Theories of Change for the Water Grand Challenges of Texas

by

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January 2020

with support from

The Cynthia & George Mitchell Foundation
Nestlé Waters North America
The Meadows Foundation

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Note that being listed as a participant does not infer agreement with any or all statements in this document.

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Executive Summary

A common thread weaving through Texas' beauty, history, ecology, and economy is water. But water has deep challenges. Depleting water resources with increased environmental impact combined with an ever-growing thirst for water and a changing climate threaten Texas' environment and economy. Texas leads the country in water planning, water conservation, and identifying environmental flow needs, but much still needs to be done to ensure sustainable water for the state.

Starting in 2012, The Cynthia & George Mitchell Foundation, The Meadows Center for Water and the Environment, and The Meadows Foundation launched a series of stakeholder discussions to identify the Water Grand Challenges for Texas. These discussions were anchored with a vision: a Texas where water is appropriately valued, efficiently consumed, and sustainably available for the community, the economy, and the environment for generations to come.

This document reports the results of the development of theories of change for the six identified Water Grand Challenges. Theory of Change is a planning process that defines a long-term goal and then maps backward to identify changes and activities that need to happen earlier to achieve that goal. Theory of Change begins with a clear problem statement, identification and analysis of

obstacles to reaching those goals, and identification of strategies and actions that explicitly address those obstacles. The theories behind our Theory of Change for the Water Grand Challenges are (1) that making progress on long-term water challenge goals requires patience, strategy, and a multi-faceted approach with multiple parties and (2) that science and analysis by respected, independent parties are often the first steps needed to inform policy discussions and achieve long-term goals.

Participants revised the Water Grand Challenges to:

- Providing adequate and sustainable water supplies for all Texans, allowing a thriving future for the state
- Ensuring scientifically-sound environmental flows are equally prioritized within an enforceable regulatory framework
- Sustainably managing our surface water and groundwater resources to meet current and future needs while avoiding unacceptable impacts
- Investing in water resources to efficiently meet human and environmental needs
- Cultivating awareness and stewardship of our vulnerable water resources
- Ensuring all Texas waters are clean, healthy, and life-sustaining

Analyzing the surveys and discussions revealed that "Thinking" and "Regulatory" were the dominant discussion themes with "Economics," "Data," and "Politics" forming a second cluster. "Thinking" involved mindsets, values, priorities, and education, among others, suggesting that participants felt that addressing the Water Grand Challenges requires changing how Texans think about water. "Regulatory" involved standards, authority, and accountability, among others. "Economics" concerned cost, funding, and negative repercussions; "Data" comprised gaps, communication, and ignored; and Politics" included policies, political culture, and political leaders.

In all, participants identified 242 unique actions to advance progress on the Water Grand Challenges, including a total of 105 actions for fact-finding, 34 actions for education, 25 actions for engagement, 22 actions for funding, and 56 actions for advocacy. Of the fact-finding actions, 36 actions were science-based, 25 were economics-based, and 44 were policy analysis.

A couple comments made during the discussion were that "Texas is big, but it isn't as big as we think it is." and "It's not that Texas is too big; it's that it's so big." The first comment relates to environmental impact—Texas is big but not big enough to accommodate growth without impacts to water supply and the environment—while the second relates to change—Texas is big, but not too big to affect change. While the Water Grand Challenges are grand, they are not too grand. Change can—and will—happen given patience, time, and coordinated effort. Another comment made during the deliberations was that "We need a much longer on-ramp and a more coordinated effort to bring things forward." Theory of Change helps to create the longer on-ramp by developing the foundational facts to build change upon. Rather than being reactive, issues—and the deficiencies in science, economic, and policy analysis and in education and engagement—can be addressed proactively such that when the policy discussions become activated, facts and analyses are available and people are educated and engaged for policymaking.

Future plans include working on fact-finding actions identified during the theory of change process, surveying participants on their ongoing and planned actions for implementing the theories of change for Water Grand Challenges, developing a strategy to begin and continue baseline work on the Water Grand Challenges, and considering climate change and its impacts on water as a Water Grand Challenge.

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"Water, not oil, is the lifeblood of Texas."

James A. Michener (1985)

1.0 Introduction

Texas is a wonderful place, from its natural beauty, to its rich history, to its ecological diversity, to its flourishing economy. It's no wonder that our population continues to rapidly grow—Texas has what most people want.

A common thread weaving through Texas' beauty, history, ecology, and economy is water. Water carves our landscapes, feeds our springs, swells our rivers, and nourishes our estuaries. Water welcomed people, defined our boundaries, and established our towns. Water provides life to our environment from the top of Guadalupe Peak to the sea level of the Gulf of Mexico. Water enables our farms, our industrial plants, and the exploration and production of oil and gas.

Water also brings deep challenges. Depleting water resources with increased environmental impact combined with an ever-growing thirst and a changing climate threaten our environment and our economy. Texas leads the country in water planning, water conservation, and identifying environmental flow needs but still needs to advance these topics to ensure we have enough water.

Starting in 2012, The Cynthia & George Mitchell Foundation, The Meadows Center for Water and the Environment, and The Meadows Foundation launched a series of stakeholder discussions to identify and work on the Water Grand Challenges of Texas. These discussions were anchored with a vision: A Texas where water is appropriately valued, efficiently consumed, and sustainably available for the community, the economy, and the environment for generations to come. Participants have represented about 30 to 40 groups including foundations, former agency heads, environmental groups, business, former legislators, religious groups, lobbyists, legislative staff, cities, and trade associations.

The participants at that time identified six Water Grand Challenges for Texas:

- Meeting the needs of 50 million Texans by 2070
- Ensuring flows to sustain healthy ecosystems
- Sustainably managing surface water and groundwater resources
- Ensuring adequate investment in water, infrastructure, and conservation to meet demands
- Fostering public awareness of water issues to advance conservation and investment in sustainable water management
- Protecting water quality to meet human and environmental needs

The purpose of this report is to document discussions on developing theories of change for each challenge which involved revising the long-term goals for each challenge and identifying near-term, quantifiable next steps to advance each challenge. These next steps can then be used be by governmental, academic, philanthropic, and private organizations for funding to achieve long-term goals.

Given the broad scope of the Water Grand Challenges, the large group of participants, and wide range of goals, it's important to note that outcomes in this report may or may not be reflective of every participant or every participant's organization. Nor were these discussions inclusive of all viewpoints on the challenges. We intend this report to document the wide-ranging discussions that occurred. Having said that, many of the foundational fact-finding outcomes should be relevant whatever the policy preferences area.

2.0 Theory of Change

Theory of Change is a planning process that defines a long-term goal and then maps backward to identify changes and activities that need to happen earlier to achieve that goal (after Taplan and others 2013). This systematic approach creates opportunities to achieve agreement on the goals and to understand and explore underlying assumptions in the goal, changes, and activities (Weiss 1995). Although the process may seem obvious, people often dive into action without first fully assessing the situation and addressing the pre-conditions—conditions that should be addressed first before diving into action. Theory of Change provides a thought-out theoretical basis for achieving change and a structure to test that theoretical basis (Coryn and others 2011). Theory of Change is

particularly important when many parties are working on the same problem—Theory of Change helps to coordinate thoughts, experiences, knowledge, and activities to achieve goals.

Theory of Change begins with a clear problem statement. The next step is expressing goals that can be measured within a specified time frame. After that, participants identify and analyze obstacles to reaching those goals—such as political, social, financial, informational, institutional, and physical impediments. Once the obstacles are identified, participants identify strategies that explicitly address those obstacles. The strategies are then broken down into actions that would implement the strategy.

An underpinning for our Theory of Change is that making progress on long-term water challenge goals requires patience, strategy, and a multi-faceted approach with multiple parties. Another underpinning is that science and analysis by respected, independent parties are often the first steps needed to inform policy discussions and achieve long-term goals. One of us (Mace) worked at the Texas Water Development Board and saw how independent science and analysis facilitated policy discussion at the Legislature as well as in communities across the state.

3.0 Approach

We started the process with a review of participants in Water Grand Challenges, updated member representatives, and expanded membership with an eye toward increasing diversity. We removed state-agency members because we knew the discussions would likely involve changing policy that would affect their host agencies—discussions that would be difficult for state employees (and possibly other participants in attendance with those agencies) to participate in. However, participants included former state agency employees and executives, thus providing the discussions with context and expertise from those state entities. We also chose not to include legislators or legislative staff as participants since we knew that the discussions would likely involve legislative changes and discussions of challenges associated with making those changes.

We then held a re-engagement meeting to (1) introduce new members and new leadership, (2) hear several updates on water activities in the state [activities of the Senate Committee on Water and Rural Affairs, Katherine Thigpen; State Flood Assessment, Carla Guthrie and Mindy Conyers; Texas 2036, Sarah Kirkle], (3) revisit the challenges, (4) discuss who was missing from the table, and (5) discuss the Theory of Change process we would follow.

Sarah Rountree Schlessinger, executive director of the Texas Water Foundation, and Susan Kaderka, regional executive director of the National Wildlife Foundation and expert in Theory of Change, assisted with the strategy, survey, and the scope of activities. Given the broad range in Water Grand Challenge topics, the large number of participants, and the challenges in getting all the participants in one room, we focused the Theory of Change activities not on consensus but on harvesting thoughts and ideas from the

participants. Along those lines, outcomes from this process should not be interpreted as consensus outputs.

To develop theories of change for the Water Grand Challenges, we first anonymously surveyed participants on theory of change questions for each challenge (Appendix A). The survey asked the following questions for each challenge:

- Describe your goal for this challenge. What does success look like?
- How do you define reaching that goal successfully? Over what time frame?
- What are the obstacles to achieving that success? Who/or what is in the way? What conditions are preventing the realization of that success?
- What would it take to influence or change these conditions or remove or reduce these obstacles?
- What would it take to accomplish/advance these changes? How do we get leverage to advance these changes?
- What data/science/information/studies/policy-analyses are we missing to advance this goal?
- What can you do to create the conditions that would set these forces in motion? What strategy could you use to propel that change?

We then scheduled three day-long workshops where we evaluated one of the challenges in the morning and one in the afternoon (Table 3.1). We paired similar challenges for each of the workshops:

- "Meeting the needs of 50 Million Texans by 2070" and "Ensuring adequate investment in water, infrastructure and conservation to meet demand" (August 19, 2019)
- "Ensuring flows to sustain healthy ecosystems" and "Protecting water quality to meet human and environmental needs" (September 16, 2019)
- "Sustainably managing surface water and groundwater resources" and "Fostering public awareness of water issues to advance conservation and investment in sustainable water" (October 15, 2019)

At the workshops, we presented attendees with responses from the survey and then held a facilitated discussion on the challenge. We organized the first meeting as a group effort with passive facilitation; however, after a post-audit of the meeting, we changed the format to a combination of full-group meetings and break-out groups focused on developing actions as well as more active facilitation. For each Water Grand Challenge, we revisited the wording of the goal for each challenge. We took notes during the meeting and documented the outcomes from the break-out groups.

After the workshops, we studied and consolidated feedback from each meeting. By workshopping the stated goals for each challenge, we were able to identify important keywords that came up in discussion. We crafted a new statement for each Water Grand Challenge based on stakeholder discussions (which often resulted in a revised statement agreed to by attendees). Next, we identified what obstacles faced each Water Grand

Challenge, developed themes for these obstacles, and cross-referenced recurring themes across challenges. We then listed specific actions that could be taken to address these obstacles by theme and priority-level.

We categorized actions to advance progress on the Water Grand Challenges in a presumed priority order as fact-finding, education, engagement, funding, and advocacy. The logic here is that fact-finding should come first followed by education using those facts followed by engagement of an educated body followed by funding and advocacy where funding often, but not always, requires advocacy at governmental levels. If there were many fact-finding actions, we subcategorized them as either science, economics, or policy analysis. We did not place individual actions in a priority order within the categories or subcategories—they rest where they rest as a random outcome of organizing actions.

