New Waves
The Research Newsletter of the Texas Water Resources Institute
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Austin Approves S. O. S. Ordinance

Residents vote to keep Barton Springs pristine

Austin voters recently approved an amendment called the Save Our Springs (SOS) initiative to protect water quality in Barton Springs.

Voters went to the polls in Auaust to vote on two proposals. The SOS initiative, which passed by a 64 to 36% margin, limits development to a maximum of 15 to 25% of paved surfaces or impervious cover. It also requires that pollutant levels in developed areas do not exceed concentrations that existed before development occurred. An alternative "City Council" amendment was defeated by a 35% to 65% count. The main difference between it and the SOS initiative is that it would have allowed 20 to 70°/O of impervious cover in developed areas. It also called for the city to eliminate existing pollution problems and for the purchase of sensitive lands to protect water quality.

Researchers from the University of Texas at Austin (UT) and the University of Texas at San Antonio (UTSA) were involved in the debate before the vote.

John Merrifield, an economist at UTSA, produced a report titled "What the Proposed SOS Ordinance Debate Should be About." He said the passage of the SOS ordinance would protect water quality, preserve the springs, and would ultimately benefit many property owners. Merrifield added that Barton Springs is a key element in Austin's "quality of life" and that preserving the springs allowed the city to compete for new business. Merrifield can be reached at (210) 458-5310.

Joseph Malina of the UT Civil Engineering Department, presented a

different viewpoint. He prepared a study titled "Environmental Impactsof the Proposed SOS Ordinance." He said it would be unlikely that water and wastewater services could be economically provided to the area because the ordinance required lot sizes of at least an acre. The result could be extensive use of septic tanks that could raise nitrate levels, and increase numbers of drinking water wells that could dry up the springs. Malina's phone number at UT is (512) 471-4614.

Researchers in the UT Law School commented on whether the SOS ordinance would constitute a Taking" of private property. Thomas McGarity, Sanford Levinson, Douglas Laycock and Jordan Steiker said the SOS ordinance is not a taking because it allows single family homes and other projects to be developed.

Potential Impacts of Global Warming on the Climate of South Texas

Researchers: Jim Norwine, Geosciences Dept., Texas A&l University, Kingsville, TX, and Jane Powley, Civil Engineering Dept., University of Delaware, Newark, DE.

Problem: South Texas already suffers from considerable variations in climate and could be especially vulnerable to the effects of global warming caused by doubled levels of carbon dioxide (CO2). Although climate change simulation models have been developed that project global or regional conditions, few efforts have been made to translate these results into local impacts that have practical applications.

Objectives: To apply temperature and precipitation values predicted to occur under doubled CO2 conditions to the climate and water budgets for Laredo, Corpus Christi, and Brownsville using the National Oceanic and Atmospheric Administration's (NOM) geophysical fluid dynamics laboratory model; and to assess how these changes might affect natural vegetation

Methodology: Simulated climate data for doubled CO2 conditions were obtained from the NOAA model. Current climate data were obtained from historical data and from the Water Budget Interactive Modeling Program (WIMP). Current and predicted data were entered into the WIMP to obtain data for potential and actual evapotranspiration (ET), soil moisture storage, water storage, and water deficits.

ResuIts: The impact of increased ET levels and reduced rainfall is projected to be most severe in Corpus Christi (23% drier), while Laredo could be less impacted (12% drier). If doubled C°2 levels cause climate change to occur, annual potential ET is projected to increase while rainfall is expected to decrease slightly. This will decrease soil moisture and increase water deficits. Summer ET will increase significantly while rainfall is likely to decrease. As a result, natural vegetation may change to more drought-tolerant types and increased irrigation will be required for agricultural producers.

Reference: Powley, Jane, and Jim Norwine, "Possible Effects of Atmospheric CO2-lnduced Global Warming on Water Budgets in South Texas," in Managing Water Resources Dunng Global Change, American Water Resources Association (in press).

Influence of Springflows on River Flows and Instream Fisheries

Researchers : Raymond Mathews, Jr., Texas Water Development Board (TWDB), Austin, TX, and Robert Edwards, Biology Dept., University of Texas-Pan American, Edinburg, TX.

Problem: Springs associated with the Edwards Aquifer in South Central Texas increase the base flow of streams in the Guadalupe, Nusces, and San Antonio watersheds. Spring-fed streams contain permanent habitats for fish and wildlife, including many threatened and endangered species. The vast majority of threatened or endangered fish species in Texas are dependent on spring systems. Research needs to be done to quantify the amount of water that springs contribute to specific species in key ecosystems of Texas so that these species can be protected.

Objective: To determine the impact of reduced flows from Comal and San Marcos Springs on instream flows below the proposed Cuero Reservoir site.

Methodology: TWDB's Macrohabitat Assessment Technique (MAT) was used in this study. The MAT involves a hydrodynamic model and a stream habitat flow model. Surveys are conducted on morphometric habitats (riffles, runs, pools, backwaters, sloughs, and undercut banks) and physical habitats (snags, debris dams, and root wads) for specific stream segments. Flow recommendations were developed based on the numbers of fish that depend on various habitat types and how different flow rates impact the availability of those habitats.

Results: Reduced springflows significantly affected habitat availability in the Cuero reach of the Guadalupe River. For example, snag habitat (submerged tree trunks held in place by bottom substrates and sediment build-up) is expected to be significantly reduced if springflows decrease. A total loss of springflows would lessen riffle habitats (essential spawning grounds for several fish species) by 23%, runs by 20%, and pools by 15%. Springflows typically contribute 25% of the freshwater inflows to San Antonio Bay and the Guadalupe Estuary. Key species that could be impacted by a reduction of springflows include the Cagle's map turtle and the blue sucker.

