SOAH DOCKET NO. 952-19-0705

APPLICATION OF LOWER COLORADO RIVER AUTHORITY (LCRA) FOR EIGHT OPERATING AND TRANSPORT PERMITS IN BASTROP COUNTY, TEXAS	**§**	**BEFORE THE STATE OFFICE OF ADMINISTRATIVE HEARINGS**

PRE-FILED DIRECT TESTIMONY

OF

JOSEPH TRUNGALE

ON BEHALF OF

ENVIRONMENTAL STEWARDSHIP

June 28, 2019

EXHIBIT LIST

Number	Exhibit
200	Direct Testimony of Joseph Trungale
201	Resume of Joseph Trungale
202	Table 1: Attainment Frequencies of BS3 Flow Standards in the Lower Colorado River

I. INTRODUCTION

Q: Please state your name.

A: Joseph F. Trungale Jr.

Q: Please state your address.

A: My address is 1206 San Antonio St, Austin, Texas 78701.

Q: Please describe your occupation.

A: I am a surface water hydrologist. For the past 15 years I have worked as an independent consultant on issues primarily related to environmental flows, water availability and water rights permitting.

II. QUALIFICATIONS

Q: Please describe your educational background.

A: I have a Master of Science degree in Civil Engineering from the University of Washington. While pursuing a Ph.D. candidacy at Texas State University, I completed required course work in aquatic biology. My area of specialty is hydrology with a focus on in-stream flows. I have also taken a graduate level course on groundwater modeling, but it has not been an integral part of my professional career.

Q: Please describe the nature of your professional work.

A: My work involves quantifying the effects of changing flows and flow patterns, aquatic habitat, and other conditions in Texas rivers and bays. I conduct instream flow studies to determine water needs to maintain sound ecological environments and serve on bay and basin expert science teams and work with stakeholder and planning groups to implement flow recommendations.

Q: Are you a licensed professional engineer in the State of Texas?

A: Yes.

Q: How long have you been a licensed professional engineer?

A: Since June 2003.

Q: Have you authored any reports or publications?

A: Yes, I have authored many reports and a few publications. Two reports are most relevant to the current proceedings. First, I was a member of the team of scientists and engineers who developed the instream flow recommendations for the lower Colorado River. This multi-year study (BIO-WEST, 2008) collected data and developed instream flow habitat models to determine how much water is needed to maintain a sound environment in the Colorado River downstream of Austin. Those instream flow recommendations are used to limit diversions available to new water right permits.

I also served on the Colorado-Lavaca Bay and Basin Expert Science Team (BBEST) established by Senate Bill 3 and co-authored the BBEST report (CL BBEST, 2011). The legislature created these teams to analyze available physical, chemical and biological data and determine the flow regimes necessary to maintain sound ecological environments. The report addressed environmental flow standards throughout the Colorado and Lavaca Basin and Bays, including the Colorado River in the vicinity of the proposed permit.

Q: **Do you have other experience relevant to water management in the Colorado River Basin?**

A: Yes, since about 2012, I have worked on behalf of several interested parties in the stakeholder process that LCRA convenes every few years to consider revisions to their water management plan, and through that process, I have developed expertise specific to the Colorado River Water Availability Model (WAM). I have also been a consultant to the Senate Bill 1 Regional planning group (Region K) since 2011. The Senate Bill 1 Regional Planning groups develop long-range regional water supply plans, and my role has been to provide support on WAM modeling and environmental flows assessments.

Q: **Do you have any experience in evaluating impacts of groundwater pumping on surface water resources?**

A: Yes. One example is in about 2005, I did some work related to groundwater in Kinney County. I collected water quality and quantity data to evaluate gain-loss in Pinto Creek. I ran the Trinity Groundwater Availbity Model (GAM) and processed results to produce maps of potential drawdowns. I also performed analyses to separate base and storm flow components of the hydrograph.

Q: Can you identify what has been marked as Exhibit 201?

A: Yes. This exhibit is a representative resume summarizing my experience in various areas of practice.

Q: Is this a true and accurate copy of your resume?

A: Yes.

ENVIRONMENTAL STEWARDSHIP OFFERS EXHIBIT 201.

Q: What materials have you reviewed in preparation for your testimony?

A: I reviewed various relevant documents and information, including the following:

Transcript of the Texas Water Development Board Hearing on Appeal of Groundwater Management Area 12 Desired Future Conditions by Environmental Stewardship March 7, 2012;

Lower Colorado River Authority's Prefiled Direct Testimonies of John B. Hofmann and Steve Young;

GAM Predictions of the Effects of Baseline Pumping Plus Proposed Pumping by Vista Ridge, End OP, Forestar, and LCRA, by George Rice, March 22, 2016;

Evaluation of LCRA's Proposal to Pump 25,000 Acre-Feet per Year from the Simsboro Aquifer, by George Rice, June 5, 2018

BIO-WEST, Inc. (March, 2008), Lower Colorado River, Texas Instream Flow Guidelines, Colorado River Flow Relationships to Aquatic Habitat and State Threatened Species: Blue Sucker, Round Rock, Texas, Lower Colorado River Authority and San Antonio Water System;

Colorado Lavaca Basin and Bay Expert Science Team (March, 2011), Environmental Flows Recommendations Report, Austin, Texas.

Q: What other type of research have you done in preparation for your testimony?

A: I read Texas Water Code section 36.113 (Permits for Wells: Permit Amendments).

Q: Are you familiar with the area where the proposed groundwater pumping is to occur?

A: Yes.

Q: How are you familiar with the area?

A: From 2004 – 2008, as part of the Lower Colorado Instream Flow Study (BIO-WEST 2008), I collected hydrologic and biologic data at several sites on the Colorado River including Austin, Bastrop, Smithville, La Grange, Columbus and Wharton. I used this data to develop instream habitat models and am familiar with how instream habitats change with changing flow rates.

III. OPINIONS

Q: Have you developed any opinions regarding the application by LCRA for Operating and Transport Permits in Bastrop County, Texas, for Well Nos. 58-55-5-0032; 58-55-5-0033; 58-55-4-0016; 58-55-4-0017; 58-55-4-0018; 58-55-4-0019; 58-55-4-0020; and 58-55-4-0021?

A: Yes.

Q: On what subjects have you developed opinions?

A: I have focused on changes in surface water availability as a result of changes to flows and to surface water resources, specifically environmental flows, caused by groundwater pumping. I relied on estimates of changes to flow in the Colorado River and several tributaries that were provided to me by George Rice. I also evaluated how reduced flows impact environmental flows needed to maintain a sound ecological environment.

Q: Please summarize your opinions with regard to the above-referenced applications.