We analyzed qualitative data collected during the workshops using an inductive approach and applied descriptive codes to all feedback, a method of analysis common in qualitative research (Hemmings 2018, Tracy 2019). We combined participants' comments during discussions with responses from the online surveys in this analysis. After we compiled and coded all feedback, we grouped like responses by category. We then determined and refined themes and subthemes after all interactions with the participants.

By following the Theory of Change planning process, participants were able to revise and better articulate the goal for each challenge, identify numerous obstacles impeding progress on these issues, and begin to develop a strategic framework for large-scale change.

Table 3.1: Steps and sub-steps that guided our discussions of each Water Grand Challenge.

Goal	Re-evaluated the goals of each Water Grand Challenge based on discussion
	Identified important keywords to include
	Crafted a new statement based on stakeholder feedback
Obstacles	Identified obstacles facing each Water Grand Challenge
	Categorize and group obstacles into themes
	Cross-reference recurring themes across challenges
Strategy	Listed specific actions to address obstacles
	Identified priorities for progress

4.0 Outcomes

For our analysis of outcomes, we first focus on the revisions of the six challenges. We then analyze all the discussions for key words and themes related to obstacles. After that, we present a summary of the results on obstacles and strategies for each Water Grand Challenge. Unavoidably, because the Water Grand Challenges can blur into each other, we received commentary on one challenge that would arguably be more appropriate to

another. In these cases, we honored the initial home for the comment but ensured it was also registered in the other, perhaps more appropriate, challenge.

We strove to be inclusive and unbiased in our analysis, but analyses like these can be affected by the methods used and the preferences of those using them. Accordingly, we have provided lightly edited survey results and notes from the meetings in the appendices (Appendix B and Appendix C, respectively). We should also note that although many of the participants can (and do) advocate on these challenges, many cannot (including the Meadows Center and the philanthropic organizations).

4.1 A Need for New Thinking

Before delving into the obstacles and opportunities present in the world of Texas water, we thought it best to be introspective. Were the challenges covered in 2012 still the grandest challenges facing today's Texans? Participants wanted to carefully discuss and revise the stated goals for the Water Grand Challenges. As a result, participants revised the Water Grand Challenges to:

- Providing adequate and sustainable water supplies for all Texans, allowing a thriving future for the state
- Ensuring scientifically-sound environmental flows are equally prioritized within an enforceable regulatory framework
- Sustainably managing our surface water and groundwater resources to meet current and future needs while avoiding unacceptable impacts
- Investing in water resources to efficiently meet human and environmental needs
- Cultivating awareness and stewardship of our vulnerable water resources
- Ensuring all Texas waters are clean, healthy, and life-sustaining

The revised challenges—which also served as the goals for the theory of change discussions—are, in general, more specific (Table 4.1). For example, participants revised "Ensuring flows to sustain healthy ecosystems" to "Ensuring scientifically-sound environmental flows are equally prioritized within an enforceable regulatory framework." Others arguably became less specific but at the same time less likely to become outdated with time and new information (for example, "Meeting the needs of 50 million Texans by 2070" became "Providing adequate and sustainable water supplies for all Texans, allowing a thriving future for the state"). The new wording for these challenges created more opportunities for participants to shape the discussions.

4.2 Overall Themes of Discussion

We collected a total of 498 individual responses from all six Water Grand Challenges and grouped these responses into five themes and 28 corresponding subthemes using an inductive coding approach (Table 4.2). We then standardized these themes and subthemes across all six challenges and totaled them for each category.

Table 4.1: Comparison between the original and revised language of the Water Grand Challenges.

	Original	Revised
1	Meeting the needs of 50 million Texans by 2070	Providing adequate and sustainable water supplies for all Texans, allowing a thriving future for the state
2	Ensuring flows to sustain healthy ecosystems	Ensuring scientifically-sound environmental flows are equally prioritized within an enforceable regulatory framework
3	Sustainably managing surface water and groundwater resources	Sustainably managing our surface water and groundwater resources to meet current and future needs while avoiding unacceptable impacts
4	Ensuring adequate investment in water, infrastructure, and conservation to meet demands	Investing in water resources to efficiently meet human and environmental needs
5	Fostering public awareness of water issues to advance conservation and investment in sustainable water management	Cultivating awareness and stewardship of our water resources
6	Protecting water quality to meet human and environmental needs	Ensuring all Texas waters are clean, healthy, and life-sustaining

"Thinking" and "Regulatory" were the dominant themes with "Economics," "Data," and "Politics" forming a second cluster (Table 4.2). "Thinking" involves mindsets, values, priorities, and education, among others, suggesting that participants felt that addressing the Water Grand Challenges requires changing how Texans think about water (or, perhaps, getting Texans to think about water in the first place).

"Regulatory" involves standards, authority, and accountability, among others, with standards receiving more than twice as many mentions as the other subthemes (Table 4.2). Discussions here generally focused on local, state, and federal standards not meeting the needs of protecting water quality and local and state standards not meeting sustainability standards, including the consideration of climate change.

"Economics" concerns cost, funding, and negative repercussions (negative externalities in economics-speak), among others (Table 4.2). Cost and funding came up frequently in discussions of obstacles to achieving Water Grand Challenge goals. "Data" comprises gaps, communication, and ignored, among others, as subthemes (Table 4.2) with ignored generally meaning data being ignored by policymakers. Discussions on gaps concerned the data and analysis missing to address Water Grand Challenges, communicating that data to policymakers, and then struggling with data and analysis being ignored. "Politics" includes policies, political culture, and political leaders as subthemes. Discussions here revolved around policies and codes that may not be supportive of achieving the Water Grand Challenges goals and a political reluctance to change.

Table 4.2: Themes and subthemes derived from stakeholder comments in the surveys and at the meetings.

Theme	Subtheme	Count	Total for Each Theme
Data	Accessibility	8	**84**
	Communication	18	
	Consensus	7	
	Ignored	12	
	Gaps	22	
	Management	7	
	Sustainability	10	
Economics	Cost	40	**93**
	Funding	17	
	Incentives	14	
	Negative Repercussions	16	
	Externalization	6	
Thinking	Advocacy	11	**168**
	Education	31	
	Mindset	48	
	Myth/Misperception	8	
	Priorities	34	
	Values	36	
Regulatory	Accountability	20	**154**
	Authority	31	
	Enforcement	18	
	Property Rights and Permitting	19	
	Standards	66	
Politics	Accountability	4	**83**
	Authority	10	
	Policies	36	
	Political culture	20	
	Political leaders	13	

Figure 4.1: Word cloud for obstacles identified across all Water Grand Challenges.

Using the same source data, we generated word clouds of the obstacles brought up in discussion using worditout.com (Figure 4.1). For visual effect, we used concise phrases in place of most subthemes on the word clouds (Table 4.3). While subthemes like cost and regulatory authority remain the same as word cloud phrases, incentives became "Lack of economic incentives" and funding became "Funding is not available or accessible" to better reflect group discussions. We set the word cloud aspect ratio to 1.6:1 and word size differences to "small" to allow for a full representation of all feedback.

Individual challenges included several additional obstacle subthemes (Table 4.4); however, since these subthemes did not fall into an overarching theme present in all challenges, we omitted them from our overall theme and sub-theme analyses. To add more context from discussion, we include these additional subthemes as phrases in word clouds for the individual Water Grand Challenges.

One statement that arose in discussions was "Texas is big." Anyone who knows a Texan also knows we love to brag about Texas and, with the second largest land area, a top-ten population growth rate, and second-largest state gross domestic product of all fifty states (TCPA 2019), who can blame us?[1]

[1] It ain't bragging if it's true!

Table 4.3: Comparison of subthemes and word cloud phrases, grouped by theme.

Theme	Subtheme	Word Cloud Phrase
Data	Accessibility	Information is not widely accessible
	Communication	Poor science communication
	Consensus	Lack of scientific consensus
	Ignored	Data is ignored
	Gaps	Data gaps
	Management	Data management
	Sustainability	Sustainability is variable
Economics	Cost	Cost
	Funding	Funding is not available or accessible
	Incentives	Lack of economic incentives
	Negative Repercussions	Negative financial repercussions
	Externalization	Externalization of industry costs
Thinking	Advocacy	Need more advocates
	Education	Lack of education or understanding
	Mindset	Mindset or mentality
	Myth/Misperception	Myths and misperceptions are prevalent
	Priorities	Competing priorities
	Values	Values are not aligned
Regulatory	Accountability	Regulatory accountability
	Authority	Regulatory authority
	Enforcement	Regulatory enforcement
	Property Rights and Permitting	Property rights and permitting
	Standards	Regulatory standards
Politics	Accountability	Political accountability
	Authority	Political authority
	Policies	Flawed or unsustainable policies
	Political culture	Political culture
	Political leaders	Political leaders

Table 4.4: Additional key phrases mentioned in the Water Grand Challenges discussions on obstacles.

Additional Phrases	Challenge(s)
Aging infrastructure	6
Behind the curve	3
Climate change is not considered	1, 6
Complacency	1,5
Disconnect from nature	6
Environmental flows are undervalued	2, 3
Environmental literacy	6
Fragmented authority	1, 3, 6
Infrastructure	6
Lack of expertise	1
Lack of infrastructure	6
Lack of public interest	5
Lack of regulations	6
Lack of understanding	5
Lack of urgency	1, 5
Maintenance of infrastructure	6
Not enough public participation	6
Private sector pushback	2
Reactive instead of proactive	1, 6
Real cost undervalued	1, 2, 3, 6
Resistance to change	1, 2, 3, 5, 6
Short-term mentality	1
State Water Plan	1
Unsustainable policies	1, 2, 3, 5, 6
Urban-Rural divide	1, 4

It is worth noting, though difficult to quantify, that the mentality of the state–bigger, bolder, and better–presented itself in a myriad of ways across all themes and subthemes. Some of the biggest challenges for the state have to do with its extremely diverse natural environment and spread of resources, both above and below ground. For example, while agriculture was described as "varied across the state" (Appendix C, Session 2) the uses of water in agriculture are just as regionally varied, for reasons regarding everything from supply to regulation.

What other inherent challenges does a 268,597 square-mile state face? The physical differences in climate, geomorphology, and hydrology, the inequitable treatment of environmental flows from basin to basin, and the stark differences in natural resource protection and enforcement–to name a few from the workshops. It is also worth mentioning that at the time of writing this report, 17 of Texas' 254 counties are currently declared to be in a state of disaster due to drought, while 60 counties are still in a state of

disaster from flooding that resulted from Hurricane Harvey in 2017 (Office of the Texas Governor 2019).

Put simply—Texans in the Panhandle do not have the same relationship with water as residents of the Rio Grande Valley; Gulf Coast dwellers have different challenges than inhabitants of the Big Bend; and on and on. While most data collected during workshops revolved around differences, challenges, and obstacles, group discussion of these impediments provided a blueprint for solutions. As much as the size, mentality and varied economy of the state can feed its challenges, these factors also lend themselves to supporting multi-pronged solutions for the state's future.

4.3 Providing adequate and sustainable water supplies for all Texans, allowing a thriving future for the state

Obstacles for this Water Grand Challenge primarily concerned thinking, mindset, politics, competing priorities, and regulatory (Figure 4.2). This challenge has two parts: (1) providing adequate water supplies and (2) providing those supplies sustainably. Many of the obstacles appear to apply to *sustainable* water supplies, which is a clear challenge for the state's groundwater resources but also to sustainable flows for surface-water resources, especially with climate change. However, the obstacles regarding thinking, mindset, and politics also apply to *how* adequate water supplies are obtained, namely a conservation versus new source water development (dams and wells) discussion.