Reference: Mathews, Raymond,and Robert Edwards, "Contributions of Spring Flows to Riverine Flows and Relationship to Instream Fisheries," presented at Texas Academy of Science, May 1992.

Growth and Catchability of Largemouth Bass in Texas Ponds

Researcher: Leroy Kleinsasser, Texas Parks and Wildlife Department, Austin, TX, J. Williamson, U.S. Fish and Wildlife Service, San Marcos, TX, and Bobby Whiteside, Aquatic Station, Southwest Texas State University (SWTSU), San Marcos, TX.

Problem: Since the late 1950s, Florida largemouth bass have been stocked in ponds in Texas and elsewhere because it was assumed that these fish grew faster, lived longer, and were less vulnerable to being caught by anglers. This would, in theory, provide larger fish

than native stocks. However, research needs to be done to make sure these assumptions are valid for Texas conditions.

Objective: To compare the length, weight and catchability of Florida and northern largemouth bass and hybrids in Texas ponds.

Methodology: Study sites included eight ponds at the San Marcos National Fish Hatchery and Technology Center and two ponds at SWTSU. Some of the ponds had clay bottoms while others had mud bottoms. Fish species used in the study included northern and Florida large mouthed bass and two hybrids (northern males and Florida females, and Florida males and northern females). In December of 1984, all four types of fish were stocked in all ponds. The total length and weight of each fish were measured before the fish were stocked. They were also sampled and measured in February, May, August, and December,1985. Four ponds were fished for one hour on two days in November, 1985. One angler fished in a pond at one time and each fisherman spent 15 minutes at a pond. Fishermen rotated sites until each angler had fished all four ponds. Anglers used spinners, plastic worms, floater-divers and live golden shiners for bait.

Results: Florida largemouth bass had the lowest weight and length and were shorter than the other species. Hybrids from Florida females and northern males were the heaviest and in the best condition at the end of the study. Florida bass were the most difficult to catch while northern bass were the easiest. This suggests that although Florida largemouth bass have been widely used and recommended by fisheries' managers, they may not fare better than other largemouth bass species in all environments.

Reference: Kleinsasser, Leroy, J. Williamson, and Bobby Whiteside, "Growth and Catchability of Northern, Florida, and Hybrid Largemouth Bass in Texas Ponds, *North American Journal of Fisheries Management*, 1990 (pp. 462-468).

Flows and Water Chemistry: in a Hill Country Grotto

Researchers: Barbara Mahler and Phillip Bennen, GeologicaI Sciences Dept., University of Texas, Austin, TX.

Problem: Hamilton Pool, 20 miles southwest of Austin, is a small cavern or grotto that is supplied by water from a 75-foot waterfall. High water quality is essential because the area is used for recreation. At base flows, the pool is fed by a series of springs and by groundwater that drips from stalactites into a cave called Drippy Rock. Only a small amount of water (0.035 cubic feet per second at base flow) travels through the stalactites because it has to pass through extremely small fractures. Water flows through the springs at higher volumes (0.1 to 0.5 cubic feet per second at base flow) and often undergoes little dilution. If spring flows dominate the system, it could suggest that the system is vulnerable to pollution.

Objectives: To characterize the geochemistry of the water that flows into Hamilton Pool, to determine the mechanisms that control each source, and to investigate the relationship between the springs and the ground water flow in the cave.

Methodology: Water samples were collected from the springs for 6 months and were analyzed for pH, temperature, alkalinity conductivity, and major anions and cations. Sand and limestone samples were taken from the walls of the cavern to determine how they influence water chemistry.

ResuIts: In general, the water chemistry at the springs and the stalactites was similar. This suggests the source of the waters is probably the Glen Rose Limestone. However, water dripping from the stalactites has increased levels of pH and reduced levels of calcium and bicarbonates as it emerges from the caves. After heavy rains, conductivity levels decreased at the springs it increased or remained the same at Drippy Rock. Conduit flows dominate the springs while diffuse flows are prevalent at Drippy Rock.

Reference: Mahler, Barbara, and Phillip Bennett, "Interaction of Flow Mechanics and Aqueous Chemistry in a Texas Hill Country Grotto," in *Proceedings of the Third Conference Hydrogeology, Ecology, Monitoring, and Management of Groundwater in Karst Terranes*, National Groundwater Association 1992.

Revenues of Public and Private Water Utilities

Researchers: S. Chibot Onyeji, lnternational lnstitute for Applied Systems Analysis, Laxenburg, Austria.

Problem: Many communities are now confronted with the challenge of ensuring that adequate funds are available to maintain, operate, and improve water supply systems. At the same time, many towns face budgetary constraints that limit their ability to obtain funding. With this in mind, many areas are contracting with private firms to operate public water and wastewater facilities. The general perception is that privately owned and operated utilities are better able to minimize costs and increase revenues. However, there has been little research to see if this really occurs.

Objectlve: To determine the effect of ownership on water utility revenue rates.

Methodology: Attention was focused on the average rate per 1,000 gallons of water sold. The study utilized regression analysis to test the relationship of revenue rates to operating costs of utilities. Variables that were tested include the number of customers served, the total amount of water produced, the rate at which water is produced, the geographical characteristics of the area, and the population distribution within the area. Data for public water utilities was obtained from the American Water Works Association while information on private water utilities was supplied by the National Association of Water Companies. That data included information on long-term debt, interest payments, energy expenses, and other items.