A: Water in the Colorado River at Bastrop and below has, for all intents and purposes, been fully appropriated. A decrease in streamflows, including a decrease as a result of increased pumping of groundwater, would likely come at the expense of existing water rights holders, and these reduced flows would have an adverse effect on flows needed to maintain a sound ecological environment.

Q: Ok, let's begin with the first part of your opinion. Can you further explain your opinion about the Colorado River, at Bastrop and below, being fully appropriated and how you arrived at that opinion?

A: Yes. The first part of my opinion is that the Colorado River at Bastrop is already over appropriated. Surface water rights are granted by the Texas Commission on Environmental Quality (TCEQ). In making determinations as to whether or not to grant a new perpetual water rights permit, the TCEQ uses a Water Availability Model (WAM), which is a computer program that keeps track of how much flow is available for diversion at specified locations within river systems. The WAM is an implementation of the prior appropriation doctrine, which helps to ensure that the TCEQ does not grant new (junior) water rights that would adversely impact the reliability of existing (senior) water rights. One of the results produced by the WAM is a timeseries of how much water would be available for diversions for a new permit in a repeat of historical flows, assuming all of the existing water rights attempted to exercise their fully permitted rights. At locations within a river system that is not over appropriated, the model would show how much water is available for appropriation or how much water could be permitted. If there is no water available for much or most of the time, then the river is considered fully or perhaps over appropriated, and TCEQ would not grant a new permit. TCEQ has some discretion in this area, and there are special circumstances when permits may be granted even though the full amount is not 100% reliable, but the general rule is that TCEQ will not grant a new permit if a river is fully appropriated.

Based on a simulation of the official TCEQ Colorado WAM (Run 3 downloaded on June 24, 2019), this unappropriated flow estimate is zero over 90% of the time. The Colorado WAM is simulated for the period from 1940 – 2013. There are some years in which there is zero unappropriated water available for the entire year modeled. In other words, there is essentially no surface water available to spare; the water has been almost fully appropriated.

Q: What about your second criticism or opinion? Can you explain the impact of increased groundwater pumping on existing water rights holders?

A: Yes. My second concern is an outcome of the first: The fact that this river is already over appropriated means that any reductions in flows will negatively impact existing water rights holders. Specifically, existing senior water rights holders will be able to divert less of the water that they are legally entitled to than they would be able to divert if there were no reductions in flow due to groundwater pumping. The WAM allows for a quantification of how many water rights holders would be negatively impacted.

Q: Please describe the modeling that you performed to arrive at these opinions.

A: I compared the official TCEQ WAM (Run 3), which I modified to show the impact of decreased flows as a result of increased groundwater pumping. I

obtained the estimates of changes in discharge from the aquifer to the rivers from George Rice. I understand these estimates to represent the exchange in flow between the aquifer and the river that would be predicted by the GAM to occur as a result of both baseline pumping and the increased pumping that is sought by the permit at issue in this hearing. For the mainstem Colorado, Mr. Rice provided me with estimates of flow exchange for each decade from 1990 to 2070. For four tributary systems (Walnut/Cedar Creeks, Wilbarger Creek, Big Sandy Creek and Piny Creek/Lake Bastrop), he provided estimates for 2010 and 2070. I calculated the change in exchange between the earliest and last year available. For example, for the mainstem Colorado, the GAM predicts that the Colorado river gains approximately 25,540 ACFT (acre-feet) per year in 1990 but loses 3,907 in 2070. This is a total reduction of flow to the river of 28,646 ACFT per year over that timeframe. I performed similar calculations on the tributary streams, though in those cases, I used the 2010 estimate as the starting point.

I also executed a WAM simulation to isolate just the change in river flow that would be the result of the pumping by LCRA that is sought in the proposed permits at issue in this proceeding. The results of these simulations show the same fundamental conclusion: a decrease in flows results in reduction in water availability for senior water rights and a reduction in the frequency of satisfying the environmental flow needs. Since the lower pumping levels have less impact on the river flow, the magnitude of the impacts is obviously smaller, though the direction is the same.

Ultimately, I focused my analysis on the full pumping (baseline and proposed pumping by LCRA), because I have no reason to expect that baseline pumping will cease. Thus, an LCRA-only pumping scenario has little relationship to expected future conditions.

I then identified the control points within the WAM associated with the Bastrop USGS gage and the locations on the Colorado River downstream of each of the tributary streams listed above. I added code with the WAM input file to remove the estimated reduction of flow to the river that is predicted to result from the increased and continued pumping. I then ran the original, unmodified, model (TCEQ Run 3) and the version I modified to produce and analyze results related to water right permit availability and a time series of instream flow values.

Q: What did this model simulation exercise demonstrate?

A: There are about 1,300 active water rights in the Colorado basin though not all include authorization to divert water. The reliability decreases for almost every water right in the basin. It should be noted that the reduction in reliability was

generally relatively small with less than a 3 percent reduction in reliability in almost all cases. However, my understanding of the prior appropriation doctrine, based on my experience in water rights permitting cases and my experience with the WAM, is that the doctrine is intended to ensure that senior water rights are protected from new (junior) water development projects. New water development projects, generally, cannot be permitted if they would result in reducing the reliability of flows available to satisfy existing water rights, at the full appropriation amount permitted. Groundwater pumping appears to create a gradual reduction of reliable streamflows, over a relatively long period of time (versus an immediate reduction of streamflows from a single development project). As groundwater pumping increases, a reduction of reliable streamflows is also likely to increase. Where, as here, we have a river that is already pretty close to being fully appropriated, even a small reduction in reliable streamflows is likely to impact existing water rights up and down the river, both above and below the groundwater pumping areas, and as groundwater pumping increases, those impacts are also likely to increase.

Q: You mentioned that in performing this modeling exercise, you relied on data or information provided to you by Mr. Rice. Is this information the type of information that an engineer, such as yourself, typically relies on to perform the modeling analysis that you performed?

A: Yes. My understanding is that Mr. Rice has vast experience in groundwater modeling. So, I consider the information that he has provided to me to be reliable for the purposes of my modeling analysis.

Q: Similarly, can you explain your third opinion? How are environmental flows impacted by the proposed pumping?