Figure 4.2: Word cloud for obstacles for the Water Grand Challenge of "Providing adequate and sustainable water supplies for all Texans, allowing a thriving future for the state."

Actions participants arrived at for this Water Grand Challenge include:

- Fact-finding
  - Science
    - Evaluate connection between water use and wildlife populations
    - Evaluate what water supplies look like when they are managed sustainably
    - Assess what our groundwater resources look like in 50 years
    - Study the effects of brackish groundwater production on fresh groundwater supplies, spring flow, and surface water supplies
    - Determine what actual water use is
    - Improve the models
    - Study the potential for greater use of aquifer storage and recovery
    - Develop climate change information for planning purposes
    - Develop better real-time monitoring
    - Develop a predictable and reliable assessment of weather impacts on water supplies
  - Economics
    - Evaluate economic impacts to downstream communities when upstream resources dry up
    - Analyze fee structures for equitably allocating true costs of water
    - Identify unintended consequences of water markets
    - Identify costs and funding sources for communities
  - Policy Analysis
    - Evaluate water-supply resiliency of Texas communities
    - Evaluate the collective thought process on desalination
    - Evaluate what groundwater sustainability means for water users and property rights
    - Analyze development codes, ordnances, and rules as they relate to conservation
    - Conduct a public survey on how much people are willing to conserve water
    - Assess what “sustainable” means
    - Identify unintended consequences of water decisions
    - Identify unintended consequences for water by disenfranchising rural voters
    - Assess the potential of future water efficiency measures likely to emerge
    - Analyze what happens to Texas when there is not enough water for everyone
    - Assess where the water might come from if the reservoirs in the state water plan aren’t built
    - Develop water conservation/water use targets and metrics
    - Identify unintended consequences of water reuse

- Education
  - Educate new decisionmakers on what is possible
  - Translate science for the public and decisionmakers
  - Shoot straight—don't overstate
  - Make sure the public understands the issues
- Engagement
  - Engage in non-regulatory ways
    - Engage builders and cities in conservation
    - Engage urban decision makers
    - Engage industrial and urban water users
  - Participate in the flood rule-making process
  - Identify which stakeholders are missing from the policy discussions
  - Develop leadership champions at all levels
  - Encourage water supply interests to recognize that fish and wildlife needs for water must be met
  - Explore partnerships and means of leveraging resources from private, philanthropic, government, and others in making advances on the challenges
  - Continue discussions across the political spectrum to find common ground
  - Develop awareness and voluntary implementation of stewardship measures
  - Demonstrate sustainability measures
  - Engage the business community using water as an economic development issue
- Funding
  - Create a grant program for small communities to implement water management strategies
  - Make SWIFT more accessible for agriculture and conservation
  - Encourage the state to fund examples of conservation
  - Develop funding to help advance agricultural water use technology
  - Create state subsidies for desalination projects
- Advocacy
  - Identify what motivates decisionmakers to think in a different way
  - Develop policy for new legislators
  - Create common interest in people that influence lawmakers
  - Create a regulatory process that does not differentiate between surface water and groundwater regulation and ownership
  - Develop the political will to study, review, and accept findings leading to implementation of science and fact-based policy modifications
  - Develop regulation to help advance agricultural water use technology
  - Create regulation to achieve sustainable water use going forward
  - Implement management strategies that achieve sustainability rather than aquifer depletion


Science
Hill Country

4.4 Ensuring scientifically-sound environmental flows are equally prioritized within an enforceable regulatory framework

Obstacles for this Water Grand Challenge primarily concerned regulatory, thinking, regulatory standards, data, permitting, property rights, competing priorities, policies, and politics (Figure 4.3). This Water Grand Challenge is a bit more specific than the others due to an existing process in the Texas Water Code on establishing environmental flows, namely Senate Bill 3 from the 80th Legislative Session. Consequently, the obstacles and actions are also a bit more specific.

Figure 4.3: Word cloud for obstacles for the Water Grand Challenge of "Ensuring scientifically-sound environmental flows are equally prioritized within an enforceable regulatory framework."

Actions participants arrived at for this Water Grand Challenge include:

- Fact-finding
  - Science
    - Conduct more studies on surface water-groundwater interaction
    - Compile existing studies on surface water-groundwater interaction and make them publicly available
    - Make data that exists more accessible so we can show when environmental-flow standards are not being met
    - Assess climate change impacts on surface water and groundwater
    - Analyze where we are in achieving environmental-flows as recommended by the basin and bay expert science teams, the basin

and bay advisory stakeholder committees, and the Texas Commission on Environmental Quality
    - Analyze how sustainably we are managing aquifers
    - Expand the citizen scientists of the Stream Team to champion the baseline and monitor the future conditions of the ecosystems within the targeted area
    - Study recharge numbers and develop better data on groundwater withdrawals.
    - Study the various relationships between flows and the maintenance of healthy populations of fish, wildlife, and plant species and to verify the effectiveness of potential strategies to meet flow regimes
    - Analyze the impact of the recommended flow regimes versus what was adopted in rule
    - Analyze how to adapt systems to best ensure protection of water for the environment downstream
    - Analyze how much river flow is reduced through groundwater pumping in the state
- Economics
    - Study the economic value and impact of ecosystem services, downstream impacts, and whole system impacts
    - Conduct an economic analysis of the true value of environmental flows
    - Conduct an economic analysis of achieving environmental flow protection, including impacts on underserved urban and rural communities
    - Conduct an economic cost-benefit analysis of proactive management such as the cost to avoid listing an endangered species versus cost to treat post-listing
- Policy Analysis
    - Analyze policy options for achieving real protection of environmental flows
    - Reach consensus on definition and metrics for "healthy ecosystems"
    - Investigate new ways to dedicate and protect water for water the environment, comparable to a conservation easement
    - Do a policy analysis of the pros and cons of bed and banks to the coast how statute can be changed to achieve this goal
    - Conduct a policy analysis on the mechanisms and cost of buying surface-water rights, impacts to other right holders, and sources of funds for purchasing water rights

        - Review what happened with the implementation of Senate Bill 3 and what a more science-informed process could look like and what its implications could be to surface water
        - Analyze how to best manage surface and groundwater together

- Education
    - Translate studies using personal stories so the public can understand the issue
        - Define the two to three key messages needed to communicate
        - Educate the decision-makers
        - Educate the electorate
    - Deliver the message that a healthy river a day keep the endangered species act away
    - Educate Texans about cost-effectiveness of conservation versus new dams
    - Create a statewide education campaign with Texas celebrities (similar to "Don't Mess with Texas") touting the value (cultural and economic) of healthy rivers, bays, and estuaries, as well as benefits of water conservation
    - Require public education curriculum for grades 1 through 12 that emphasizes benefits of water conservation, describes river and bay ecology, and describes water needs of each part of the state
- Engagement
    - Diversify stakeholders in the planning groups
        - Include diverse socio-economic and working-class interests
    - Diversify and empower advocates and champions that can engage on this challenge
    - Identify who the best people are to “move the needle”
- Funding
    - Create a program of state-funded acquisitions to incentivize private/philanthropic acquisitions
    - Provide more funding to Texas Water Development Board to improve models
- Advocacy
    - Develop statewide standards considering climate change impacts on surface water and groundwater
    - Make water for the environment co-equal to other uses
    - Direct water permit cancellations to environmental flows
    - Create drought triggers tied to low environmental flows
    - Change state law to allow bed and banks to deliver water to bays and estuaries
    - Manage surface and groundwater together in parts of the state with significant interaction

- Create incentives for setting aside guaranteed in-stream and bay/estuary flows for new dam projects such as streamlined permitting
- Better integrate surface and groundwater interaction in permitting decisions for groundwater pumping
- Create incentives for current water right holders to set aside a portion of their water right for dedicated in stream flows
- Create watermasters in more river basins to monitor environmental needs/conditions and protect/enforce downstream flows
- Strengthen water conservation education requirements (and resources) for every municipal water supplier in Texas

4.5 Sustainably managing our surface water and groundwater resources to meet current and future needs while avoiding unacceptable impacts

Obstacles for this Water Grand Challenge primarily concerned regulatory, unsustainable policies, thinking, regulatory authority, and economics (Figure 4.4). Here, regulatory refers to the regulatory impediments to managing sustainably. For example, permitting or managing surface water without considering climate change or a regulatory approach that allows groundwater mining. In some cases, regulating bodies may feel that they do not have the regulatory authority to manage sustainably such as groundwater conservation districts. These same districts may feel that they are not able to manage sustainably because of the resulting economic impacts, impacts that inform local thinking on how groundwater should be managed.

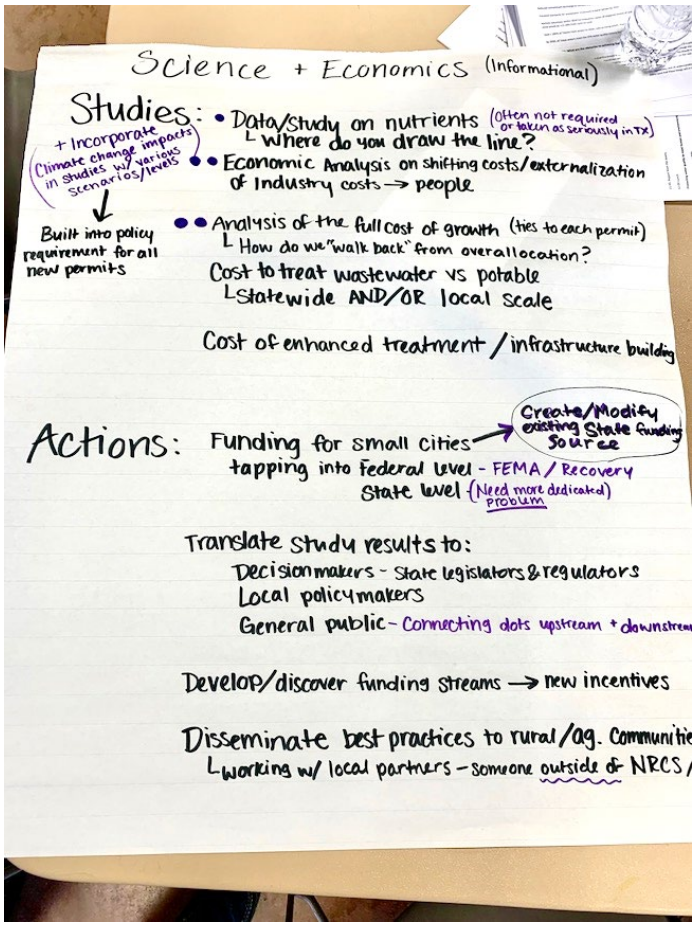
Figure 4.4: Word cloud for obstacles for the Water Grand Challenge of "Sustainably managing our surface water and groundwater resources to meet current and future needs while avoiding unacceptable impacts."

