with the people of Texas. This could change the way TCEQ issues permits in the future. One thing that a lot of folks are expecting is an answer to the question of whether or not we will have instream flow permits in the future like the SMRF application or some other kind of system (maybe a system where we set aside a certain amount of water for the environment that is not available for permitting). We will be looking to the Legislature for guidance on how to incorporate these decisions into out permitting process.

How we consider environmental concerns in the permitting process is a dynamic process and is very much in the hands of the state leadership right now.

David Bradsby: Texas Parks and Wildlife Department

David Bradsby heads the Water Quality Program in the Resource Protection Division of Texas Parks and Wildlife. He has worked on water quantity and water rights issues for 14 years, and represents TPWD in the Lower Colorado Regional Water Planning Group. He has a B.S. in Biology from the University of Texas and a Masters in Aquatic Biology from Southwest Texas State University.

Environmental flows are flows that remain in the stream (instream flows) and freshwater inflows to bays and estuaries. Environmental flows provide for native and rare species, aquatic and riparian habitat, water quality protection, recreation, navigation, and healthy bay and estuary systems. Environmental flows are important for biodiversity and habitat. They are also necessary for water quality, channel maintenance, and recreation.

Since water rights are granted on a perpetual basis, many streams in the state are over-appropriated. Most water rights do not have provisions for environmental maintenance flows, and data indicates that some aquatic systems have degraded due to dams and reduced stream flow. Legislatively mandated studies have been completed to determine

freshwater inflows necessary to conserve the health and productivity of Texas' major estuaries including the Laguna Madre, Nueces, Sabine, Galveston, San Antonio, Aransas and Matagorda.

The delivery of freshwater inflows must incorporate seasonality to have any ecological significance. For example, the monthly inflow needs in May are much higher than in September. The instream flow studies were mandated by Senate Bill 2 to be a joint effort between TCEQ, TWDB, and TPWD. The studies are to establish an instream flow data collection and evaluation program for determining flow conditions in the state's rivers and streams necessary to support a sound ecological environment. The studies will be completed by December 31, 2010, and will be based on five river components including: water quality, biology, hydrology, connectivity, and geomorphology of 6 river basins in Texas.

The Study Commission on Water for Environmental Flows was created by the 78th Legislature (through SB 1639) in recognition of the importance that the ecological soundness of our riverine systems, bay and estuary systems, and riparian lands has on the economy, health, and well-being of the state." The bill states that the commission may not issue a new permit for instream flows dedicated to the environmental needs or bay and estuary flows. While the bill requires TCEQ to stop issuing water rights for instream flows it allows them to continue issuing other kinds of permits. There is a concern that there will be a run on non-instream use permits in the interim and there will be nothing left by the time the commission issues its report and the Legislature takes action.

The Texas Water Trust is a mechanism to retire water rights from consumptive use and dedicate the water right to environmental purposes, either for a term or perpetually. The ultimate goal is to restore depleted surface water flows by retiring existing water rights through dedication to the Texas Water Trust.

While it is important to preserve flows for the environment, it is also important that we keep flows in our rivers and streams, and freshwater going to our bays and estuaries, for the enjoyment and benefit of current and future generations of Texans.

Myron Hess: National Wildlife Federation

Myron Hess is Legal Counsel in the Austin office of the National Wildlife Federation, where he concentrates on protection of wetlands and water resources. Mr. Hess has worked on environmental law in private practice and for Texas Parks and Wildlife Department. He is a graduate of the University of Texas Law School and Texas A&M University.

The population in Texas is expected to double in the next 50 years. The net effect of all these additional people is that we will need more water. The assumption is that we will be taking more water out of our rivers and groundwater. Where are we today with permitting? Water rights have been issued as perpetual rights. There are a very few permits

issued with environmental flow conditions. For a lot of our streams the water rights with no environmental conditions on them (those issued prior to 1985) will take all the water out of the system if the rights are fully exercised. That is not a rosy scenario in terms of our environmental flows. Is putting environmental flow conditions on permits too little, too late? That alone certainly will not solve our problems.

We have computer models in the state to analyze the amount of flows that would historically be in our streams (naturalized flows). On the Nueces River that would vary over the year. The model also shows that if you take all the water that has been permitted out of the river with no return flows then you have only a very small fraction of what would historically be in the river. Luckily, all water rights permits are not fully utilized. But legally, this is what we have authorized to happen.

This is a fairly serious situation. Using those same models to look at the Trinity River where it flows into Galveston Bay, it shows that in 85% of the years you would get the amount of water the state says we need to keep the bay healthy under naturalized flow conditions and that with current permitting you will get that amount of water about 60% of the time. How much of the time are we willing to not have enough water for the bays and estuaries?

What needs to be done? We have to change our planning exercise. We have to make protecting rivers and bays a priority in water planning. Right now it is an afterthought.