A: Yes. My third opinion has to do with how the reduction in flows impacts the ecological health of the Colorado River. I was part of the team that developed the instream flow guidelines for the lower Colorado River: a study conducted as part of the proposed LCRA-SAWS water supply project. In that study, we developed water quality and instream habitat models to determine the seasonal magnitudes of flows, including subsistence, base, high flow pulse, and bankfull flows necessary to maintain a sound environment for the Colorado River. A sound ecological environment is defined as "a functioning ecosystem characterized by intact, natural processes, resilience, and a balanced, integrated, and adaptive community of organisms comparable to that of the natural habitat of a region." (Texas Instream Flow Program, Technical Overview, MayTIFP 2008). These recommendations, consistent with literature on the science of instream flows, recommended that flows be managed to mimic natural patterns. They further

recommended that subsistence flows should be considered "hands off flows" (Hardy et al. 2006, Acreman et al. 2006), with the goal that flows do not fall below the subsistence flow guidelines and thus should be met 100% of the time. For base flows, which provide for variable instream habitat conditions that differ during dry and average times, the recommendation was that base-dry and base-average flow magnitude occur 80 and 60 percent of the time. These flow recommendations were adopted by the Senate Bill 3 Colorado Bay and Basin Expert Science Team and the Bay and Basin Stakeholder Advisory Group.

Q: Please describe what has been marked as Exhibit 202.

A: This is a table that I prepared using information from the results of two WAM simulations. It shows the attainment frequencies of subsistence, base-dry and base-average flow targets under naturalized (NAT), current (TCEQ3), and the simulation modified to show the impact of groundwater pumping (GWP) scenarios.

Q: Did you prepare this table yourself?

A: Yes.

ENVIRONMENTAL STEWARDSHIP OFFERS EXHIBIT 202.

Q: Can you elaborate on these results and explain their significance?

A: These results show that reduction in base flows due to increased groundwater pumping would lead to a decrease in the frequency in which these flows will be observed in the future. As with the reductions in the reliability of water permit availability, the reductions are relatively small, most cases less than 3 percent; however, it is important to consider the context of these reductions. As noted above, the instream flow studies and SB3 process concluded that subsistence flows should be maintained essentially all the time. Subsistence flow targets were derived primarily to ensure that water quality remain within acceptable levels and that at least a refugia habitat is maintained during conditions when the biological community may become stressed. Based on my modeling analysis, continued groundwater pumping would cause the subsistence attainment frequency at Bastrop to fall below 90% in February. I'll note that under existing conditions (TCEQ3), there is some reduction in the frequency at which these subsistence flows are achieved. But the groundwater pumping would cause a greater reduction in subsistence attainment frequency. At Bastrop, for instance, it would increase the number of months when the target is not met from 6 out of 12 months to 7 out of 12 months, when the initial objective was to achieve these subsistence flows

essentially all the time. In other words, instead of moving towards the goal of constant subsistence flow attainment, we are moving farther from it, with increased groundwater pumping.

Base flow targets were developed to ensure adequate habitat conditions, including variability. While there are many months in which the reduction in attainment frequencies is relatively small, in several months and at several locations, base flow attainment frequencies would, according to the modeling, fall by more than five percent from current conditions. In many cases these targets are already predicted to be met less frequently than the 80 and 60 percent frequencies recommended by the LCRA-SAWS instream flow study, and the additional pumping would continue to move the health of the river in the wrong direction. I would be most concerned with the reduction in frequency of meeting base-average flows in February – April. This is the spawning period for the Blue Sucker, a state threatened species, which is benefited by higher flows. Base-average flows in this period are already below the 60 percent goal, and the increased pumping is predicted to lower the frequencies over 5 percent, to less than 45 percent of the time at the Columbus gage.

Q: Does the effect of reduced flows due to groundwater pumping have impacts further downstream and affect freshwater inflows into Matagorda Bay?

A: Yes.

Q: Please explain.

A: Less water in the Colorado River means less freshwater inflow into Matagorda Bay. Similar to the instream flow targets for the Colorado River, the LCRA-SAWS project developed recommendations to maintain the health of Matagorda Bay, and these recommendations were largely adopted by the SB3 BBEST and BBASC groups. These recommendations are complex, multi-tiered, seasonal inflow volumes and have corresponding recommended attainment frequencies designed to protect oyster reef health, benthic condition, estuarine marshes, and shellfish and forage fish habitat. While the reduction in flow in the river will impact these important ecological functions across a range of levels and seasons, the clearest impacts are to the threshold flow levels. Threshold inflow levels into Matagorda Bay, similar to subsistence flows in the Colorado River, are designed to maintain tolerable protection for ecosystem functions during extreme low flow conditions, and like subsistence flows, these are the minimum flows below which the freshwater inflow should not fall. The threshold flows for Matagorda Bay are 15,000 ACFT per month. The WAM includes 888 months in the period of record from 1940-2013. Under natural conditions, freshwater inflow exceeded this

threshold level 884 of those 888 months. Under the TCEQ Run 3 WAM, this number falls to 603 months, and when the WAM is modified to account for impacts due to groundwater pumping, this level would fall to 587 of the 888 months in the period of record. As with the flow needed to protect the health of the river, the freshwater inflows needed to protect the health of the bay are already below recommended levels, and the increased pumping that this permit would allow would only exacerbate the problem.

IV. CONCLUSIONS REGARDING LCRA's APPLICATIONS FOR GROUNDWATER PUMPING PERMITS

Q: Please summarize the conclusions you've reached regarding LCRA's applications for groundwater pumping permits?

A: My understanding is that permits for wells shall consider whether the proposed use of water unreasonably affects existing groundwater and surface water resources for existing permit holders. I consider the effect of the proposed groundwater pumping on surface water resources to be unreasonable because it increases the shortfalls in meeting environmental flow targets. If the flows in the river are already below levels needed to maintain the ecological health of the river, then I consider any additional pumping that causes further instream flow reduction to be unreasonable.

I did not see any analysis in the application that considered the effect of the proposed permits on existing (surface) water permit holders.

Q: Based on the modeling and analysis you have performed and described above, please summarize your opinion regarding the expected consequences of LCRA's requested permits?

A As a hydrologist, I understand that groundwater and surface water sources are physically connected, and considering them as independent and disjointed is contrary to reality. The best available science concludes, logically, that pumping water from aquifers near the Colorado River and its tributaries will reduce the flow in the river and the tributaries. Since this river is already fully appropriated, this reduction will adversely impact the reliability of water for existing senior water rights holders. The reduction in flow will also mean that the flows needed to maintain a sound environment, which in some cases are already not being meet, would be further reduced below levels recommended by the best available science. The uncertainty regarding the precise magnitude of the river flow decline does not change my fundamental conclusion. Groundwater pumping will decrease flows in

the river and the tributaries, and for the reasons stated above, the river cannot afford the reduction.

Q: In your professional opinion, does this application comply with the groundwater district's requirements?

A: No. In my professional opinion the application has not considered the effect of the proposed pumping on existing surface water resources or existing permit holders.

Q: Does this conclude your testimony?

A: Yes, although I reserve the right to supplement this testimony. I understand that the release of a new version of the TCEQ WAM, which includes the more recent LCRA water management plan, is expected within the next month, and if requested, I may replicate my analysis using that updated version.

EXHIBIT 201

JOSEPH F. TRUNGALE, P.E.