Results: Mean revenues accrued by public water utilities were $1.16 per 1 ,000 gallons, while private firms earned $1.61 per 1 ,000 gallons. lnterest payments and the type of ownership were statistically significant and explained 42% of the difference in revenue earnings between private and public utilities. Privately owned utilities tend to charge for the full cost of service (capital expenditures, depreciation, billing, administration, and

other services). Publicly owned utilities appear to base rates on average costs. Without competition, a utility,s capital program might have the single greatest impact on rates. Rates will typically be higher for utilities that recover capital financing through their rate structures. Public utilities have Iower rates, in part because their decisions are based on political and administrative decisions and not on economic judgments.

Reference: Onyeji, S. Chibot, *Economic Effectsof Ownership in the Water Supply lndustry: a Quantitative Analysis*, Ph. D. Dissertation, Urban and Regional Planning Dept., Texas A&M University, College Station, TX, 1990.

A&M Project Aims to Predict Force of Irregular Waves

When waves from the Gulf of Mexico pound the Texas coast, they can cause a lot of damage. Bridges, piers, wharfs and other structures are all vulnerable to the force of the waves. However, do all waves carry the same punch? If so, how do you predict just how powerful a wave will be? That's the focus of a research project by Jun Zhang and Robert Randall of the Texas A&M University Civil Engineering Department.

Many currently used models do a fair job of simulating the force of waves as long as they have uniform size and flow rates. The problem is that's rarely the case. In reality, the height and speed of individual waves vary significantly. Compounding the problem, smaller waves often form and ride on other waves.

This project will try to account for waves with irregular properties to predict their kinematics (velocity and acceleration). This includes modeling the orbits of wave crests and troughs. Zhang will refine theoretical approaches to predict the kinematics Quinn computer simulations. Randall will try to verify the simulation results in laboratory studies using wave tanks. The tanks replicate waves of different velocities. The kinematics can be measured with a laser system equipped with Doppler radar and a wind speed gauge to measure the flow of small particles.

For details, contact Randali at (409) 845-4568 or Zhang at (409) 845-2168.

Surfactants May Help Clean Up Polluted Aquifers

Methods now being used to clean up aquifers contaminated by organic chemicals called non-aqueous phase liquids (NAPLs) are not economical or effective, but technology being developed at the University of Texas at Austin could provide a better solution.

William Wade of the Chemistry Department and Gary Pope of the Petroleum Engineering Department are testing the use of surfactants to remediate polluted aquifers. The goal is to develop surfactants that are biodegradable, work in fresh water at low temperatures, and are highly efficient at removing NAPLs. NAPLs are commonly associated with chemical and petrochemical operations.

For details, contact Pope at (512) 471 -3235.

Texas A&M Study to Develop Computer Models for Oil Still Clean-Up

Research at Texas A&M University may improve the response to oil spills, reducing costs and environmental damage.

Wilbert Wilhelm of the Industrial Engineering Department, Jan Wolter of the Computer Sciences Department, and Richard Geyer of the Offshore Technology Program are collaborating on the project.

For example, before oil spills occur, decision makers must select sites to deploy resources that can respond to an accident as soon as possible. After the spill occurs, other quick decisions have to be made about the method to be used to clean up the spill‹ mechanically containing the spill using booms, spreading chemicals or oil-eating microbes, or even burning the oil. While the cleanup is underway, resources must be assigned until the situation is resolved.

The goal of the study is to develop computer models and expert systems that can assist emergency planners and decision makers in preparing for and responding to oil spills. The models are designed to be used in "real world" situations.

For details, contact Wilheim at (409) 845-5493, Wolter at (409) 845-1489 or Geyer at (409) 847-9004.

Understanding Why Waves Cause Coastal Erosion is Goal of Texas A&M Studs

Researchers in the Civil Engineering Department at Texas A&M University are attempting to understand how and why waves that pound the Texas coast cause so much erosion.

Francis Ting of the Ocean Engineering Division is studying the "surf zone"--the area that begins where waves break and ends where they hit the coast.

In the study, he will simulate the effects of coastal wave action in a glass-walled tank where waves of various heights and slopes can be produced and break on a sloped false bottom installed in the tank.

Ting is placing small, irregular shaped objects on the bottom of the tanks to simulate ripples and irregular flows common to those found in nature.

Radar-like technology that uses lasers will be used to track how fast fluid particles are moving. Through these studies, he hopes to measure the energy that these breaking waves produce.

The study will provide data on beach erosion, coastal flooding, sediment transport, and how buildings and bridges may be damaged by heavy waves.

For more information, contact Ting at (409) 845-4504.

Reducing Non-Point Source Pollution in Arroyo Colorado is Goal of TSU Study

Finding ways to reduce non-point source pollution in the Arroyo Colorado Basin is the goal of a study being led by Jack Nelson of the Texas Institute for Applied Environmental Research at Tarleton State University.

Afler heavy rains, the Arroyo Colorado watershed is often contaminated by agricultural pesticides and fertilizers and urban runoff from areas like Harlingen and McAllen. Past studies have found pesticides in the arroyo's sediments. At low flows, high levels of coliform bacteria, low oxygen demands, and widespread algal growth are common.

The project will examine urban and agricultural pesticide and fertilizer use and runoff in Cameron and Hidalgo counties. The goal is to determine the impact of fertilizer and pesticide use on water quality. Researchers hope to demonstrate ways to enhance water quality and to field test improved nutrient and pesticide management strategies.

The project will also involve personnel from the Texas Agricultural Extension Service and the State Soil and Water Conservation Board. It is being funded by the Texas Water Development Board and the EPA. For details, contact Nelson at (817) 968-9567.