Actions participants arrived at for this Water Grand Challenge include:

- Fact-finding
  - Science
    - Develop more scientific validation of the potential impacts of reduced environmental flows and groundwater levels on species habitat and species population viability
    - Conduct more local, site-specific science to understand groundwater and surface water connections in river basins
    - Conduct comprehensive, statewide scientific studies that document the type and degree of inter-relationships between surface-water and groundwater
    - Provide a clear understanding of downstream impacts of reuse
    - Develop methods of measuring desired future conditions
    - Create a statewide database on groundwater use and permits
    - Identify areas of significant groundwater/surface water interaction
    - Analyze the impact of reuse on downstream water availability
    - Study how rapidly we are depleting sources of water
  - Economics
    - Conduct pilot or test cases to value or appraise groundwater in place
    - Conduct an economic analysis on the value of conserving groundwater in place
    - Identify any state financial program barriers to integrated water approaches
  - Policy Analysis
    - Prepare a case study on how the San Antonio Water System made San Antonio water aware and receptive
    - Link or identify water quantity used in products
    - Develop an efficiency rating/scorecard for commercial and residential buildings
    - Evaluate the benefits of publicly shaming water abusers versus championing conscientious water users
    - Provide clarity on state rules for reuse
    - Measure local and statewide progress toward sustainability
    - Analyze the variations in groundwater management approaches (permit rules, lengths, allocations)
    - Analyze alternative regulatory/management structures
- Education
  - Use consumer power to incentivize responsible water usage and then policy change
  - Develop and implement an education campaign

    - Integrate water education into schools and universities (in classes and housing spaces)
    - Create a public education campaign to help lay people understand the interconnectedness of water
    - Have a communications effort to demonstrate how treating surface water and groundwater as separate resources can negatively affect surface-water rights holders and groundwater permit holders
    - Promote integrated water management approaches at the local level
- Engagement
    - Build a coalition of groups (such as conservation, responsible businesses, and certain municipalities) to balance the influence of users who only want to use water for economic benefit
    - Launch Texas Watershed Exchange, focused on protecting source water and connecting rural and urban interests
- Funding
    - Create financial incentives for surface-water rights holders and groundwater permit holders to dedicate a portion of their rights to water trusts or other mechanisms to meet environmental water needs and species maintenance
    - Provide funding to groundwater conservation district funding to compensate for takings
    - Provide funding to Texas Water Development Board, Texas Parks and Wildlife Department, and university research institutions for additional research on the potential impacts of reduced environmental water needs and reduced groundwater levels
    - Provide funding for incentives for the dedication of surface water rights and groundwater permits for environmental water needs and maintenance of species
    - Provide state funding for scientific studies
    - Solicit state and foundation funding for a public education campaign
- Advocacy
    - Cancel unused water rights
        - Canceled rights could go into the Texas Water Trust
    - Give the Texas Water Development Board more authority to manage water rights in the Texas Water Trust
    - Allow landowners to conserve water in place
    - Have the legislature redefine beneficial use to include environmental benefit
    - Develop an economic incentivization program with paybacks for efficiency
    - Empower issue champions
    - Create groundwater protection easement-like opportunities for interested landowners

- Create a Senate Bill 3 for groundwater to set aside some groundwater for environmental flows
- Recognize the connection between surface water and groundwater
- Require that environmental flows be considered in all existing permits
- Create incentives for permittees to return more flows to rivers
- Clarify the law that a groundwater conservation district can reduce a permit and it is not a taking
- Change groundwater management district boundaries so that they are based on water-resource considerations (aquifers, river basins) rather than political boundaries
- Overhaul of legal framework to provide for holistic management of surface and groundwater in areas of significant interaction
- Manage groundwater on an aquifer-wide basis
- Create a new mechanism for protecting source water (land) to promote sustainable future water sources
- Pass legislation establishing caps on groundwater permits/production
- Mandate water supply diversification toward sustainable supplies



4.6 Investing in water resources to efficiently meet human and environmental needs

Obstacles for this Water Grand Challenge primarily concerned economics, regulatory standards, regulatory, cost, and thinking (Figure 4.5). Economics here generally refers to the cost of implementing the state water plan or implementing other water management strategies to ensure that there is enough water to meet human and environmental needs. If environmental needs are met, additional economic costs might result since the current planning process does not provide full protection for environmental flows. Many funding programs are loans, but many small communities need grants to invest in water infrastructure.

Regulatory standards and regulatory generally refer to the inability of regulators to truly regulate, either due to the standards they operate under or the fact that standards and demands vary widely across the state. For instance, the Texas Water Development Board collects self-reported data on utilities' water use, but as an institution lacks the power to enforce accurate reporting from utilities.

Figure 4.5: Word cloud for obstacles for the Water Grand Challenge of "Investing in water resources to efficiently meet human and environmental needs."

Actions participants arrived at for this Water Grand Challenge include:

- Fact-finding
    - Science

        - Quantify how much water is being lost
        - Assess how resilient the state is to drought and climate change
    - Economics
        - Develop a cost-benefit analysis for investment in water resources, including efficiency strategies
        - Identify ways to retain the value of water by not selling/using it
        - Conduct a statewide economic impact study on water
        - Study the economic impact of the state water plan on rural Texas
        - Assess how the state could reshape requirements and incentives within state water financing programs to promote greater private capital
        - Develop risk transference valuation methodologies to incentivize private capital infusion
        - Analyze of public versus private capital procurement processes that consider life cycle costs
    - Policy Analysis
        - Assess regulatory hurdles for implementing One Water in Texas
        - Evaluate how the Texas Water Development Board has implemented requirements to meet certain levels of water loss for loans
        - Evaluate state-wide how efficiency and One Water could meet the state's water requirements
        - Evaluate how the state water plan could be improved
        - Conduct research on the allowable levels of water loss
        - Analyze what the true long-term needs are in balance with expected/actual population growth
        - Assess the data transparency needed from the agricultural and industrial users to generate accurate water balance to identify true additional capacity requirements to ensure sustainability
        - Survey water systems (capture feedback by size) on the greatest impediments to infrastructure improvements
- Education
    - Provide communities with the information and know-how to access funding programs
    - Develop a "Know Your Water" app
    - Educate public officials on the need for water investment
- Engagement
    - Align with the with Economic Development Corporation partnerships to promote conservation and investment
    - Promote use of public-private partnerships to bridge the gap in water infrastructure financing needs

- Funding
    - Create a grant-funding source dedicated to water (can be used for items that cannot be paid for through a loan program such as small communities or environmental flows)
    - Allow rate structure to include investment in externalities such as environmental flows and agriculture
    - Make SWIFT available as grants for infrastructure
    - Create a continuous funding source for sustainable long-term water solutions
        - Florida has a real estate fee to protect Everglades
        - Minnesota has a small tax to protect Open spaces and water resources
    - Charge a fee for new wells drilled to plug old wells
    - More funding to advance water technology
- Advocacy
    - Reduce water loss through infrastructure
    - Create an efficiency limit that needs to be met before becoming eligible to build source-water infrastructure
    - Ensure everyone has access to water
    - Invest in efficiency first, source water later
    - Remove regulatory hurdles for implementing One Water
    - Create an incentive to address water loss
    - Require or incentivize proper management/updates in asset management or capital improvement plan
    - Incorporate climate change in the state water plan
    - Use data on utilities and water use collected by state to leverage changes in policy process
    - Prepare a Green Infrastructure Bill
    - Facilitate a Texas Water Caucus
    - Protect rural supplies by encouraging alternative supplies for large demand centers

4.7 Cultivating awareness and stewardship of our water resources

Obstacles for this Water Grand Challenge primarily concerned thinking, mindset or mentality, values not aligned, and competing priorities (Figure 4.6). Thinking and mentality generally concerns the fact that most Texans don't think about water—where it comes from, how much there is, how resilient it is, and how water's use affects the environment and other users. Users values are generally not aligned with water issues because water has been (fortunately) reliable.

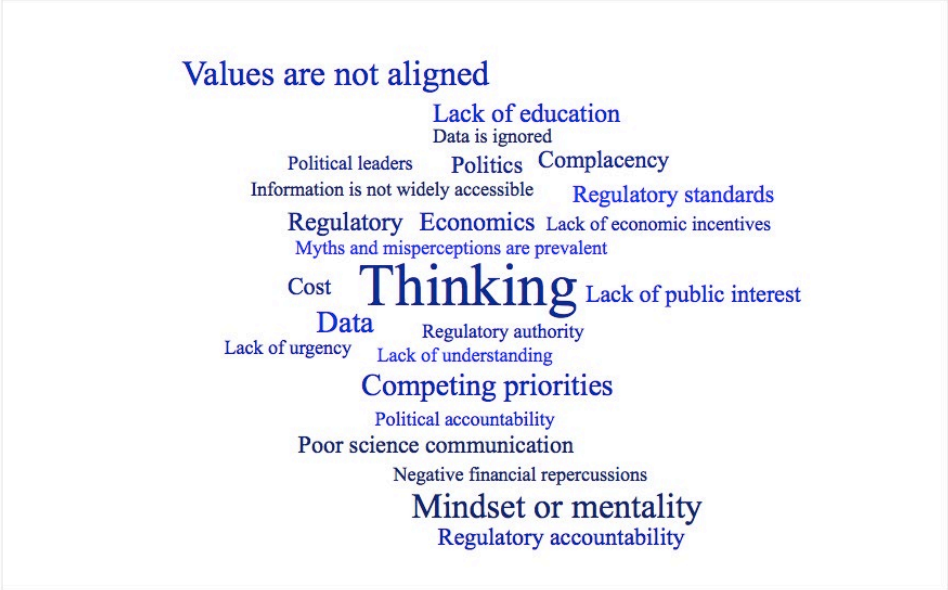


Figure 4.6: Word cloud for obstacles for the Water Grand Challenge of "Cultivating awareness and stewardship of our vulnerable water resources."

Actions participants arrived at for this Water Grand Challenge include:

- Fact-finding
  - Policy Analysis
    - Develop case studies of success stories
      - One Water School in Wimberley
      - San Antonio Water System's program to protect water quality in the Edwards Aquifer
    - Produce unbiased one- or two-pagers that highlight key water challenges
    - Conduct a poll to assess what Texans understand and don't understand about water
    - Study where water is undervalued
- Education
  - Use a neutral, outside organization to create venues for education and briefings
  - Promote water focus by other research groups/influencers
  - Create accreditation incentives with press coverage
  - Use events (such as football games, rodeos, state fairs, movie previews) to educate and engage viewers on water
  - Use Water IQ as it was originally intended
- Engagement
  - Increase social and regular media attention to Texas water
  - Involve celebrities in messaging

- Demonstrate how the conservation community adds value to non-traditional partners

- Advocacy
  - Launch a Texas Water Caucus
  - Encourage state agencies and local governments to set an example of water efficiency with their own facilities

4.8 Ensuring all Texas waters are clean, healthy, and life-sustaining

Obstacles for this Water Grand Challenge primarily concerned regulatory, regulatory standards, thinking, and economics (Figure 4.7). Regulatory and regulatory standards generally concerned what were perceived as inadequate regulations to adequately protect water quality. Thinking generally refers to the general Texas desire to regulate as little as possible. Economics generally concerns the additional costs that may be associated with higher levels of treatment.

Figure 4.7: Word cloud for obstacles for the Water Grand Challenge of "Ensuring all Texas waters are clean, healthy, and life-sustaining."

Actions participants arrived at for this Water Grand Challenge include:

- Fact-finding
  - Science
    - Conduct a study on nutrients and where you draw the line
    - Conduct a study that examines options for water treatment and discharge

        - Conduct a study that creates a baseline of water quality parameters for groundwater
    - Economics
        - Analyze the full cost of growth
        - Conduct an economic analysis on shifting costs/externalization of industry costs to people
        - Assess new funding sources
        - Assess the cost to treat wastewater versus potable water
        - Assess the cost of enhanced treatment and infrastructure
        - Explore state funding mechanisms for preserving land for water quality protection
        - Study cost savings from agricultural practices that minimize pesticide/herbicide use
    - Policy Analysis
        - Develop a best practices document
        - Study what is needed to restore currently polluted streams to water quality standards that would allow and protect human contact recreation; identify strategies to restore Texas rivers and streams to those conditions
        - Review what other states have done in karst terrain
- Education
    - Translate study results to legislators, regulators, and local policymakers
    - Connect the upstream and downstream dots for the public
    - Distribute a best practices document to rural and agriculture communities
    - Create and promote wastewater champions
    - Support water and wastewater certification at community colleges
    - Develop the technical capacity for analysis and alternatives mapping
    - Create an awareness campaign on water quality
    - Promote of organic/"natural" foods (that have not been subject to herbicides and pesticides) as healthy for the consumer and Texas waters
- Engagement
    - Make wastewater an “electable” factor
    - Shape rural political ethics to focus on local control and impact on water resources
    - Create more local citizen science and advocacy groups
- Funding
    - Seek more dedicated funding at the state level
    - Seek more dedicated funding at the federal level
    - Solicit funding for studies to assess current water quality impacts from point and non-point sources in Texas
- Advocacy
    - Require that climate change be built into all new permits
    - Advance new water quality requirements for streams of significance

- Use model subdivision rules template program to give counties limited land use authority in order to insure state funding
- Create an evolution of best management practices and financial incentives for agriculture as it relates to non-point pollution
- Pass legislation to strengthen water quality discharge permit requirements and to loosen limits on public participation as parties in contested case hearings

4.9 Summary of Actions

In all, participants identified 242 unique actions to advance progress on the Water Grand Challenges, including a total of 105 actions for fact-finding, 34 actions for education, 25 actions for engagement, 22 actions for funding, and 56 actions for advocacy. Of the fact-finding actions, 36 actions were for science-based, 25 were economics-based, and 44 were policy analysis.