Owner / Principal

FIELDS OF EXPERIENCE

Mr. Trungale is a professional engineer and the principal of Trungale Engineering & Science in Austin, Texas. He has over 20 years of experience working in water resource planning and environmental flow studies, including work for the river basin commission responsible for raw water supply for Washington D.C., as a consultant with HDR Engineering managing regional water planning and availability modeling and as the surface water hydrologist for the Texas Parks and Wildlife River Studies program. Mr. Trungale is currently an independent consultant with expertise conducting instream flow studies to quantify the effects of changing flow regimes on aquatic habitat. His expertise extends to groundwater-springflow studies, freshwater inflows for bays and estuaries, and regional and state water planning including water availability analysis and water rights review. Mr. Trungale has an MS degree in Engineering from the University of Washington and has completed course work in pursuit of a PhD candidacy at Texas State University in Aquatic Biology.

EDUCATION

- Completed course work in pursuit of PhD candidacy, Aquatic Biology, Texas State University (San Marcos, Texas) 2010
- M.S. Engineering, University of Washington (Seattle, Washington), 1996
- B.A. English Literature, Georgetown University (Washington, D.C.), 1990

PROFESSIONAL/TECHNICAL AFFILIATIONS

- Texas State Board of Professional Engineers – Professional Engineer No. 92040
- Member of American Society of Civil Engineers

TECHNICAL REPORTS

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https://repositories.tdl.org/twdl-ir/handle/10850/1357

Owner and Principal
2004 - Present Trungale Engineering & Science Austin, Texas

In 2004, Mr. Trungale established Trungale Engineering & Science and began working as an independent consultant. While continuing to conduct state of the science studies, he has brought his expertise in engineering and ecological science to broader contexts within the public policy and legal arenas. He works with diverse groups of stakeholders and scientists to develop innovative solutions to natural resource challenges that balance growing human needs for water with the need to protect and maintain sound ecological environments. In addition to addressing the needs of individual clients, he has also served on several science committees and testified as an expert witness in a number of precedent-setting decisions.

Caddo Lake/Cypress Basin Environmental Flows Study - Caddo Lake Institute

Since 2005, Mr. Trungale has served as Director of Science for Environmental Flows Project for the Caddo Lake/ Cypress Watershed. He establishes priorities, develop budgets, and secures funding to support the long term ecological health of this Texas treasure. The work includes managing partnerships with federal and state agencies and scientific and academic intuitions and conducting complex multi-disciplinary scientific studies to a broad range of ecological issues. He also organizes and leads multi-day meetings with diverse groups of stakeholders to develop consensus-based decisions to implement environmental flow policies worked with local, state and federal agencies and the Nature Conservancy. He worked closely

with the U.S Army Corps of Engineers and the local water supply organization to develop approaches to implement environmental flow recommendations and is currently developing a monitoring and adaptive management program to assess the efficacy of these recommendations on maintaining the ecological health of this system.

Gulf Flows Project - Texas Environmental Flows Initiative

Mr. Trungale is currently supporting the work of the Texas Environmental Flows Initiative (TEFI), a team of NGOs and university partners including the National Wildlife Federation, The Nature Conservancy, the Harte Research Institute, and the Meadows Center for Water and the Environment which is pursuing scientific and technical analyses to set the stage for one or more transactions to help permanently secure freshwater inflows for several Texas bay / estuary systems. The project is focused on three coastal watersheds, the Colorado-Lavaca, the lower San Antonio and the lower Trinity. Trungale Engineer supports this effort through the development of a Geospatial Database Tool which complies and summarizes water right permit, use and availability and through the development and execution of water availbity models to test alternative water management strategies and estuarine circulation and salinity models to evaluate the benefits of these strategies.

Region K Water Plan - Texas Water Development Board

Since 2016, Mr. Trungale has been engaged by the Region K water planning group (Lower Colorado River including the City of Austin) to conduct water supply analyses to support the development of long term (50 year) water supply plan. This includes selection of hydrologic assumptions, models, and operational procedures for modeling the region's river basins and reservoirs and modification of these tools to reflect recent changes to permits, transfers, legal requirements, new water rights, and/or specified operational requirements. Mr. Trungale presents these analyses to stakeholders representing a diverse group of interests.

Technical Evaluations of Guadalupe-Blanco River Authority and Lower Colorado River Authority Projects – National Wildlife Federation

Both the Guadalupe-Blanco River Authority (GBRA) and Lower Colorado River Authority (LCRA) are pursuing efforts to develop new off-channel reservoirs, or potentially aquifer storage and recovery projects, and divert water from the Guadalupe and Colorado rivers, respectively, into storage. These proposals would reduce instream flows in the river and freshwater inflows into the San Antonio and Matagorda Bay. TES was retained to assist NWF in assessing the reductions in instream flows and freshwater inflows expected from the proposed operations, understand the ecological significance of those changes, and support NWF advocacy efforts to mitigate those effects.

SB3 work plans in Colorado and Guadalupe Basins. - Texas Water Development Board

Mr. Trungale worked on two separate teams to evaluate various aspects of the environmental flow rules adopted by TCEQ. In the Colorado basin, he updated the state's salinity and circulation model of Matagorda Bay in order to investigate how the recent drought has affected salinity in the bay. In the Guadalupe basin, he worked with the San Antonio Bay Partnership to evaluate alternatives including acquiring existing water rights and storing them in underground aquifers to be used to supplement flows during times of low inflow.

Assessment of Impacts of Proposed Marvin Nichols Reservoir in the Sulphur River Basin. Region D Water Planning Group

Mr. Trungale recently completed a report assessing the adequacy of an analysis produced by Region C on the potential impacts of the proposed Marvin Nichols Reservoir on natural resources in the Sulphur River

Basin. His GIS-based assessment considered the potential impacts of the loss of overbank flow to maintenance of bottomland hardwoods.

Evaluation of Brazos BBASC recommendations and review of TCEQ implementation of Brazos Rules into WAMs. National Wildlife Federation

Mr. Trungale attended a number of facilitated meeting of the Brazos Basin and Bay Advisory Stakeholder Committee as they deliberated over their recommendations to TCEQ regarding the BBEST Environmental Flow regime recommendations report. He provided analysis of the competing proposals and provided input on the BBASC minority report. After the rules were adopted, he evaluated their implementation into the Brazos WAM and provided comments to TCEQ. Finally, Mr. Trungale produced a technical analysis of the implementation and evaluation, including costs, of alternative flow recommendations on hypothetical water development projects.

Lake Ralph Hall – Texas Conservation Alliance

Mr. Trungale conducted analysis of the costs of the proposed Ralph Hall reservoir, including a comparison of that project with other alternatives, and generated cost estimates for a new alternative. He provided expert report and testimony in support of protestant (TCA) in the matter of the Application of Upper Trinity Regional Water District for Water Use Permit No. 5821 (SOAH Docket No. 582-12-5332).