We have to ensure that water is used efficiently if we are going to be able to met environmental needs. We have to have definite enforceable flow protections. Lastly, we must act quickly. There has been a moratorium on issuing environmental permits, but not other kinds of permits.

Legally, how can we protect environmental flows? We can place conditions on new permits, but that is not enough. It is extremely important but it is only a limitation on the amount of *additional* harm that can be done by water rights permits. A lot of people thought instream flow water rights were a good idea. The legislature so far does not agree. We think that the environment is a beneficial use that can be issued a water right but that is not where we are right now. Hopefully the Legislature will revisit this issue. A third option is a reservation system where a certain amount of water is set aside for the environment and is not available for permitting. This option has its problems as well. Another option is cancellation of water rights. It is important to remember that surface water belongs to the people of Texas. A water rights permit is issued to use water for a specific purpose. If it is not being used for that purpose anymore it can legally be cancelled. The general theory underlying western water has been that if you do not use it, you lose it. We can also purchase water rights, and they can be donated to the Texas Water Trust.

Let decision makers know that you care about this issue. Talk to members of the Study Commission on Water for Environmental Flows. Find out what your Regional Water Planning Group is up to and let your elected official know that you care about this issue.

Protecting Groundwater & Springflows: The Edwards Aquifer and Comal & San Marcos Springs

Moderator: Melinda Taylor, Environmental Defense
Melinda Taylor is an attorney with extensive experience working on endangered species issues. She is currently the program manager for Environmental Defense's Ecosystem Restoration program, which includes all of the organization's work on habitat protection and water issues around the country. Ms. Taylor leads efforts in Environmental Defenses' Texas office to restore ecosystems and implement incentive programs for habitat restoration and conservation.

Geary Schindel, Edwards Aquifer Authority
"Protecting the Edwards Aquifer"

Geary Schindel *is the Chief Technical Officer for the Edwards Aquifer Authority. Before joining the Authority, Geary held positions as Senior Project Manager and Director of Karst Hydrology for Eckenfelder Inc.; Manager of the Environmental Division of ATEC Associates, Inc., in Nashville, Tennessee; and Manager of the Groundwater Branch for the Kentucky Division of Water in Frankfort, Kentucky. He has also worked as a research assistant at Mammoth Cave National Park and at the Center for Cave and Karst Studies at Western Kentucky University. Geary has a M.S. degree from Western Kentucky University and a B.S. from West Virginia University. Geary has written or co-written more than 20 publications related to caves, karst, and hydrogeology.*

The Edwards Aquifer Authority (EAA) is a regional groundwater management agency created by the Texas Legislature in 1993. The Authority began operations in June 1996. The legislated mission from the Edwards Aquifer Authority Act is to: "manage, con-

serve, preserve, and protect the aquifer and to increase the recharge of, and prevent the waste or pollution of water in the aquifer." The "aquifer" means the San Antonio segment of the Balcones fault zone Edwards Aquifer. The Authority encompasses all or parts of eight counties in south central Texas. Our offices are in San Antonio The EAA is governed by a board of directors elected by popular vote. The board has 15 voting members and two nonvoting members. We currently have 55 positions including administrators, support staff information and education specialists, planners, environmental scientists, and technicians.

The EAA is funded by a water management fee paid by certain categories of pumpers. In 2003, Municipal and Industrial (M&I) pumpers currently pay $29 per acre-foot. One acre-foot = 325,851 gallons. A typical family of 4 uses about 0.5 acre-feet per year. Agricultural pumpers currently pay $2.00 to per acre-foot. EAA's 2003 budget is $12.2 million.

The properties of Edwards Aquifers include triple porosity/ permeability flow system, rock matrix, fractures and conduits. Both laminar and turbulent flow occur in the aquifer
The flow is convergent from west to east to discharge in wells and springs.

Groundwater velocities are rapid in some areas of the aquifer – 600 to 6,000 feet per day. Direct surface water input comes through fractures, caves, sinkholes. There is no filtration of water in the Edward Aquifer. Dilution and biologic and chemical changes can occur in the Edwards Aquifer.

The EAA has an ambient Monitoring System that includes a surface water system, groundwater system and springs. The EAA also monitors areas of concern.

Environmental sources of concern include non-point agricultural runoff such as nitrates, pathogens, herbicides, and pesticides. Non-point urban runoff such as nitrates, pathogens, herbicides, pesticides, VOCs, metals. Non-point Industrial runoff such as nitrates, VOCs, herbicides, and pesticides.

We have more than a fifty-year history of water quality monitoring for the Edwards Aquifer. Water quality in the aquifer is very good with only a few locations exceeding standards. Development over the recharge zone is a significant concern. Pathogens, nitrates and VOCs are biggest water quality concern. We need to constantly reevaluate water quality monitoring strategy to reflect better understanding of hydrogeology.

You can contact the EAA at www.edwardsaquifer.org.