5.0 Next Steps

Future plans included working on several of the baseline studies identified during the theory of change process, surveying participants on their plans for the Water Grand Challenges, developing a strategy to begin and continue baseline work on the Water Grand Challenges, monitoring progress, and considering climate change and its impacts on water as a Water Grand Challenge. Other partners, such as the Texas Water Foundation, can work to connect to larger stakeholder groups and develop educational programs, something they are already moving towards. Advocacy activities are ultimately up to the advocacy groups.

6.0 Conclusions

This document reports the results of the development of theories of change for the six identified Water Grand Challenges. Theory of Change is a planning process that defines a long-term goal and then maps backward to identify changes and activities that need to happen earlier to achieve that goal. Theory of Change begins with a clear problem statement, identification and analysis of obstacles to reaching those goals, and identification of strategies and actions that explicitly address those obstacles. The theories behind our Theory of Change for the Water Grand Challenges are (1) that making progress on long-term water challenge goals requires patience, strategy, and a multi-faceted approach with multiple parties and (2) that science and analysis by respected, independent parties are often the first steps needed to inform policy discussions and achieve long-term goals.

Participants revised the Water Grand Challenges to:

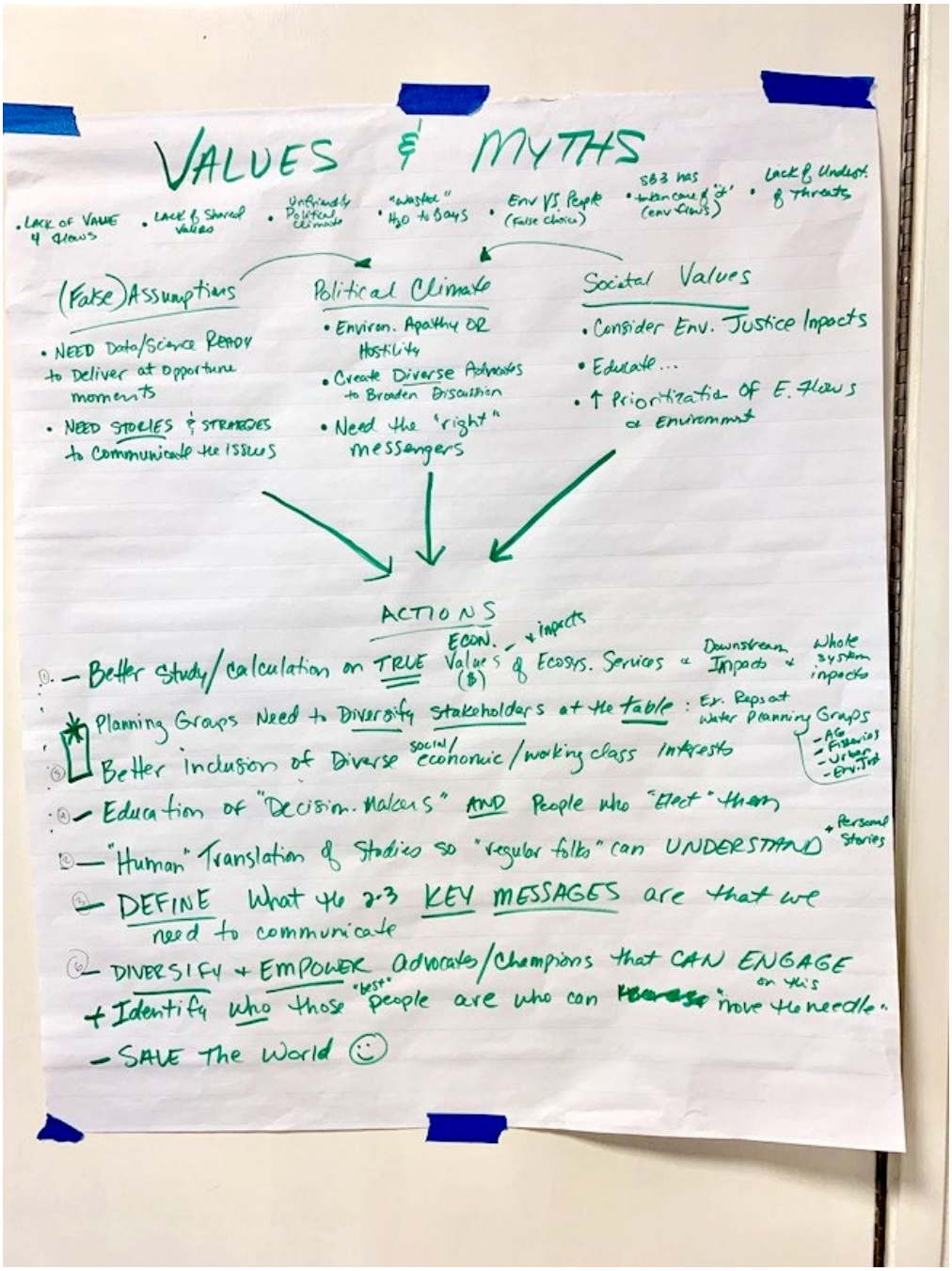
- Providing adequate and sustainable water supplies for all Texans, allowing a thriving future for the state.
- Ensuring scientifically-sound environmental flows are equally prioritized within an enforceable regulatory framework.
- Sustainably managing our surface water and groundwater resources to meet current and future needs while avoiding unacceptable impacts.
- Investing in water resources to efficiently meet human and environmental needs.
- Cultivating awareness and stewardship of our vulnerable water resources.
- Ensuring all Texas waters are clean, healthy, and life-sustaining.

Analyzing the surveys and discussions revealed that “Thinking” and “Regulatory” were the dominant discussion themes with “Economics,” “Data,” and “Politics” forming a second cluster. “Thinking” involved mindsets, values, priorities, and education, among others, suggesting that participants felt that addressing the Water Grand Challenges requires changing how Texans think about water. “Regulatory” involved standards, authority, and accountability, among others “Economics” concerned cost, funding, and

negative repercussions; “Data” comprised gaps, communication, and ignored; and Politics” included policies, political culture, and political leaders.

In all, participants identified 242 unique actions to advance progress on the Water Grand Challenges, including a total of 105 actions for fact-finding, 34 actions for education, 25 actions for engagement, 22 actions for funding, and 56 actions for advocacy. Of the fact-finding actions, 36 actions were science-based, 25 were economics-based, and 44 were policy analysis.

Future plans include working on fact-finding actions identified during the theory of change process, surveying participants on their ongoing and planned actions for implementing the theories of change for Water Grand Challenges, developing a strategy to begin and continue baseline work on the Water Grand Challenges, and considering climate change and its impacts on water as a Water Grand Challenge.



7.0 Acknowledgments

We are grateful for financial support of The Cynthia & George Mitchell Foundation, Nestlé Waters North America, and The Meadows Foundation in the Water Grand Challenges effort as well as for their participation in process and interest in the future of Texas. We are indebted to Ms. Susan Kaderka of the National Wildlife Federation and Ms. Sarah Rountree Schlessinger of The Texas Water Foundation for critical guidance

and support in the Theory of Change process as well as discussions on the future of implementation. We would not be able to hold these meeting with the able support of Ms. Susan Hankins in organizing off-site locations and food and drink. And last, but not least, the participants and participant organizations for dedicating time and resources to this effort.

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Appendix A

Survey

Dear Water Grand Challenges member:

As you heard when we met in March, the Water Grand Challenges Initiative is committed to building out a plan of action to advance the major water challenges we have collectively identified for Texas. Our intention is to engage in a Theory of Change exercise to develop that plan. So what, exactly, is Theory of Change?

Theory of Change is essentially a planning process that goes through a series of steps to **identify the right strategies and actions to effectively address a problem at hand:**

- It begins with a clear statement of a problem or set of problems (the Water Grand Challenges group has done this by identifying the six Challenges).
- The process then moves to the articulation of a goal or set of goals that can be operationalized, in real-world terms, ideally within a given time frame.
- Having defined the goal(s) that would address the problem(s), planners then identify and analyze the obstacles to reaching that goal. These could be political, social, financial, informational, institutional, physical—any number of things. Usually there is more than one obstacle.
- Once the obstacles are identified/articulated, planners identify strategies that explicitly address those obstacles.
- The strategies are then broken down into action steps or activities that would implement the strategy.

Theory of Change is a logical process that, when you break it down this way, seems self-evident. Don't we all already do this? Actually, we don't. Most of us tend to operate within the boundaries of our organizational or professional approach to things. These limits can express themselves in how we define a problem: like the blind men and the elephant, we define a problem in the context of what we know. They can likewise express themselves in how we define obstacles. If we are ill-equipped or disinclined to address a given obstacle, we may just not even see it, let alone develop strategies to address it.

So Theory of Change is a method that helps us remove some of our blinders and gets out of our organizational/professional silos to really think through what it would take, collectively, to address a problem. It promises to be a fruitful exercise for a group as diverse as the Water Grand Challenges Initiative because we represent such a diversity of interests, skills, and experiences.

We will begin this exercise by asking each member of the initiative to fill out—to the best of your ability—the survey below. This is a priming-the-pump exercise. The Grand Challenges group will be meeting in late summer/early fall to go through this process together, and your survey response will help inform and guide those meetings.

Thank you for your participation in Water Grand Challenges, and for taking the time to help with this initial phase.

I. Meeting the needs of 50 Million Texans by 2070

Describe your goal for this challenge. What does success look like? *(Example: Everyone in Texas becomes a cat lover.)*

How do you define reaching that goal successfully? Over what time frame? *(Example: Every home in Texas has a cat by 2030.)*

What are the obstacles to achieving that success? Who/or what is in the way? What conditions are preventing the realization of that success? *(Example: (1a) Dog-only people think cats would bother their canines, (2a) lots of people have cat allergies, (3a) adoption fees are prohibitive, (4a) too many apartments have no-pet restrictions, and (5a) bird lovers who see cats as killers are discouraging cat ownership.)*

What would it take to influence or change these conditions or remove or reduce these obstacles? *(Example: (1b) Dog-cat meet-up events, (2b) free allergy shots, (3b) financial incentives to adopt cats, (4b) removal of no-pet restrictions (or exemptions for well-behaved cats) on rentals, and (5b) the construction of catios to keep cats indoors.)*

What would it take to accomplish/advance these changes? How do we get leverage to advance these changes? *(Example: (1c) Modeled after Sierra Club, create Kitten Klub [led by Ken "KittyKat" Kramer] to host dog-cat meet-up events and "Bring Your Cat to Work Day", (2c) legislative funding for allergy shots, (3c) philanthropic funding to incentivize cat adoption, (4c) legislation to remove pet restrictions, (5c) federal funding through the Endangered Species Act to fund catio construction.)*

What data/science/information/studies/policy-analyses are we missing to advance this goal? *(Example: (1d) We need better geographic and demographic information on cat and dog ownership in Texas, (2d) we need a white paper on the effectiveness of treating cat allergies and the need for new treatments, (3d) we need a survey on adoption fees across Texas, (4d) we need a policy analysis on how to remove pet restrictions on rentals, and (5d) we need an analysis on the economic impact of building millions of catios.)*

What can you do to create the conditions that would set these forces in motion? What strategy could you use to propel that change? *(Example: (1e) We can support Kramer's Kat Klub with start-up funding, (2e) we can host free allergy shot clinics, (3e) we can help fund a survey of adoption fees, (4e) we can serve on an advisory committee on pet restrictions, and (5e) we can share our existing data on the cost of catios.)*

II. Ensuring flows to sustain healthy ecosystems

Describe your goal for this challenge. What does success look like?