Analysis of the Lower Colorado River Authority Water Management Plan - Colorado Water Issues Committee of the Texas Rice Industry Coalition for the Environment

In response to the historic drought currently underway in central Texas the LCRA has applied for a number of emergency orders that allow them to completely curtail releases of water for rice irrigators. Mr. Trungale was retained by CWIC to analyze the proposed emergency order and develop alternatives that would achieve a more equitable balance among all of the water users in the basin. He reviewed the proposed, current and past water management plans, used LCRA's stochastic model to forecast future combined storage in the highland lakes assuming the proposed and alternative emergency orders and produced a technical report. Mr. Trungale testified as an expert witness testimony (TCEQ Docket No. 2-14-0124-WR / SOAH Docket No. 582-14-2123 (LCRA WMP Emergency Order)) describing his conclusions that the same level of protection for upstream interests could be achieved with a more moderate order.

Learning from Drought: Next Generation Water Planning for Texas – Texas Center for Policy Studies

Under a grant from the Meadows Foundation, Mr. Trungale co-authored a report that analyses the Texas regional and state planning process. The report includes: an analysis of the assumptions and methods employed to develop forecasts for municipal, irrigation and stream electric water demands; calculations of water available from existing supplies, including estimates of additional supplies that could be made available if drought contingency plans are incorporated; and a discussion of the need to provide water for the protection of a sound environment. The report includes several policy recommendations to develop a more sustainable water plan.

Effect of Diversions from the Guadalupe San Antonio River Basins on San Antonio Bay - The Aransas Project

Mr. Trungale produced a technical report on behalf of The Aransas Project, an alliance of citizens, organizations, businesses, and municipalities seeking responsible water management of the Guadalupe River Basin and bays. In 2011, TAP filed a federal lawsuit in the United States District Court for the Southern District of Texas, Corpus Christi Division, against several officials of the Texas Commission on Environmental Quality (TCEQ) in their official capacities for illegal harm and harassment of Whooping Cranes at and adjacent to Aransas National Wildlife Refuge in violation of the Endangered Species Act.

Mr. Trungale testified as an expert witness in this trial describing how future changes in inflow are expected to alter salinity patterns in San Antonio Bay. His analysis focused on salinity thresholds for Blue Crabs, an important for source for the cranes, in the vicinity of the Aransas National Wildlife Refuge.

Instream Flow – Habitat Relationships for the Nueces River Basin and the Upper Rio Grande Basin

Mr. Trungale conducted extensive field data collections and developed instream habitat simulation models for selected locations in the Nueces and Upper Rio Grande River basins in order to develop predictive relationships which describe the response of instream available habitat over a range of flows. These relationships will be used to evaluate the flows that may be recommended by the Bay and Basin Expert Science Teams as part of their charge under the Senate Bill 3 Environmental Flows mandate.

Brazos River Instream Flow Study - Texas Rivers Protection Association & Friends of the Brazos River

Mr. Trungale analyzed the Brazos River Authority systems operation permit application and evaluated effects on instream flows to support environmental and recreation flow needs. Mr. Trungale characterized flow regimes under pre-development and currently modified management scenarios using a Water Availability Model (WAM) developed for the Brazos River Systems Operations Permit application which seeks to appropriate water from the Brazos River. He provided expert testimony in support of protestants (Friends of the Brazos River) in the matter of the application by Brazos River Authority for Water Use Permit No. 5851 (SOAH Docket No. 582-10-4184; TCEQ Docket No. 2005-1490-WR).

Llano River Sand and Gravel Mining Protest

Mr. Trungale conducted analysis of potential impacts from sand and gravel operations in the Llano River specifically with respect to compliance with 31 TEX ADMIN. CODE § 69.108 (c) including the evaluating sediment budget, erosion rates of the river segment to be mined, and the effect on coastal and receiving waters. He provided expert report and testimony in support of protestants (Peron and others) in the matter of an application of Joe B. Long and Mark L. Stephenson for a Sand and Gravel Permit (SOAH Docket No. 802-09-4552).

Colorado and Lavaca River Basins and Matagorda Bay and Basin Expert Science Team (BBEST) and Trinity and San Jacinto River Basins and Galveston Bay and Basin Expert Science Team (BBEST)

As a Texas Senate Bill 3 Expert Science Team member, Mr. Trungale developed science based flow recommendations for rivers and freshwater inflows. This included analysis of hydrology and hydraulics, biology, water quality and geomorphology to refine and validate hydrology based instream flow recommendations. He applied a salinity zonation approach to predict ecologically relevant salinity response to changes in freshwater inflows.

Lower Colorado River Instream Flow Study – Lower Colorado River Authority/San Antonio Water System

Mr. Trungale developed models to evaluate the effects of flow alterations, specifically related to a proposed water development project to provide water from the Colorado River to the City of San Antonio. He was responsible for several components, which included performing reconnaissance to determine study sites, developing conceptual study flow charts, collecting physical and hydrologic data to model and characterize hydraulic habitat, analyzing results, recommending flow targets and preparing a final report.

Review of Desktop Methods for Establishing Environmental Flows in Texas Rivers and Streams – Texas Commission on Environmental Quality

Mr. Trungale provided technical support to the workgroup tasked with evaluating the current default method for determining instream flow needs, primarily for the purpose of defining special conditions

within water rights permits. This included making comparisons between naturalized and gauged flows and between Lyons method and values derived from Indicators of Hydrologic Alteration (IHA) software as well as comparing estimates from desktop methods and recommendations from a comprehensive site specific study.

Kinney County Groundwater Management – Kinney Country Farmers and Ranchers Association

Mr. Trungale supported the coalition of ranchers and farmers to protect local wells and springs from excessive groundwater diversions and transfers. He evaluated previous and current studies, including Groundwater Availability Modeling (GAM) and provided support recommendations for springflow needs and approaches to meet these needs. Mr. Trungale provided affidavits to the Kinney County Groundwater Management District.

San Marcos River Foundation Instream Flow Permit Application – San Marcos River Foundation

Mr. Trungale provided technical guidance to the San Marcos River Foundation, a local non-profit which had applied for a permit for the protection of instream and freshwater inflows in the Guadalupe River. He also performed Water Availability Modeling (WAM) to support permit application, evaluated completed applications, and researched the TCEQ permitting policy to evaluate precedence and authority of the agency to grant such permits. Finally, Mr. Trungale evaluated state methodology to determine freshwater inflow needs for San Antonio Bay and continues to monitor activities to the Commission on Environmental Flows and their Science Advisory Committee. He provided affidavits in the matters of water rights applications from the San Marcos River Foundation and the Canyon Regional Water Authority.