Finding a Way to Manage the Edwards Aquifer Proves Elusive Again

Just a few days after R seemed like that a solution had finally been developed in the on-going struggle to find a way to manage the Edwards Aquifer, a court ruling threw things back off track again.

In September, the Texas Water Commission (TWC) unanimously adopted a set of rules to manage the aquifer as an "underground flowing river." Those rules would have taken effect in June 1993. The rules, which were approved after lengthy and bitter debate, set a cap on overall pumping of 450,000 acre feet (AF) per year from 1993 to 2008. After that, the cap would fall to 400,000 AF annually. It would have also required that well owners that use 1,500 or more acre feet (AF) of water must submit conservation plans by 1995. To reach that cap, many aquifer users would be required to submit conservation plans to the TWC. A moratorium on drilling new wells For all purposes other than public and private water supplies) was also included in the new rules.

That plan may never have a chance to be implemented, however. Less than a week after the rules were approved by the TWC, Austin State District Judge Pete Lowry ruled that the Aquifer is not an underground river, but that R is, instead, a groundwater system. The TWC had argued that the Edwards is both a groundwater system and an underground flowing river. The judge said the TWC had no right to regulate the aquifer under existing law.

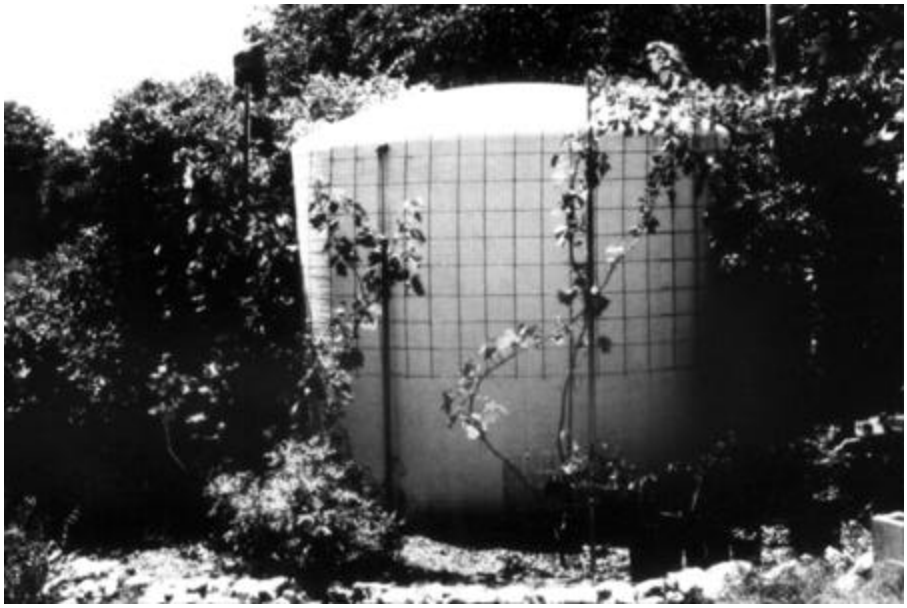
The judge was acting in response to a lawsuit by Danny McFaddin, a Uvalde County irrigator, the Uvalde County Water Conservation District, and the Texas Farm Bureau. The plaintiffs had challenged the TWC's authority to regulate pumping and claimed that the statutes were an unconstitutional seizure of private property.

The TWC said later they would appeal the judge's ruling. However, they also said they would not implement the new rules for the aquifer until the appeal is resolved or until the Legislature develops a solution.

To help give the Legislature more time to discuss management strategies for the Aquifer, the TWC, the U.S. Fish and Wildlife Service, and the City of San Antonio have filed a joint motion to ask that lawsuit seeking protection for Comal and San Marcos Springs under the Federal Endangered Species Act be delayed. That suit was filed by the Lone Star Chapter of the Sierra Club.

Cisterns May Provide Good Source of High Quality Water for Many Rural Texans

Most rural residents look underground when searching for water. Drilling a well seems to be the typical solution.



But an Austin man is looking in the other direction‹up to the sky. He's harvesting rainwater using cisterns, an old idea that's largely been forgotten, and he believes the system may be workable for many rural Texans.

Michael McElveen has built a water barn that catches rainwater. The water runs off a steel roof into an 8,500 gallon tank. Another 8,500 gallon tank captures the overflow. Each tank cost about $3,900 while it took another $2,400 to build the water barn.

McElveen figures that users of cisterns should be able to capture 600 gallons of water from every inch of rain that falls on a 1,000 square foot roof. That can add up to a lot of water. So far this year, for example, the cisterns have provided enough water to fill a 35,000 gallon swimming pool, a fish and lily pond, a catfish tank, and a garden.

One of the benefits is that the water is relatively free of contaminants, but McElveen still treats his drinking water with an ultraviolet light system. Another plus is that the costs are lower than drilling a well or tapping into a local water supply company, he said.

For more information about the cisterns, call Morris Media at (512) 343-7900.

Proposal to Use Heat Exchangers Denied by TWC

A proposal that would allow the use of "heat exchangers to provide inexpensive heating and air conditioning has been denied by the Texas Water Commission (TWC) because of fears that it could contaminate drinking water supplies.

In simple terms, a heat exchanger takes water from the distribution system and passes it through coils to heat or cool buildings. In other words, water (not air) is used for heating and cooling. The water is then returned to the distribution system.