How do you define reaching that goal successfully? Over what time frame?

What are the obstacles to achieving that success? Who/or what is in the way? What conditions are preventing the realization of that success?

What would it take to influence or change these conditions or remove or reduce these obstacles?

What would it take to accomplish/advance these changes? How do we get leverage to advance these changes?

What data/science/information/studies/policy-analyses are we missing to advance this goal?

What can you do to create the conditions that would set these forces in motion? What strategy could you use to propel that change?

III. Sustainably managing surface water and groundwater resources

Describe your goal for this challenge. What does success look like?

How do you define reaching that goal successfully? Over what time frame?

What are the obstacles to achieving that success? Who/or what is in the way? What conditions are preventing the realization of that success?

What would it take to influence or change these conditions or remove or reduce these obstacles?

What would it take to accomplish/advance these changes? How do we get leverage to advance these changes?

What data/science/information/studies/policy-analyses are we missing to advance this goal?

What can you do to create the conditions that would set these forces in motion? What strategy could you use to propel that change?

IV. Ensuring adequate investment in water, infrastructure and conservation to meet demands

Describe your goal for this challenge. What does success look like?

How do you define reaching that goal successfully? Over what time frame?

What are the obstacles to achieving that success? Who/or what is in the way? What conditions are preventing the realization of that success?

What would it take to influence or change these conditions or remove or reduce these obstacles?

What would it take to accomplish/advance these changes? How do we get leverage to advance these changes?

What data/science/information/studies/policy-analyses are we missing to advance this goal?

What can you do to create the conditions that would set these forces in motion? What strategy could you use to propel that change?

V. Fostering public awareness of water issues to advance conservation and investment in sustainable water management

Describe your goal for this challenge. What does success look like?

How do you define reaching that goal successfully? Over what time frame?

What are the obstacles to achieving that success? Who/or what is in the way? What conditions are preventing the realization of that success?

What would it take to influence or change these conditions or remove or reduce these obstacles?

What would it take to accomplish/advance these changes? How do we get leverage to advance these changes?

What data/science/information/studies/policy-analyses are we missing to advance this goal?

What can you do to create the conditions that would set these forces in motion? What strategy could you use to propel that change?

VI. Protecting water quality to meet human and environmental needs

Describe your goal for this challenge. What does success look like?

How do you define reaching that goal successfully? Over what time frame?

What are the obstacles to achieving that success? Who/or what is in the way? What conditions are preventing the realization of that success?

What would it take to influence or change these conditions or remove or reduce these obstacles?

What would it take to accomplish/advance these changes? How do we get leverage to advance these changes?

What data/science/information/studies/policy-analyses are we missing to advance this goal?

What can you do to create the conditions that would set these forces in motion? What strategy could you use to propel that change?

Appendix B

Responses to Surveys

Note that we provided a light edit to the responses. Because we sent this survey out before the discussions on the goal, we are using the pre-revised titles for the Water Grand Challenges.

Meeting the needs of 50 million Texans by 2070

Describe your goal for this challenge. What does success look like?

a. Meeting our needs includes meeting the needs of our wildlife, estuaries & streams, and our ecosystems, because without them, Texans cannot thrive. Success equals sustainability, which encompasses what people and ecosystems need to survive, and thrive, together. The goal is sustainable water use into the future.
b. (1) Texans, including marginalized communities, have access to clean water. (2) Communities adopt a water conservation ethic that is normalized and not just in times of drought. (3) The engineering community and the state rely on green water supply infrastructure as the first choice (including one water concepts and source water protection).
c. Goal has multiple parts: (1) all water needs are recognized and quantified (Texans don't just use water at home, in business, and on the farm but also for fishing, hunting, and other recreation); (2) needs are distinguished from wants, based on increasingly efficient use, including demand management during drought; (3) realistic strategies, taking into account financial needs and environmental impacts, are identified and agreed upon for implementation on a set schedule to meet all identified water needs.
d. Enough water is available for all Texans for all needs, so as not to constrain the economic future of the State. Needs include industrial, recreational, domestic, agricultural, and environmental uses.
e. The goal for this challenge is actually being able to provide the water needs for communities, industry/business, and the environment. This will be daunting given the projected human population, and in many cases, we are already in the "red" in some cases regarding terms of supply/quality/quantity. It will require everyone in the state to recognize and accept that sacrifices are needed by everyone and the lowering of future water expectations and use levels.
f. Access to adequate and sustainable water supplies without adverse community, economic, or environmental consequences.
g. I think the only way to achieve providing water for 50 million Texans AND provide water for irrigating crops is to move as much of the municipal/industrial use to desal as possible. Success for me is for our group to plan a path to

seawater/brackish groundwater as a major supply for the municipal/industrial sectors.

h. Research, research, research!! In order to know how to provide for the future, we must understand what we have now. How much is available in aquifers and how much unappropriated surface water are we starting with. Where is the water, where is the demand going to be in the future? What will consumption look like in 2070. How much does a cat use? Success looks like a more sophisticated state water plan.
i. Freshwater, drinking water or private groundwater resources meeting the maximum contaminant level with 50% targeted excess capacity per capita, 10 years in advance of the projected volumes, where it is needed to meet the domestic needs of Texans in conjunction with sufficient volumes (of appropriate quality) for agriculture/irrigation, thermoelectric power supply, industrial and recreational uses.
j. Texas can balance water demands and water supply in the face of booming population growth and dramatic weather variability.
k. Providing a balance between the competing interests for water resources where everyone has their needs met without "finger-pointing" or creating "losers".
l. Everyone in Texas has access to clean and sustainable sources of water to meet needs that reflect efficient use of water.

How do you define reaching that goal successfully? Over what time frame?

a. Clean drinking water for all. Developing a culture of sustainable use (conservation) among Texans. Maintain adequate/historical stream flows in all Texas rivers and streams throughout the year. I imagine that time frame as 15 years to get this in motion (campaigns, outreach, legislation), perhaps longer for ultimate success.
b. (1) By 2019. There is no excuse for this not to be a priority now. (2) By 2024 (3) By 2024.
c. Comprehensive needs assessment by end of 2023, updated periodically. Implementation strategy, including financing, for major projects by 2025, updated periodically. Ongoing implementation timed to meet needs.
d. No constraints beyond normal conservation. The time frame is before there is a constraint.
e. Significant conservation measures need to be implemented to slow down the water use compared to the increasing populations. Much like San Antonio did several years ago, the water demand needs to flatten in the next 10 to 20 years. That is the measure of success. Every regional plan includes some amount of desalinization in time for the next state water plan.
f. The state water plan is updated every five years. It's a good process, but perhaps a bit stagnant at this point. The time frame is appropriate, but we should adjust some important forward-looking components within the plan.

g. Demonstrated with appropriate data from the Texas Water Development Board water use surveys. This is of course tied with many other of the Water Grand Challenges relating to awareness, priority, conservation, science, governance, planning, and required investment.
h. Zero projected water need in drought of record conditions in the current decade.
i. Water strategies are achieved that meet future needs through proper education, training, and financing.
j. Texas actually implements water management strategies or conserves and reduces water use in a corresponding amount as that reflected as an unmet need in each panning decade as reflected in the current state water plan.

What are the obstacles to achieving that success? Who/or what is in the way? What conditions are preventing the realization of that success?

a. Lack of understanding or interest among majority of legislators. Lack of funds, generally. Perception that the environment and economy are a CHOICE we need to make, rather than two joined sectors that we need to cultivate together in order to thrive.
b. (1) Too many small utilities that are not regulated (<500); Too much development in unincorporated areas that don't require connections/future water supplies to be identified; lack of county authority. (2) There is no top-down approach. People get their cues on this through leadership. (3) development frames that are antiquated (e.g. Texas Commission in Environmental Quality rules or suggestions on water needs/person).
c. Reluctance by many to recognize water for fish and wildlife as a true need for water. Inadequate environmental flow standards that primarily reflect a subset of unappropriated water instead of need. Resistance to relying on demand management as a long-term drought-response strategy. Desire for water providers to control their own supply source. Costs and pricing constraints: price of water doesn't reflect true costs and financial incentives drive utilities to sell more water. Resistance by conservation interests to large water projects in absence of comprehensive approach. Lack of funding mechanism, esp. for water for fish and wildlife Failure of current processes to address climate change impacts in a comprehensive manner Inadequate authority and accountability for wholesale suppliers to conserve.
d. Competition for supplies and lack of public passion.
e. The approaches to water conservation and water use (i.e., infrastructure, delivery, etc.) need to be novel and beyond what is currently being implemented. The primary obstacle is the difficulty in identifying new technologies and implementing those approaches that may include public acceptance (e.g., water reuse) and willingness to make those kinds of long-term investments.
f. (1) Demands exceeding available supply (2) Inadequate investment in technology, infrastructure (3) Mismatch with regulatory framework and conflicts with private

property rights (4) Definitional and value disconnects (i.e., what is sustainable, what weight to put on environmental considerations).

g. Short-term solutions such as groundwater transfers are cheaper to the buyer and make more money for the sellers and as long as those cheap options are available large municipalities are unlikely to invest in desalinzation.
h. The good folks at the Texas Water Development Board and in the Texas Legislature need to see the need for a new vision. I would encourage a priority to revamping the state water plan to look more at consumption changes and what that will look like in 2070. We cannot assume our world will still be operating the way it is today. The effort will, of course require funds for research and design of an updated state water plan.
i. The current water use surveys focus on actual water withdrawals and do not include true evaluation of source capacities and management to, or demonstration of sustainable water balances within a specific catchment or basin.
j. Political forces and entrenched interests protecting the status quo instead of thinking of the state's long-term needs. Poor implementation of strategies to bend supply and demand curves, even while the planning process does not prepare for the likely worst scenario because it doesn't account for climate change. Inadequate data to better inform impacts of moving the location or use of a water right; creates uncertainty in buying/selling/leasing water rights. Antiquated regulatory/ management systems that do not reflect current science and discourage voluntary actions to help balance supply and demand through a market. Specifically: Rule of capture promotes over-pumping of groundwater instead of incentives for a long-term approach to using water for its best/highest use Inconsistent management of groundwater through districts based on political boundaries (which include some areas without management at all) and (sometimes limited) permit lengths that vary across districts or rule variations that introduce unfairness and uncertainty in water transactions Junior rights provision chills movement of surface water, limits the ability of some areas to meet needs Not accounting for groundwater/surface water interaction; impacts water availability Texans need pricing that reflects the value of water to promote greater conservation and more thoughtful approaches to water supply solutions.
k. Money. Low-cost Water Culture.
l. (1) Lack of water champions, (2) Lack of political will at local and regional levels to implement water strategies irrespective of "current" weather patterns. (3) Protectionism by utilities. (4) Funding and ability to service debt.