Surface Water Hydrologist
1999 - 2004 Texas Parks and Wildlife Department San Marcos, Texas

Mr. Trungale's work at TPWD encompassed a large scope of projects including collecting and analyzing field data and developing hydraulic and habitat models to determine instream flow needs to support healthy ecosystems. In addition, he collected physical and biological data which included surveying stream cross sections and benchmarks with levels, total stations and GPS, measuring discharge with flow meters, collecting bathymetry with digital transducer and echosounder connected to GPS units, characterizing and mapping stream cover and substrate, collecting biological data, primarily fish, using seines, boat and backpack shockers, and also some limited collecting of chemical data primarily using automated data loggers. He performed statistical and time series analysis on hydrologic and hydraulic data, specifically calculating watershed and stream channel and flow statistics that have biological significance, e.g. Indicator of Hydrologic Variability (IHA) (central tendency, recurrence intervals, frequency and duration) and that may be used to develop or refine instream flow standards and requirements. Also Mr. Trungale developed and ran 1D and 2D hydrodynamic models including PHABSIM, River2D and SMS/RMA2, water quality models (SNTEMP and BASINS). He developed spreadsheet and GIS tools to analyze outputs of habitat preference and utilization. At TPWD, Mr. Trungale served as an agency expert on issues related to surface water hydrology in statewide permitting and planning including a review of major water rights applications, water availability modeling, reservoir yield calculations and departmental and state water planning processes.

Water Availability Models to Assess Alterations to Instream Flows

Mr. Trungale used water availability models to assess alterations to instream flows under current conditions and full authorized use assumptions. He developed monthly benchmark flow values at 72 sites throughout Texas based on a percentage of daily naturalized median flow (similar to the regulatory default method) and calculated the frequency of meeting or exceeding these benchmarks under natural and

modeled assumptions. Finally, Mr. Trungale characterized the level of alteration based on the difference in percent of time targets met between natural conditions and full authorized use.

Guadalupe Instream Flow Study

Mr. Trungale was responsible for characterizing flow regime at three sites on the Guadalupe River by reviewing and comparing historical stream flow records, calculating flow statistics, and producing cumulative frequency graphs. He also collected physical and biological data at three sites on the Guadalupe River by several methods, including surveying cross section depths and water surface elevations, taking velocity measurements according to USGS protocol and calculating discharge, collecting bathymetry data using a boat mounted Echosounder/GPS system, and making substrate and cover calls and fish collections. Mr. Trungale developed 1D (PHABSIM) and 2D (SMS/RMA2 and River2D) hydraulic-habitat models including calculating stage-discharge relationship (rating curve), running and calibrating models and producing maps of model depths, velocities and habitat.

Regional Environmental Monitoring Assessment Program (REMAP)

Mr. Trungale's involvement in REMAP included collecting physical and biological data for small streams in East Texas including surveying cross section depths and water surface elevations, measuring velocity according to USGS protocol and calculating discharge. He also made substrate and cover calls, and developed spreadsheets to calculate summary statistics for more than 200 sites. The calculated statistics for each cross section included calculation of wetted width, maximum and median depth for current water surface elevations, bank full and flood prone areas. Mr. Trungale also summarized fish species collected at each site. Using GIS Software, Mr. Trungale calculated drainage areas for more than 200 sites using digital elevation models and land use density for each site according to Anderson scale and land use land cover data sets. Finally, Mr. Trungale developed programs to calculate the regionalized Index of Biotic Integrity (IBI) for fish and benthic macroinvertebrate metrics.

Evaluation of Spring Flows to Support the Upper San Marcos River Spring Ecosystem, Hays County, Texas

Mr. Trungale characterized flow regime by reviewing and comparing historical stream flow records, calculating flow statistics, and producing cumulative frequency graphs. He also developed a 1-D hydraulic-habitat model (PHABSIM) including calculating stage-discharge relationship (rating curve), by performing log-log regression between observed stage and discharge pairs at 28 cross sections, calculating velocities at each station within each cross section at a range of discharges using Manning's equation to solve for "n" at each station (in this context "n" acts as a roughness distribution factor across the cross section), calculating weighted usable area as a function of flow for target species (in this case five native plant species) by relating habitat suitability indices to modeled depths and velocities, and performing time series analysis to calculate weighted usable area over period of record to access historical variable and duration of "good" habitat conditions. In addition, Mr. Trungale developed a stream temperature model (SNTEMP) using results from hydraulic modeling and additional observed data to create inputs for a stream temperature model including latitude, elevation, travel time, stream width, shading data, and historical meteorological data (used for alternative scenarios). Finally, he modeled net heat flux = solar radiation + atmospheric radiation + vegetative radiation + evaporation + convection + conduction + friction-water's back radiation on a monthly time step, validated results against observed water temperatures, and predicted flow rates at which temperature thresholds might be violated.

Project Engineer
1997 - 1999 HDR Engineering, Inc. Austin, Texas

As a Project Engineer for HDR Engineering, Inc., Mr. Trungale developed water availability models and regional water plans. He was a principle programmer for state water availability models for the Guadalupe

and San Antonio River Basins. Mr. Trungale was a project manager for new reservoir alternatives in the South Central Texas Regional Planning Study. He integrated long-range water supply plans for state sponsored regional planning studies based on demand projections, availability of new supplies, cost and environmental impacts. He modified reservoir yield simulation models for analysis and assessment of water supply alternatives on a daily time step. Models were evaluated for both the reliability of these alternatives to supply water as well as their impact on natural and aquatic resources downstream. Other projects included sizing and laying out potential pipeline routes and accessing costs for municipal water, sewer and drainage structures.

Guadalupe River Basin Water Availability Model

Serving as a Principle Modeler for the Guadalupe San Antonio Water Availability Model (GSA WAM), Mr. Trungale built a GSA water rights dataset which included reviewing permits, assigning priority dates and a diversion location to a geographical coordinate. He calculated monthly distribution factors, created storage area curves, and estimated historical evaporation rates. Mr. Trungale modified naturalized flow sets including updated spring flow sets. Basin specific modifications were made to the WAM source code to calculate daily operations for Canyon Reservoir to meet FERC and hydropower daily flow requirements, including modifications to handle special permits (Braunig/Calveras/Victoria), and Medina/Diversion Lake leakage. Alternative scenarios were devised to evaluate changing return flow assumptions, exclusion of cancelable and term permits, and accounting for reservoir sedimentation. Model runs were performed to validate and present results.