The system could save up to half the energy now being used by air conditioners and furnaces and could make those technologies obsolete, according to its backers. Critics, including the Texas Section of the American Water Works Association, argue that the heat exchangers are unsafe because they could allow contaminants to enter the distribution system and because they could foster bacterial growth. There are also concerns that copper and lead could leach from pipes that are exposed to hot water in the process. They want to make sure the water that has been used by the heat exchangers receives additional treatment before it re enters the distribution system . The technology was proposed by DeMarco Energy Systems and was lobbied for by Jim Mattox, former Attorney General and candidate for Governor.

Fish from 3 Lakes with High Selenium Levels May Not Be Safe

The Texas Department of Health has issued health advisories for three northeast Texas lakes that have elevated selenium levels.

The advisories warn pregnant women and children younger than 7 to not eat fish taken from Brandy Branch Reservoir in Harrison County, Welsh Reservoir in Titus County, and Martin Creek Reservoir in Rusk and Panola Counties. All three lakes receive discharges from lignite burning power plants. Fly ash from the plants is believed to be the source of the selenium. In December, the Texas Parks and Wildlife Department (TPWD) reported it found elevated selenium levels in fish taken from the lakes. TPWD personnel are still sampling fish from the lakes. It should be noted that the selenium levels found in fish from the lakes was lower than the EPA recommendation of 5 parts per million. Also, much of the contamination occurred as long as 14 years ago before efforts to reduce selenium levels were begun.

TWC Proposes Tough New Rules to Deal with West Texas Sludge Project

A plan to spread sludge over a desolate ranch in West Texas may result in an unexpected additional benefit. The project generated so much public outcry that new State guidelines were proposed to make sure the project and others like it are safe.

The project involves shipping 400 dry tons of sludge daily by rail from New York City wastewater plants to a 200 square-mile ranch near Sierra Blanca in Hudspeth County. Over the next six years, the $168 million project will apply roughly 240,000 dry tons of sludge on the soil. Three dry tons of sludge would be applied per acre per day.

These trucks apply municipal sludge to rangelands near Sierra Blanca. Proponents say this will provide needed moisture and vegetation for West Texas deserts, while opponents argue that waste should not be imported from New York and other states.

After numerous groups claimed the sludge might pollute the environment or may contain hazardous materials, the Texas Water Commission proposed tough new rules that should make sure the project is safe. The rules require that a water and soil survey be performed on the ranch where the sludge will be applied, that water quality samples of runoff be taken after every storm, and that cattle be kept off of sludge-treated land for at least two years.

The first bad of sludge was spread in mid-August. After laboratory testing, it was Fund to be clean enough to "use for a garden compost."

University scientists were involved in educating people about the project. Texas A&M University Extension agricultural engineer John Sweeten, Extension soils specialist Willis Gass, and Harold Wiedeman, a researcher from the Texas Agricultural Experiment Station in Vernon, told residents of the pros and cons of applying the sludge. Ron Sosebee of the Texas Tech University Range Science Department provided input to the project.

CCA to Provide Rapid Response to Oil Spills

A cooperative called the Clean Channel Association (CCA) has been formed to rapidly respond to oil spills in the Houston Ship Channel and Galveston Bay and its tributaries. Members of the CCA include petroleum refineries, chemical manufacturers, operators of barges, ships, and docks, and companies that handle hazardous materials. Members pay dues based on the volume of material they handle and a base fee. Each memhar contributes resources such as personnel and equipment that can be used to initially contain spills. The association will not focus on shoreline cleanup. CCA's resources include a 155-foot barge that can hold 13,000 barrels of oil. The barge is equipped with a crane, boats, booms, and skimming devices, and has lights so it can be used at night. A 120-foot oil skimming barge was recently commissioned and another skimming barge is now being built.

To learn more about the CCA, call (713) 676-1318.

Many Texas Cities Now Testing for Cholera

Many Texas cities, especially those along the border with Mexico, are now regularly testing water and wastewater supplies to see if the deadly cholera virus is present.

Cholera is spread by fecal contamination of water supplies. Individuals who get their water from municipal water systems are typically not at risk. Individuals that drink untreated water maybe at risk unless they disinfect their water (for example, boiling or chlorinating it) before drinking it.

Much of the concern about cholera increased in July after signs of the bacteria were detected in sewage and irrigation canals in Juarez, Mexico. More than a dozen cases were noted in Monterrey, Mexico, in March. Last year, cholera killed thousands of people in Latin America.

San Antonio and Brownsville both test for cholera at wastewater treatment plants. Brownsville also is testing septic tank effluents from outlying communities.

In El Paso, a group of retirees and the local Warhead Protection Committee are testing 400 shallow wells in eight colonias for fecal bacteria. In July, three wells in a colonia in Socorro, TX were found to be contaminated with human waste. In addition, the water utility has sponsored two cholera awareness days.

Information about how to detect and prevent cholera is available from the Infectious Disease Program of the Texas Department of Health at (512) 458-7111, ext. 6354.

Critics Fear Saltwater Diversion Dam May Pollute Groundwater

A proposal to reduce the amount of salt flowing into lakes along the Upper Colorado River may, its critics charge, increase levels of salt flowing into nearby groundwater supplies.

In many areas of West Texas, the water is so salty that it is unusable. A solution that's been proposed is to build diversion dams to trap salts that flow into the rivers during rainfall runoff.

The Permian Basin Underground Water Conservation District (PBUWCD) is protesting a diversion dam being proposed in Martin County by the Coiorado River Municipal Water District (CRMWD). The dam would back up a natural salt water impoundment that keeps salty water out of Spence and Ivie Lakes.

The PBUWCD wants groundwater studies to be performed before the dam is built to examine if the dam poses a potential pollution threat. They would also like to see that all existing wells in the area are located and plugged before it is flooded. Unplugged wells could provide pathways for pollutants to reach local aquifers.