What would it take to influence or change these conditions or remove or reduce these obstacles?

a. Political change. Political will. More funding of science and better understanding of the interconnections of our water use/impacts to wildlife/fisheries/tourism/other economic factors. Need info to persuade....or a good, old fashioned crisis.

b. Analysis of what obstacles exist & what would have to change to help new/re-development. County authority to regulate growth/development. Strengthened groundwater conservation district/groundwater management area authority that is consistent with sustainability principles. Strong water conservation leadership at local and state levels (training? water caucus?).
c. Public education campaign on water challenges, including fish and wildlife flow needs and need for efficient use. Truly comprehensive planning and implementation approach with meaningful consideration of interests of those often-marginalized rate structures that cover true costs and ensure equity for low income water users Acknowledgment of impacts of climate change on demand and supply.
d. Education of issues and impacts of inaction.
e. Perhaps 3 to 4 pilots or proof-of-concept projects to overcome some of the previously mentioned obstacles. In showing success, it would be easier to implement state-wide. Looking at technologies used by other states and/or countries also can be helpful in demonstrating success elsewhere that can be applied within the state.
f. (1) Conservation (2) Increase increase/commitment to technology and infrastructure investment (3) Shifts in political landscape—additional regulatory requirements and legislative action (4) Develop shared values.
g. Encourage investment in desal by either subsidizing the cost or investing in better/cheaper technology. We are lucky to have talented and engaged leadership at the Texas Water Development Board. Educating them about the need for a fresh approach should not be too difficult. Of course, appropriations requests would have to be taken to the legislature. Having a plan in hand makes the task as easy as changing the kitty litter.
h. This will require significant changes in governance, particularly within the agricultural and industrial communities to reach data transparency for evaluate sustainable operations (where the withdrawals occur) not inclusive of mitigation measures.
i. A coalition of forward-thinking water advocates and business and community folks representing a range of interests from across the state that push for change
j. More money. Changing the culture through education about the value of water to themselves and other stakeholders.
k. (1) Increased awareness of the value of water. (2) Incentivized regulatory and funding structures to promote regionalization. (3) Water implementation with blinders on for wet years.

What would it take to accomplish/advance these changes? How do we get leverage to advance these changes?

a. Better regulation of water use in the state. Regulation to achieve sustainable water use going forward, given population growth. Funding to advance water

conservation and stream flow enhancing initiatives. Regulation and funding to help advance ag water use technology.

b. Proactive legislative agenda; leadership champions (at all levels)
c. Emergence of state leaders to champion comprehensive approach A broad sense of urgency--make sure public understands the challenge Recognition by water supply interests that fish and wildlife needs for water must be met, including through affirmative measures.
d. Legislative buy in and public education.
e. Funding seems to always be the issue. Rather than just exclusively focus on that, exploring partnerships and means of leveraging resources from private, philanthropic, government, etc. in making advances would be helpful. This process at the Meadows Center can be an important starting point in identifying key priority areas, likely stakeholders that would be invested in seeing changes/improvements, and commitments to aforementioned pilot projects are some considerations to discuss.
f. (1) Conservation/water use reduction targets/metrics (2) Additional funding (probably more grants to truly spur interest in new technology) (3) Continued conversations across political spectrum to find common ground (4) Education and outreach.
g. Legislative and University funding for research and State subsidies for desal projects.
h. First step is to create a new plan that encompasses a new vision. A new plan must be reasonable and enforced by good research. Politics should be minimized.
i. Awareness and voluntary implementation of stewardship measures, science and demonstration of sustainability as initial steps. Governance changes to obtain critical missing data (agricultural, industrial) and appropriate management strategies for sustainable operations rather than desired future conditions with allowable chronic depletion, etc.
j. Try to engage the business community and make it an economic development issue. Engage the Municipal League, Farm Bureau (??? unsure), Association of Counties - nonprofits and funders who have an interest in finding practical long-term solutions. Public awareness. Drought or flood. Be clear about the long-term goals, take advantage of opportunities, and otherwise approach change in chunks.
k. Drought. The inability to feed or clothe ourselves. Loss of rural communities.
l. Mandated implementation of items in previous response as a measure of compliance of public water suppliers, wholesalers of water, developers and users.

What data/science/information/studies/policy-analyses are we missing to advance this goal?

a. We need to understand the connections between water over use and wildlife population declines. Data on how communities (particularly towns with rivers/streams flowing through them) would be economically impacted if those resources “dried up.” We need analyses to determine what ACTUAL sustainability looks like in Texas, with regard to water use, so that we can make a

plan to get there. We need public surveys about where people are with regard to water conservation and how much they are willing to do...versus what may have to be "regulated" to start changing behavior. We have to adjust our "new normal" with regard to water use.

b. Analysis of development codes/ordinances/rules.
a. Agreed-upon criteria for fish and wildlife flows and assessment of likelihood of being met with status quo Analysis of fee structures for equitably allocating true costs Assessment of potential of future water efficiency measures likely to emerge Analysis of climate change impacts on water availability, water quality, flow levels, and demand Analysis of where Senate Bill 3 standards fall short of statutory goals.
c. There is not a clear knowledge of what happens to Texas if there is not enough water for all.
d. Good question. There are some relationships/trends we really don't understand too well. For example, what is the distribution of water wells, projected current/future water use, projected impacts to ground water levels/hydrology, and, how is all that likely to change in the next 50 years? This kind of information is needed to know what we are actually facing with an increasing Texas population.
e. I am still learning Texas water, so I am not sure what's missing, vs. what I simply don't know yet.
f. We need to study the impact of brackish groundwater production on fresh groundwater supplies, spring flow, and surface water supplies
g. I would suggest that we need much more data on our aquifers. How sustainable are they, how prolific are they? What will consumption look like in our cities and on our farms in the future? Will mining still be a big consumer? Take a realistic look at the SWP. Are all of those reservoirs going to be built? If not, what will replace them. There are many questions about the SWP that need an honest assessment.
h. No current agreement or uniform studies on what "sustainable" means within a given catchment or basin. We will need a governance change to manage by water balance within the catchment. This will drive the necessary changes and infrastructure to support that geography and population demographic.
i. Better data on actual (not estimated) water use Improved water models with improved temporal and spatial details Implementation plans for how each proposal for change (addressing the barriers) would work practically, informed by a coalition. Study results on the potential for greater use of ASR Greater climate change information available for planning purposes.
j. All of it.
k. (1) Better real time modeling. (2) Regulatory process that do not differentiate between surface water and groundwater regulation and ownership, (3) Predictable and reliable assessment of weather impacts on water supplies. (4) Political will to study, review and accept these findings leading to implementation of science and fact-based policy modifications.

What can you do to create the conditions that would set these forces in motion? What strategy could you use to propel that change?

a. Talk to legislators about funding research that can put some of these things in motion. Talk to Foundations about funding that as well. Work with universities to do research to advance our understanding of the issues, so that our legislators can act.
b. I can support research/analysis.
c. Help with sustained public outreach Can do analysis of shortcomings of Senate Bill 3 implementation Can help educate state leaders on the water challenge
d. Individuals need to become educated and in turn educate others.
e. To me, it seems we need to (1) identify those significant system drivers and likely outcomes regarding water, (2) demonstrate/illustrate those likely outcomes to key decision makers to make a convincing argument to implement these significant changes, (3) generate a public campaign to educate and instill a sense of urgency of now, and (4) implement strategies that likely will result in meaningful change and improvements.
f. (1e) Encourage including desal options in the Statewide water plan; (2e) encourage University and Texas Water Development Board investment in desal technology studies; (3e) encourage State funding in desal projects.
g. As stated earlier, develop an outline of a plan that the State could use for this purpose. But research is first, you must know what you are starting with.
h. Continue to drive the conversation and legislation for awareness, conservation, stewardship and sustainability through stakeholder engagement at the local, basin, county, state and federal level.
i. Start in the interim building a coalition, starting with Water Grand Challenge members and reaching out from there. Build on known legislative opportunities.
j. Participate in Water Grand Challenges.
k. (1) Be active in policy development processes. (2) Base your involvement on factual and not ideological basis. (3) Secure funding for such studies and for water value awareness.

Ensuring flows to sustain healthy ecosystems

Describe your goal for this challenge. What does success look like?

a. Texas finds a balance between surface water and groundwater demands to ensure adequate recharge to aquifers and adequate discharge to springs.
b. Development and implementation of an environmental flow regime for each river basin and any associated bay & estuary system in Texas that sustains populations of native fish and wildlife and plant species on an ongoing basis.

c. The total system (streams, rivers, bays and estuaries) are healthy and not adversely impacted by the future population. Success is no worsening of the current status and enhancing the health of current problem areas.
d. Enough stream flow to ensure healthy conditions for wildlife and people, to ensure the survival of our full breadth of biodiversity, to provide for healthy bays and estuaries that can thrive and sustain beautiful, functioning ecosystems. Goal: Majority of Texas comes to realize that healthy ecosystems are vital and that we must prioritize that in all we do.
e. Reach consensus on definition and metrics for "healthy ecosystems". Identify at what geopolitical (example Hydrologic Unit Code) level the criteria will be applied. Identify existing resources and available data to identify data gaps and provide for assignment of priority ecosystems.
f. Real protection (i.e. protected flows) of environmental flows based on science.
g. Because I feel strongly about the issue, my first critical success point would be recognition and accepted methodology by which the value of water for all uses, and in particular - for the environment is calculated and accepted. Second success would be predictable regulatory process that allows for these flows to be protected.
h. (1) Be active in policy development processes. (2) Base your involvement on factual and not ideological basis. (3) Secure funding for such studies and for water value awareness.
i. Every Texas watershed, bay, and estuary maintains self-sustaining populations of native flora and fauna.

How do you define reaching that goal successfully? Over what time frame?

a. Water availability models and groundwater availability models address the demands for recharge and discharge by 2030.
b. By 2030, any existing environmental flow regimes for river basins and associated bays are revisited and improved, regimes for other bay/basin areas are established, and effective strategies to meet those regimes are put into place.
c. Water quality standards are maintained...now.
d. Texas' elected leaders will prioritize and value environmental sustainability and enact policies and program, appropriate funds, and direct agencies to prioritize it as well. Not sure about time frame...might be doable in 10 years?
e. Consensus on definition and metrics for "healthy ecosystems" within 1 year. Existing resources, data gaps and initial priority ecosystems identified within 2 years.
f. State allowing surface-water rights to be bought and reserved for e-flows by 2030. State defining environmental-flow protection based on scientific minimums with a policy overlay to do more, decided wholly by locals by 2030. Purchase of surface-water rights to protect e-flows by 2040.
g. Within next 2 to 3 years, taking advantage of interim and regular session efforts at legislature.

h. I would define success as Texas having planning and management process that include environmental needs to be weighed among other uses. Would suggest aligning any success/planning timeline to the 50-year horizon.
i. By 2050 all native species within Texas watersheds, bays, and estuaries sufficiently thrive so none need be listed as threatened or endangered.