Ed Obourny, BIO-WEST, Inc.
"Protecting Springflows: The Edwards Aquifer and Comal & San Marcos Springs"

Ed Obourny is a Senior Fisheries Biologist with BIO-WEST, Inc., specializing in aquatic ecology, water quality, biological modeling, and instream flow issues and concepts. Mr. Oborny has participated in freshwater and coastal monitoring programs, water quality investigations, instream flow analyses, radio telemetry studies, and numerous other fishery- and water-related project components. Oborny has managed several large ecological and water resource projects in Texas. He is currently project manager for the multi-discipline, multi-year variable flows and water quality study for the Edwards Aquifer Authority. He has a B.S. in Wildlife Biology from Eastern New Mexico University and a M.S. in Wildlife and Fisheries Science from Texas A&M University.

As a biologist I get excited about the observations that I will be talking about today. I will focus on the Comal and San Marcos ecosystems, and then I will talk about the BIOWEST study on low flows on the San Marcos ecosystem. I will finish with the observations of the study.

There are seven endangered species in the Comal and San Marcos ecosystems. These include two fish, a plant, a salamander, and three invertebrates. We also have the threatened San Marcos salamander in the San Marcos system.

The Comal is the shortest river in the country and possibly the world. The Comal passes through Landa Park. When you look at these systems you will see a lot of human developments such as concrete bulkheads.

The old channel on the Comal is more natural. The upper San Marcos is above Interstate 35, with flows through City Park.. Texas wild rice grows in this area of the river.

The study we have been conducting started in the fall of 2000. At that time the flows of the Comal had dropped below 200 cfs, which is the "take" level for endangered species established by USFWS (the level at which a "taking" of the endangered species occurs). The study includes a lot of aquatic vegetation mapping – the species' habitat. We use a glass bottom kayak to do this kind of mapping. We also do drop netting and drip netting for aquatic species such as the fountain darter. Sometimes snapping turtles and snakes will jump in the nets. The San Marcos River has been impacted by numerous exotic aquatic species such as talapia, snails, and sucker catfish.

BIO-WEST has also done a lot of laboratory evaluations on the endanger species of the Edwards Aquifer. We have had a couple of species sampling events on the Comal River where the flows were below the federal endangered species take level. Flows on the San Marcos River have not yet dropped below the federal take level for endangered species.

As a result we have used laboratory evaluation to simulate the effects of low flow conditions on endangered species such as the riffle beetle. Our laboratory studies show that the riffle beetle moves up and down through the river substrate toward flows. We've have not yet found this in the wild. We've also found through our laboratory studies that a certain parasite does not effect the reproduction of fountain darters. In the laboratory we are simulating the effect of low flow conditions on aquatic vegetation such as wild rice.

Our studies on the Comal riffle beetle show that the invertebrate's habitat is much more diverse than we originally thought. We have found the riffle beetle in various seeps and not just in the riffles of that we once though as their only habitat.

We now have three and half years of observations in these river systems. During that time we've seen flows below the take level, intense rains, and impacts from high flushing flows. Our observations also show that recreation has a lot of impact on these river systems. You see a lot of fishing and tubing in these areas. Obviously education will play an important part in conserving these river systems.

In the late summer on the Comal River you see a lot of green algae build up with flows below 150 cfs. Our comprehensive monitoring over three years showed that even with higher flows the green algae and vegetation mats build up. This appears to be more of a late summer event than a low flow event. Obviously high flows are needed to push out the green algae and vegetation mats.

High flows can result in aquatic vegetation being washed out and sediment being moved out. Immediately high flow will take out a lot of habitat but you also see a rapid recover of aquatic vegetation such as wild rice. Though high flows may look damaging they are important for system flushing.

Our observations show that variable flows at different cfs are critical to the Comal and San Marcos systems. There is not one flow level that will sustain the endangered species of these systems. You need a variety of flow level to sustain the species. According to our observations it is the duration and frequency of the low flow/high conditions that are critical to sustaining this systems and the species that depend on them.

It is also important to know the condition of the system before the starting the study since you will only see a snapshot of the system. When you track the system over a long period of time you know the system going in and coming out of the study. This provides you with a better understanding of the system.

It is critical to understand the condition of the system before a critical period [High or Low flow] and to track the recovery. Laboratory studies are providing a glimpse into the life history of these endangered species. We still need low-flow data to evaluate the levels and durations suitable for survival of the endangered species in the wild.

Ken Kramer, Lone Star Chapter, Sierra Club
"Wrap Up"
Everyone is encouraged to take the "Principles for Protecting Texas' Water Resources" found in the conference packet and get endorsements from their local governments and/or community organizations and send those endorsements to the Texas Living Waters Project in order to demonstrate widespread public support for sound water policies. The Sierra Club and the Texas Living Waters Project will endeavor to keep everyone informed about activities on the water issue and inform people of opportunities to provide input on actions to be taken by water decision-makers.