South Central Texas (Region L) Water Planning

Mr. Trungale was a Project Manager for the SB1 Region L planning study for five new reservoir alternatives in the GSA. He managed a $20,000 budget and supervised the work of other project engineers. He calculated availability for water diversion into storage facilities with the constraints of meeting downstream senior water rights and bay and estuary flow requirements. He calculated reservoir yields subject to local evaporation and meeting a three-tiered environmental flow pass through, the impact of diversion at the site and at the mouth of the bay and the unit cost of water for the project. Mr. Trungale summarized yield estimates, costs and implementation/feasibility issues.

Environmental Criteria Refinement Study

Mr. Trungale modified the Texas Water Development Board's reservoir yield model (SIMDLYYD) to accept monthly flows, pass throughs for senior downstream water rights, bay and estuary flows, daily flows from a nearby reference gage, and to convert the daily values to monthly values. The model performs a mass balance on a proposed reservoir, passing flows to meet environmental targets based on triggers and iterating on storage to calculate evaporative losses. He calculated reservoir yield by increasing diversions until reservoir volume goes to zero. Options were also included for "stacking" pass throughs for instream flows on top of flows for bays and estuaries. Mr. Trungale performed this analysis on 7 proposed reservoirs in the South Central region. At one site, Sandies Creek, he made additional model runs to examine the effects of changing pipeline capacity. He compared resulting flows at the diversion site and the bay inflow with pre-project flow by calculating cumulative exceedance and monthly medians. Mr. Trungale ran fish production and salinity models to evaluate bay and estuary impacts.

Water Resource Systems Engineer
1996 - 1997 Interstate Commission on the Potomac River Basin Rockville, Maryland

During this period, Mr. Trungale managed raw water supply sources and planned for future water supply needs for the Washington, D.C. metropolitan area. He designed and maintained a hydrologic computer simulation model of the Potomac River Basin for use in long term planning of water supply needs. He

issued monthly water supply outlook forecasts to alert Washington area water suppliers as to the likelihood of drought. He was responsible for scheduling water supply releases from storage facilities in the event that natural stream flow in the Potomac would be insufficient to meet current water supply demands. Mr. Trungale provided technical support and participated in planning efforts related to a range of water supply issues including yield analysis of current and future projects, management of water supply agreements across state lines, development of alternatives to meet future water supply needs, maintenance of historic flow and demand databases, development of local watershed groups and investigation of threats to future safety of area water supply.

Engineering Technician

1994 - 1996 ACT-ACF Comprehensive Water Resource Study Seattle, Washington

Serving as an Engineering Technician, Mr. Trungale developed a user-friendly computer simulation model to develop and analyze alternatives to manage water resources shared between three states and a wide range of stakeholders. He designed and programmed an object oriented computer simulation model using Stella™ software for use by local and regional stakeholders, Alabama-Coosa-Tallapoosa (ACT) river basin. Mr. Trungale incorporated surface and ground water resources as well as findings from 14 concurrent studies. He met with public and private contractors and with representatives of environmental and planning departments from Georgia, Alabama, Florida and the federal government. Mr. Trungale consulted with these and other groups and developed measures of performance for municipal, industrial, and agricultural demands, hydro and thermal power production, environmental impacts on streams and reservoir lakes, and navigation and economic impacts. As a working group member, he had an extensive role interacting with stakeholders and making public presentations.

Volunteer

1991 Georgetown University Volunteer Program Santa Lucía, Boaco, Nicaragua

In 1991, Mr. Trungale lived in the small village of Santa Lucía in Central Nicaragua and worked as a volunteer for the organization *Campesino a Campesino*, or Farmer to Farmer which promoted sustainable agriculture. He got more than he gave living with a wonderful family and becoming conversant in Spanish.

COMPUTER EXPERIENCE

- Surface Water Modeling (TxBLEND, WRAP, HEFR, RMA-2, River-2D, HEC-RAS)
- Statistical Software Packages (S-Plus, R, Conoco, Primer)
- Productivity (MS Excel, Word, Power Point)
- GIS (ArcView, Spatial Analyst, 3D Analyst)
- Database (Access, SQL)
- HTML, FORTRAN, VB, C

EXHIBIT 202

Table 1 Attainment Frequencies of BS3 Flow Standards in the Lower Colorado River

		TARGET ATTAINMENT FREQUENCY					TARGET ATTAINMENT FREQUENCY					TARGET ATTAINMENT FREQUENCY				
		100%					80%					60%				
		SUBSISTENCE FLOWS					BASE FLOWS - DRY CONDITIONS					BASE FLOWS - AVERAGE CONDITION				
CP J30000	MONTH	FLOW	NAT	TCEQ3	GWP	DIFFERENCE	FLOW	NAT	TCEQ3	GWP	DIFFERENCE	FLOW	NAT	TCEQ3	GWP	DIFFERENCE
		(AC-FT/MO)	% TIME MET	% TIME MET	% TIME MET	%	(AC-FT/MO)	% TIME MET	% TIME MET	% TIME MET	%	(AC-FT/MO)	% TIME MET	% TIME MET	% TIME MET	%
Bastrop	Jan	12,789	100.0%	94.6%	94.6%	0.0%	19,246	97.3%	85.1%	86.5%	1.4%	26,624	93.2%	56.8%	56.8%	0.0%
	Feb	15,217	98.6%	90.5%	87.8%	-2.7%	17,605	98.6%	83.8%	83.8%	0.0%	27,602	94.6%	52.7%	50.0%	-2.7%
	Mar	16,848	97.3%	98.6%	95.9%	-2.7%	16,848	97.3%	98.6%	95.9%	-2.7%	30,559	87.8%	74.3%	70.3%	-4.1%
	Apr	10,949	100.0%	100.0%	98.6%	-1.4%	17,078	100.0%	98.6%	97.3%	-1.4%	37,785	95.9%	77.0%	75.7%	-1.4%
	May	16,909	100.0%	97.3%	97.3%	0.0%	35,601	98.6%	95.9%	95.9%	0.0%	50,666	93.2%	89.2%	90.5%	1.4%
	Jun	12,020	100.0%	100.0%	100.0%	0.0%	24,873	100.0%	98.6%	98.6%	0.0%	43,617	87.8%	93.2%	91.9%	-1.4%
	Jul	8,424	100.0%	100.0%	100.0%	0.0%	21,336	98.6%	98.6%	100.0%	1.4%	37,507	87.8%	93.2%	93.2%	0.0%
	Aug	7,563	100.0%	100.0%	100.0%	0.0%	11,929	100.0%	100.0%	100.0%	0.0%	23,427	91.9%	97.3%	97.3%	0.0%
	Sep	7,319	100.0%	100.0%	100.0%	0.0%	14,043	98.6%	98.6%	98.6%	0.0%	25,170	94.6%	91.9%	86.5%	-5.4%
	Oct	7,809	100.0%	100.0%	100.0%	0.0%	15,064	98.6%	95.9%	94.6%	-1.4%	26,624	93.2%	70.3%	64.9%	-5.4%
	Nov	10,711	100.0%	98.6%	94.6%	-4.1%	16,840	97.3%	70.3%	60.8%	-9.5%	25,230	87.8%	47.3%	45.9%	-1.4%
	Dec	11,437	100.0%	95.9%	91.9%	-4.1%	19,123	98.6%	73.0%	73.0%	0.0%	27,669	86.5%	47.3%	47.3%	0.0%
	Non-Attainment		2	6	7			0	2	2			0	4	4	