However, the CRMWD says that many playa lakes and shallow aquifers in the area already contain three to four times as much salt water as seawater. Their studies indicate groundwater quality will not be adversely impacted by the project.

TWRI Issues Call for Pre-Proposals for FY 93 Program

The Texas Water Resources Institute has issued a call for research and technology proposals for its FY 93 Cooperative Research Program. Projects that are funded will begin in September 1993 and run through August 1994.

The FY 93 program will focus on the top research priorities that were identified by participants at the "Water for Texas: Setting the Research Agenda" Workshop that was held in 1991 in Austin. That meeting was co-sponsored by TWRI and the Texas Water Development Board.

The top priorities were: 1) evaluate the actual effectiveness of best management practices (BMPs) for non-point source pollution (NPS); 2) measure effects of point and non-point discharges on water quality; 3) remote sensing and GIS mapping of water quality; 4) groundwater management; 5) evaluate water conservation programs; 6) impact of oil wells on water quality; 7) economic, institutional and legal aspects water allocation; 8) conservation in production agriculture; 9) types and amounts of non-point source pollution; 10) aquifer recharge, and 11) develop and Evaluate water quality monitoring strategies.

TWRI hopes to fund three or four projects with budgets of up to $20,000 for each project. Preproposals need to be submitted to TWRI by October 30. Preproposals will be evaluated by TWRI Director Wayne Jordan and The TWRI Advisory Committee. Full proposals will be required from the highest rated preproposals.

Detailed guidelines for submitting preproposals can be obtained by calling TWRI at (409) 845-1851.

Xeriscape Gardening *Co-Authored by Extension Horticulturist*

A new book on saving water in landscapes ghas been co-authored by Doug Welsh, a horticultural scientist with the Texas Agricultural Extension Service at Texas A&M University in College Station.

The book, *Xeriscape Gardening*, was written by Welsh, Connie Ellefson, a partner in a company that makes water absorbing polymers in Aurora, CO, and Tom Stephens, a landscape

architect from Castle Rock, CO. Welsh is active in promoting xeriscaping throughout Texas.

It provides a comprehensive overview of the principles of xeriscaping: planning and design, soil analysis and improvement; practical turf areas; apporpriate plant selection; efficient irrigation, mulching, and maintenance. The book also has information on specific plants for each region and their water requirements.

The book was printed by MacMillan Publishing at (609) 461-6500. Welsh can be reached at (409) 845-7341.

TWC Studies Outline Water Quality, Monitoring Networks

New reports from the Texas Water Commission deal with water quality monitoring and stream assessments.

An Introduction to Water Quality Monitoring for Volunteers: Handbook for Coordinatorsoutlines how to organize and solicit funding for a monitoring project. Copies are available from the TWC Texas Watch program at 512-239-4720.

An Assessment of Placedo Creek; Garcitas Creek (Above Tidal); and Garcitas Creek Tidal in the Westem Gulf Coastal Plain Ecoregion (LP 91-11) describes the water quality of streams that have not been impacted by man-made pollution in DeWitte, Victoria and Jackson counties.

For ordering information on any TWC report, call 512-463-7834.

Texas A&M Civil Engineer Writes Book on Dredging Engineering

A new book on dredging engineering has been written by John Herbich of the Civil Engineering Department at Texas A&M University. Herbich teaches classes and short courses about dredging in the Ocean Engineering Division. R.E. Schiller. Jr., a professor emeritus in the Civil Engineering Department, also contributed to the book.

The book, *Handbook of Dredging Engineering*, contains information on the types of pumps and equipment that are used, transporting | solids and sediments, disposing of dredged materials, environmental l impacts, project planning, and other aspects.

The book is available by contacting McGraw Hill at (800) 2624729. Herbich can be reached at (409) 845-4517.

Environmental Inventories of Armand Bayou, Christmas Bay, Available from Galveston Bay NEP

Two recent reports from the Galveston Bay National Estuary Program characterize water-related characteristics and trends of Armand Bayou and Christmas Bay.

The reports were prepared by Robert McFarlane and Linda Shead of the Galveston Bay Foundation. They include information on human alteration of physical habitats, water quality trends, freshwater inflows, hydrology and meteorology, and living resources.

The reports paint different pictures. *An Environmental Inventory of the Armand Bayou Coastal Preserve* describes the water quality of this ecosystem as poor. Major water quality issues include increased pollutants carried by urban stormwater run off and the loss of irrigation water from the Bayou. *An Environmental Inventory of the Christmas Bay Coastal Preserve* reports that this area is "near pristine" and that there are no known water quality problems. The Bay is inhabited by 96 fish species,68 types of crustaceans, and 140 mollusk species. For details call the Galveston Bay NEP at (713) 332-9937.

Baylor Report Describes Recharge in Trinity Aquifer

A new report describing groundwater recharge in the Trinity Aquifer has been produced by the Geology Department at Baylor University.

The report, *Groundwater Recharge in the Trinity Aquifer of Central Texas* (Bulletin 46) was written by K. B. Rapp, a graduate student, and was supervised by Joe Yelderman.

The study looks at recharge, regional flow patterns, and the amount of water contributed by various sites in the recharge zone.

The report is available from the Baylor Geology Department by calling (817) 755-2361.

TAES Study Estimates Costs of Catfish Farms on Upper Texas Coast

A new study by the Texas Agricultural Experiment Station examines the profitability of catfish farming on the upper Texas Coast.

The report, *Estimated Costs and RF turns for Catfish Farms with Recirculating Ponds Along the Uper Texas Coast* (B-1704), was written by Wade Grfflin, Ron Lacewell, and Johannes Lambregts of the Texas A&M University Agricultural Economics Department, Jim Davis, an extension specialist with the Wildlife and Fisheries Sciences Department, and Gregory Clary, an extension economist at Overton.

The study was undertaken to evaluate the economic viability of a new technology used in Texas to grow catfish that don't have an "off-flavor." Water is circulated in ponds without catfish before it is sent to ponds with fish in them. Differences in capital investment, marketing, water supplies and climate were also studied.

The report shows that internal rates of return are often greater than they are for other catfish-growing regions of the U.S. Pond construction accounts for nearly half of the total funds needed for such operations.

For details, contact Wade Griffin at (409) 845-4291.

Rice University Publishes Subsurface Restoration Proceedings

Proceedings of a conference on the science and technology of restoring the water quality of contaminated groundwater systems are available from Rice University.

Subsurface Restoration was the focus of the 3rd International Conference on Ground Water Quality Research that was held in Dallas in June 1992.

The conference was organized by the National Centerfor Ground Water Research at Rice University and the EPA Kerr Environmental Laboratory, in cooperation with the Waterloo Centre for Groundwater Research, the Gulf Coast Hazardous Substance Research Center at Lamar University, and other groups.

Major areas of the conference include regulatory strategies, the basic science required for decision making, site characterization, and technologies to immobilize, contain, remove and destroy, contaminants. The Proceedings contains 117 papers from 540 scientists.

To order the Proceedings, call the Rice University Environmental Science and Engineering Department at 713-527-4086.

Relationships Between Agriculture, Water Quality Studied by GPAC

A new study that summarizes the relationship between agriculture and water quality in the Great Plains states, including Texas has been published by The Texas Agrkultural Experiment Station (TAES).

The report, *Agriculture and Water Ouality in the Great Plains: Status and Recommendations* (MP 1738), was published for the Great Plains Agricultural Council. Ron Lacowell of the Agricultural Economics Department at Texas A&M University chaired the task force that wrote the report.

The study recommends that water quality degradation from agricultural activities is not perceived to be a major problem across vast areas of the Great Plains, especially rangeland and dryland farming areas. However, local site-specific water quality problems related to irrigated farming or livestock operations are common. The report also summarizes trends in the use of agricultural chemicals, irrigation, and conservation tillage.

For more information about the report contact Lacowell at 409-845-8476.

Proceedings of On-Site Wastewater Conference Now Available

The *Proceedings of the 1992 Texas On-Site Wastewater Treatment and Research Conference* are now available.

The Proceedings contains presentations that were made at the conference which met in August in Austin. Papers cover such topics as how to evaluate innovative systems, performance evaluations of rock and sand filters, microbial rock plant filters, aerating

sewage in existing septic tanks, disposal of large flows, low pressure dosed trench systems, and other issues.

The Proceedings cost $6. To order a copy, contact Maureen McReynolds with the City of Austin's Center for Environmental Resources at (512) 322-2960.

Symphonies Help Identify Stonefly Species

Stone flies make up an important and often dominant part of the food eaten by fish in North American streams, and play vital roles in the energy, economy, and production of these systems.

Since stoneflies only live in relatively clean water, the presence or absence of their populations can serve as a biological indicator of pollution. Despite their importance, little is known about the growth, development, and behavior of stoneflies.

Ken Stewart of the Department of Biology at the University of North Texas has been extensively studying Texas stonefly species for 30 years.

Much of Stewart's research examines how adult stoneflies communicate. Stoneflies are one of the few groups of insects that communicate by tapping their bodies against resonant natural substrates such as live or dead woody plants and leaf mats. Scientists who have listened to laboratory recordings of drumming stoneflies have compared the amplified sounds to purring cats, bongodrums and knocking on doors. The duets of male and female stoneflies help them find mates.

Each species produces a distinctive series of vibrations, including differences in tapping patterns, the number and volume of beats, and intervals between beats. Stewart and his students have recorded drumming signals of 120 North American stonefly species. The signals help identify similar species.

One of the most interesting parts of the research includes the use of ``high tech" methods to verify the signals. A spectrum of male signals is simulated with a computer and played before an audience of females. The scientists record how many females react to strains produced by males of their own species. Results show that females can identify the call of males of their own species and that, when they hear it, they respond.

For details, contact Stewart at (817) 565-3618.

Acid Rain May Be Harming Aquatic Nymphs, Baylor Study Shows

Is acid rain harming aquatic species that live in rivers and lakes? Answering that question is the goal of a study Cynthia Gorham recently conducted in the Biology Department at Baylor University.

In the study, damsel fly nymphs were placed in waters with pH levels simulating both normal and acidic rainfall. Gorham focused on if pH levels affect the damsel flies, ability

to prey on mosquito larvae. Other factors that were studied included changes in growth, survival, and respiration rates.

The resuIts show that acidic conditions (pH levels less than 3.5) lessened the predatory ability of the damsel flies, increased respiration rates, and increased the number of damsel flies that were killed. The study suggests that acid rain can change the mineral content of natural waters by reducing the levels of calcium and magnesium. These minerals protect organisms from stresses caused by low pH waters.

Gorham is now with the Lower Colorado River Authority. The phone number is (512) 327-9245.

TCU Photographer Presents Unique View of Trinity River

The Trinity River has been studied in many different ways. Countless projects have investigated flooding, pollution, aquatic ecosystems. and other topics. But Luther Smith of the Texas Christian University (TCU) Department of Art and Art History is approaching things from a different angle--he's literally looking at the many facets of the river through a photographer's lens. Aided by a TCU research grant, Smith has been exploring the river from its source to the Gulf of Mexico and has been gathering information about it. His photos of the river have been exhibited in galleries in Dallas and Houston.