		SUBSISTENCE FLOWS					BASE FLOWS - DRY CONDITIONS					BASE FLOWS - AVERAGE CONDITION				
CP J10000	MONTH	FLOW	NAT	TCEQ3	GWP	DIFFERENCE	FLOW	NAT	TCEQ3	GWP	DIFFERENCE	FLOW	NAT	TCEQ3	GWP	DIFFERENCE
		(AC-FT/MO)	% TIME MET	% TIME MET	% TIME MET	%	(AC-FT/MO)	% TIME MET	% TIME MET	% TIME MET	%	(AC-FT/MO)	% TIME MET	% TIME MET	% TIME MET	%
Columbus	Jan	20,906	97.3%	100.0%	100.0%	0.0%	29,944	93.2%	68.9%	68.9%	0.0%	50,912	75.7%	50.0%	50.0%	0.0%
	Feb	20,826	98.6%	94.6%	93.2%	-1.4%	32,767	93.2%	64.9%	60.8%	-4.1%	49,706	81.1%	45.9%	44.6%	-1.4%
	Mar	23,058	91.9%	98.6%	95.9%	-2.7%	32,281	90.5%	73.0%	70.3%	-2.7%	62,717	73.0%	50.0%	44.6%	-5.4%
	Apr	17,792	100.0%	100.0%	100.0%	0.0%	32,965	95.9%	93.2%	91.9%	-1.4%	58,136	82.4%	52.7%	47.3%	-5.4%
	May	26,132	98.6%	100.0%	100.0%	0.0%	59,397	91.9%	93.2%	94.6%	1.4%	80,918	87.8%	86.5%	83.8%	-2.7%
	Jun	31,775	98.6%	100.0%	100.0%	0.0%	57,540	89.2%	93.2%	93.2%	0.0%	85,686	78.4%	85.1%	85.1%	0.0%
	Jul	21,029	100.0%	100.0%	100.0%	0.0%	35,048	91.9%	98.6%	98.6%	0.0%	55,031	75.7%	87.8%	83.8%	-4.1%
	Aug	11,683	100.0%	100.0%	100.0%	0.0%	19,061	98.6%	100.0%	97.3%	-2.7%	31,728	89.2%	90.5%	86.5%	-4.1%
	Sep	16,602	98.6%	100.0%	100.0%	0.0%	24,099	95.9%	100.0%	98.6%	-1.4%	36,298	93.2%	82.4%	77.0%	-5.4%
	Oct	11,683	100.0%	100.0%	100.0%	0.0%	21,890	98.6%	91.9%	86.5%	-5.4%	45,562	86.5%	62.2%	54.1%	-8.1%
	Nov	12,020	100.0%	97.3%	97.3%	0.0%	28,562	86.5%	50.0%	44.6%	-5.4%	44,926	75.7%	43.2%	43.2%	0.0%
	Dec	18,508	98.6%	94.6%	91.9%	-2.7%	28,530	91.9%	62.2%	58.1%	-4.1%	45,316	75.7%	41.9%	35.1%	-6.8%
	Non-Attainment		7	4	4			0	5	5			0	6	7	

		SUBSISTENCE FLOWS					BASE FLOWS - DRY CONDITIONS					BASE FLOWS - AVERAGE CONDITION				
CP K20000	MONTH	FLOW	NAT	TCEQ3	GWP	DIFFERENCE	FLOW	NAT	TCEQ3	GWP	DIFFERENCE	FLOW	NAT	TCEQ3	GWP	DIFFERENCE
		(AC-FT/MO)	% TIME MET	% TIME MET	% TIME MET	%	(AC-FT/MO)	% TIME MET	% TIME MET	% TIME MET	%	(AC-FT/MO)	% TIME MET	% TIME MET	% TIME MET	%
Wharton	Jan	19,369	100.0%	100.0%	100.0%	0.0%	30,252	97.3%	73.0%	73.0%	0.0%	51,527	77.0%	58.1%	56.8%	-1.4%
	Feb	16,828	98.6%	98.6%	98.6%	0.0%	33,156	93.2%	71.6%	63.5%	-8.1%	50,317	83.8%	48.6%	47.3%	-1.4%
	Mar	12,543	97.3%	98.6%	97.3%	-1.4%	32,650	91.9%	62.2%	62.2%	0.0%	63,701	74.3%	44.6%	43.2%	-1.4%
	Apr	16,066	100.0%	98.6%	98.6%	0.0%	33,382	97.3%	59.5%	58.1%	-1.4%	60,159	85.1%	48.6%	44.6%	-4.1%
	May	18,692	100.0%	100.0%	100.0%	0.0%	60,565	91.9%	54.1%	51.4%	-2.7%	85,898	85.1%	44.6%	44.6%	0.0%
	Jun	22,076	100.0%	97.3%	94.6%	-2.7%	58,552	89.2%	60.8%	56.8%	-4.1%	89,970	77.0%	32.4%	33.8%	1.4%
	Jul	13,035	100.0%	97.3%	94.6%	-2.7%	35,478	93.2%	79.7%	75.7%	-4.1%	55,708	78.4%	44.6%	40.5%	-4.1%
	Aug	6,579	100.0%	98.6%	98.6%	0.0%	19,307	97.3%	79.7%	77.0%	-2.7%	32,097	90.5%	73.0%	70.3%	-2.7%
	Sep	11,187	100.0%	98.6%	94.6%	-4.1%	24,397	95.9%	73.0%	67.6%	-5.4%	36,714	94.6%	51.4%	50.0%	-1.4%
	Oct	9,039	100.0%	98.6%	98.6%	0.0%	22,136	100.0%	71.6%	67.6%	-4.1%	46,054	87.8%	48.6%	44.6%	-4.1%
	Nov	10,294	100.0%	98.6%	97.3%	-1.4%	28,919	91.9%	62.2%	58.1%	-4.1%	45,461	79.7%	41.9%	40.5%	-1.4%
	Dec	12,420	100.0%	97.3%	93.2%	-4.1%	28,899	93.2%	68.9%	66.2%	-2.7%	45,870	78.4%	54.1%	48.6%	-5.4%
	Non-Attainment		2	10	10			0	12	12			0	11	11	