Photos (c) Luther Smith 1990

Luther Smith of the TCU Art and Art History Department has taken many copyrighted photographs showing different views of the Trinity River. Above, the Dallas skyline is shrouded in fog as viewed from the banks of the Trinity. Below, much of the area surrounding the Trinity is still rural, even though it is close enough so that downtown

Dallas is still clearly in view.

Some parts of the Trinity's contributing watershed are relatively arid rangeland.

Smith hopes that visitors, appreciation for the river will increase when they view it from the many different perspectives of his photographic essays.

"One thing I learned is that the Trinity doesn't always look like a river," he said. "ln some laces, it dries up during the summer and forms pools. After heavy rains, it rages and floods. I want people to see the diversity associated with the river."

Smith also wants people to see that the river can be beautiful--even in urbanized areas where the river has been transformed by man into a lined canal. "It's possible to make beautiful pictures out of even a scarred landscape," he said. "he Trinity can have an elegant beauty in the evening light." For details, contact Smith at (817) 921-7643 or (817) 921-7670.

Texas Tech Invention Lets Biologists Study Streams Indoors

When most aquatic biologists want to study how streams function, there's typically only one logical course to follow‹go out and observe.

But researchers at Texas Tech University may change all that. They've made substantial improvements on techniques to simulate streams indoors.

Michael Willig of the Biology Department and graduate student David Herrmann of the Agronomy, Horticulture, and Entomology Department designed the laboratory stream in cooperation with Robert Sites of the University of Missouri .

The stream is roughly 1 0 feet long and 4 feet high and uses a closed water-fall system to internally recirculate water. Flow rates and depths can be varied to simulate shallow and rapidly flowing riffles and slower streams with larger depths.

The Texas Tech researchers are now involved in several laboratory projects in Central Texas. ,,We hope to learn how stream insects change their behavior in response to currents of different velocities and we want to know how insects compete for space,,, Willig said. "We can more easily answer these questions with a laboratory stream because we can control factors that are uncontrollable in nature."

For details, contact Willb at (806) 742-2590.

UT Developing Glass Beads To Help Microbes Clean Up Oil Spills

Researchers at the University of Texas have developed small photoactive glass beads that could help clean up oil spills and other pollutants.

Adam Heller and James Brock of the Chemical Engineering Department say the microbeads are about the width of a human hair and are hollow so that they will float. They are coated with titanium dioxide‹a substance that has replaced lead compounds in paint.

When sunlight hits the beads, they oxidize the oil. The partially oxidized oil is water-soluble and can be easily digested by microbes. Beads are being developed that spread with the oil over a wide area so the beads can best harvest sunlight and strip oil from coastal areas, lakes and rivers. The process is efficient and cost-effective. The researchers say it could have cleaned up the Exxon Valdez spill in three days at only 5% of the cost.

For details, contact Heller at (512) 471-8874.

Midwestern State Checks Catfish for Heavy Metals

A study at Midwestem State University is sampling channel catfish in lakes and rivers near Wichita Falls to see if heavy metals have built up to dangerous levels.

The study is being led by Norm Horner and graduate student Robert Bina of the Biology Department. They believe that heavy metals such as lead and arsenic build up over time. Older catfish may contain more heavy metals. "Mudcats" are now being gathered from a campus lake. Later, the study will expand to include sampling from Wichita Lake and the Red River. The researchers hope to learn more about pollutants in the area. For details, call Horner at 817-689-4253.

Aquatic Life Returning to Lower Neches River After Pollution Cleanup, Lamar Biologist Says

Since the 1970s, the lower Neches River has been cleaned up considerably as cities and industries were required to upgrade their wastewater treatment systems.

The result, says a Lamar University biologist, is that many aquatic species that were absent because of intense pollution are now returning to the river system.

Richard Harrel of the Bblogy Department collected samples of estuarine and freshwater benthic macroinvertebrates (segmented worms, crustaceans, clams, and insect larvae) along the river both before and after the pollution control strategies were implemented.

Comparing the two surveys reveals some interesting results. Many common estuarine species that were absent from the river before pollution abatement improved were found in the river afterwards. This is probably because dissolved oxygen levels increased while pollution dropped. Higher river flows also helped by flushing the system, and by allowing the natural migration of freshwater organisms up the channel. Dredging improved conditions by removing polluted sludge.

For details, contact Harrel at (409) 880-8255.

Tarleton State Research Examines if Dairies are Polluting Groundwater

One of Texas' most pressing water quality concerns is the potential of dairies and feedlots to pollute groundwater supplies in Central Texas.

To determine if these facilities are actually causing pollution, Jack Nelson, Joan Flowers and Dahna Branyan of the Texas Institute for Applied Environmental Research at Tarleton State University sampled soil and water quality downslope of five dairy lagoons in Erath County.

Samples were taken at sites with different types of soils including sands and clays. Samples were analyzed for soluble salts (nitrate and ammonium), and phosphates. Water samples were tested for fecal bacteria. Contamination was found at the three sites with the most permeable soils and perched water tables. This suggests that leaching from lagoons is the probable cause of the contamination. High ammonia levels (44 parts per million) were found at one site, and elevated nitrate levels were found in two other sites.

For details, contact Nelson at (817) 968-9567.

Photo by Reagan Johnson

Confined dairies (above) may increase levels of nitrates and other contaminants in groundwater.

When heavy storms occur, large amounts of manure and other pollutants run off dairy sites like this one and can contaminate nearby rivers, streams, and groundwater systems.