What are the obstacles to achieving that success? Who/or what is in the way? What conditions are preventing the realization of that success?

a. (1) We need more data on the impact of surface supplies on recharge and groundwater withdrawals on spring flow. (2) Property rights in groundwater appear to trump property rights in surface water.
b. (1) Some water suppliers continue to oppose adequate flow regimes; (2) Disagreements continue over how much data is needed to establish regimes. (3) Texas surface water law limits strategic options for strategies to meet flow regimes.
c. Flows are diminishing at critical times of replenishment due to the water needs of our growing population. People's needs must be met when that need exists. Generally, one cannot average water needs.
d. A variety of short-term, for-profit interests who prioritize financial gain over long-term environmental sustainability and ecosystem health (which actually benefits greater economy, public health, biodiversity long-term). Those interests have money and time to influence politics. Public is less engaged due to lack of time/money/interest to influence politics. Classic private wealth versus common wealth dilemma.
e. Consistent, representative studies to identify baseline conditions and base flows required. Appropriate governance, regulations, partnerships and funding to fill the data gaps and ensure minimum flows are met. Shared value and collective actions to maintain and improve the ecosystems.
f. (1) Existing surface-water right holders not wanting to protect environmental flows (2) Not being able to protect flows downstream for e-flows via bed and banks permits (3) Cost of buying surface-water rights (4) Policy (and politics) at Texas Commission in Environmental Quality overruling science
g. Prior appropriation system and any downstream user taking the water. As well as regulatory process that "requires" an actual diversion point for an environmental water right.
h. Planning and management processes do not recognize environmental needs. Water is fully appropriated in drought times when need is the greatest. Modeling is not detailed enough to predict when those needs may or may not be met. Current water permitting system doesn't protect dedicated flows downstream, undermining the effectiveness of obtaining a water right to dedicate flows to the environment. Surface and groundwater are managed separately, limiting the ability to tackle this issue holistically in parts of the state with significant interaction.

i. (1) State law and Texas Commission in Environmental Quality give water diversions for municipal, industrial, and agricultural uses far greater priority than maintaining healthy bay/estuary and in stream flows; (2) many people view water flowing to the Gulf as "wasted" water; (3) Texas groundwater management law does not sufficiently recognize the link between surface and groundwater (and limits recharge of rivers through groundwater pumping); (4) people fear "running out of water" and see more dams as the best/only solution to water supply; and (5) many people do not understand the great commercial value of recreation and fishing/shrimping/oystering in Texas waters.

What would it take to influence or change these conditions or remove or reduce these obstacles?

a. (1) More data and better models. (2) Put surface water rights owners on an equal footing with groundwater rights owners.
b. (1) Broader vision by water supplier leadership about the nature of their responsibilities; (2) Better understanding of flows in relation to target species; (3) Creation of incentives to pursue voluntary strategies for maintaining flow regimes.
c. When there is more than enough flow, store excess flows. Create various desal solutions for surface and underground water.
d. Continued engagement and education of lawmakers on environmental issues, their importance, and the science/data to back it up. Finding the right messengers to deliver this information in a way that will be understood and accepted. We need better public education and engagement on these issues (starting in school curriculum) to demand that these issues are in the forefront of our societal decision-making.
e. Awareness, proper governance and funding mechanisms to support the data collection, management, priority and implementation regarding the health of the ecosystems.
f. (a) Market-based water rights acquisitions; messaging that a healthy river a day keep the endangered species act away; leveraging the support of superior rightholders (riparian users) (b) Change state law to allow bed and banks to deliver water to bays and estuaries. (c) Developing state-funded acquisitions to incentivize private/philanthropic acquisitions; rainy day fund (d) Removing Texas Commission in Environmental Quality from the process (and having a science-based bottom line that policy can't supercede a la the Edwards Recovery Implementation Program process).
g. Legislative desire and mandate to revisit aspects of Senate Bill 3 (1997) and Texas Commission in Environmental Quality willingness to reopen rules. This will require increased efforts to raise awareness as to the value and benefit of water for the environment, ways to protect it, and where Senate Bill 3 fell short.
h. Changes to planning and management processes to incorporate environmental needs. More detailed modeling of surface water availability. New way to dedicate

and protect water for water the environment, comparable to a conservation easement. Manage surface and groundwater together in parts of the state with significant interaction.

i. (1) Educate Texans about cost-effectiveness of conservation versus new dams; (2) incentives for setting aside guaranteed in stream and bay/estuary flows for new dam projects (e.g., streamlined permitting); (3) educate Texans about economic value of rivers, bays and estuaries; (4) give in stream flows higher priority on all water rights permitting decisions; (5) better integrate surface and groundwater interaction in permitting decisions for groundwater pumping; and (6) incentives for current water right holders to set aside a portion of their water right for dedicated in stream flows.

What would it take to accomplish/advance these changes? How do we get leverage to advance these changes?

a. (1) More funding to Texas Water Development Board to improve models; more reporting to provide data for those models. (2) Although there may be a way through legislation (giving surface water rights holders standing in groundwater permit contested cases and vice versa) the real answers will come through litigation.
b. (1) Appointment of new members of river authority and other water supplier boards; Enhanced state appropriations and other funding for (2) ongoing flow studies and (3) financial support for reservations of water to meet flow regimes.
c. It will take education and money and the knowledge of the cost to the State if we take no action.
d. Political will. Elect officials who will prioritize this stuff; have a public that will demand these issues be brought to the forefront.
e. Would appear to be a great opportunity to expand the citizen scientists of the Stream Team to champion the baseline and monitor the future conditions of the ecosystems within the targeted area.
f. (1) Market-based solutions instead of legislative decree/involuntary cutbacks; leveraging support of riparian users, outdoorsfolk, and fisheries (2) Coalition building to change state law (3) Coalition building to develop state incentives (4) Coalition building to change the environmental-flow process.
g. I would recommend a coalition of philanthropic, former regulatory/legislative policy influencers, private land/water right holder(s) and business interests advance the need for this type action.
h. Find a way to create or reserve more water and dedicate it to the environment (Aquifer storage and recovery? Protected downstream permits? More robust water market?) Watermasters in more river basins to monitor environmental needs/conditions and protect/enforce downstream flows.
i. (1) Statewide education campaign with Texas celebrities (similar to "Don't Mess With Texas") touting the value (cultural and economic) of healthy rivers, bays, and estuaries, as well as benefits of water conservation; (2) legislation to adjust

surface and ground water permitting requirements, as well as water rights set asides; (3) beef up water conservation education requirements (and resources) for every municipal water supplier in Texas; (4) require public education curriculum for grades 1 through 12 that emphasizes benefits of water conservation, describes river and bay ecology, and describes water needs of each part of the state.

What data/science/information/studies/policy-analyses are we missing to advance this goal?

a. We need more study of recharge numbers and better data on groundwater withdrawals.
b. We need more studies to demonstrate conclusively the various relationships between flows and the maintenance of healthy populations of fish, wildlife, and plant species and to verify the effectiveness of potential strategies to meet flow regimes.
c. We know what to do. We must create the political will to do it.
d. Need easily understood information on what Texas has, what is has to gain and what it has to lose, if we get this wrong. If we cannot get adequate stream flow as a priority in our public policy, there will certainly be repercussions.
e. The data gap analyses will follow the consensus on definition. Policy and governance changes between the existing river authorities, groundwater conservation districts, Texas Commission in Environmental Quality, Texas Water Development Board, Railroad Commission, etc. All have current programs that effect the health of the ecosystems and base flow availability.
f. (1) Policy/economics review of the benefits of protecting environmental-flows (2) Policy analysis of the pros and cons of bed and banks to the coast how statute can be changed to achieve this goal (3) Policy analysis on the mechanisms and cost of buying surface-water rights, impacts to other right holders, and sources of funds for purchasing water rights. (4) Policy analysis of what happened last time and what a more science-informed process could look like and what its implications could be to surface water (based on the current science team recommendations)
g. The impact of the recommended flow regimes versus what was adopted in rule would be of benefit. Impact to the environment and economic impact to the state.
h. More detailed modeling of conditions to inform permitting. Policy analysis of how to adapt systems to best ensure protection of water for the environment downstream. Policy analysis of how to best manage surface and groundwater together.
i. (1) We need reliable/objective economic data on the value of healthy rivers/bays/estuaries (tourism, recreation, commercial fishing, etc.); (2) we need reliable data on how much river flow is reduced through groundwater pumping infall parts of the state; (3) we need hard economic data on the savings from water conservation versus new dam construction; (4) we need analysis of economic incentive possibilities for conserving water and setting water aside for in stream flows.

What can you do to create the conditions that would set these forces in motion? What strategy could you use to propel that change?

a. We can support funding for Texas Water Development Board.
b. We can identify and promote leaders for river authorities and other boards who take a broad view of water mgmt. We can work to educate state legislators and other decision-makers and opinion leaders on the need for more aggressive action and funding for environmental flows.
c. Educate the public at the grass roots level (grade school) about the importance of maintaining flows (healthy conditions) into our water ways.
d. Work to educate lawmakers. Try to develop information and tools to deliver information about these issues that is compelling and tells a story. Partner and collaborate with other groups to do something bigger to really push on these issues.
e. Continue to support the Alliance for Water Stewardship certification which includes focus and collective action to create shared value in the catchments and communities where we operate. Continue to support awareness efforts, the Water Grand Challenges and education of future environmental scientists.
f. Could assist with policy papers and analysis and informing coalitions.
g. Promote the need and facilitate the discussions and recognition of needed additional work as recommend above.
h. Joint funding of policy analyses, visualizations, etc to clearly articulate the problem to policymakers. Once you have a proposed recommendation, determine who will be most impacted and talk to them/try to compromise ahead of time.
i. (1) We can help fund studies on economic impacts of these issues; (2) we can expand our group to include well known figures (non-water people) from around the state to help promote our proposals at the legislature and in the media; (3) we can host meetings of stakeholders from the coast, water recreation/fishing interests, and water managers from major metropolitan areas to share concerns and promote our goals.

Sustainably managing surface water and groundwater resources

Describe your goal for this challenge. What does success look like?

a. Surface water and groundwater are managed sustainably in a way that protects both water rights and the environment.
b. The State of Texas manages surface water and groundwater as connected resources to meet the needs of both people and the environment on an ongoing basis.
c. To me this means….That there are enough flows in our rivers to provide a healthy ecosystem for aquatic life and bays and estuaries – that we do not have issues with high salinity levels due to low flow – that rivers are entitled to reach the

coast. That we do not pump groundwater to the point that artesian pressure is reduced, and springs stop flowing. That for aquifers with major connections to surface water, we only pump recharge.

d. The State of Texas regulates surface-water and groundwater in a fully integrated way that recognizes their interconnection.
e. Texas sustainably manages its water resources to ensure adequate water to support future needs.
f. Not sure we can actually attain this given how we have managed. allocated and developed our current sources of water. Coupled with documented demands for new sources of water and impacts from a changing climate, perhaps our best shot at sustainable management of water will be reduction of current consumptive uses (conservation) and how we sustainably develop new sources - preferably drought proof sources. Proper valuation of water is also needed. Water is currently undervalued.

How do you define reaching that goal successfully? Over what time frame?

a. For surface water, it's protecting surfaced water for environmental flows. For groundwater, it's either changing the Rule of Capture or the Texas Water Code to require the protection of groundwater discharge to surface water. Within 10 years for surface water; within 30 years for groundwater.
b. By 2025, the Texas Legislature adopts legislation recognizing the connections between surface water and groundwater and adapting management and regulations of these water sources to reflect those connections and require maintenance of those resources to meet environmental water needs and reasonable public water needs.
c. By the time my children are adults. [Hope they aren't 17!... -editor]
d. By 2035 Texas water laws will fully recognize the interconnection of surface-water and groundwater and will require that approval of any use, diversion, or withdrawal of one category of water not have an unduly adverse effect on the other category of water.
e. Measure based on if we demonstrate an existing water need in the current decade through water planning process and have reasonable/practical strategies to meet next 50 years of need. Water management entities operate under a legal framework that coordinates water management and related impacts across all water. Water management entities use data and science in considering impacts across all water to inform decision making.
f. As previously stated, not sure we can achieve this goal on existing developed sources of water, but perhaps in new ones. Having said that, a refocused view on how the environment has been impacted by having neglected water allocation to the same could lead to a more sustainable use of water. In other words, we should conserve water as a means to improve environmental flow protection or preservation and not simply so we can have more during drought.

What are the obstacles to achieving that success? Who/or what is in the way? What conditions are preventing the realization of that success?

a. Surface water: reluctance to provide real protection because it will reduce firm yields; existing permit holders and politics. Groundwater: reluctance to reducing groundwater use; economic impacts; concerns over property rights.
b. Existing management statutes, institutions, and mind-sets that treat surface water and groundwater separately, that lock in water rights, and that do not provide adequate protections for environmental water needs. Those who benefit from the existing situation are in the way of change. The tendency for everyone to protect their existing turf stands in the way of moving toward a situation that prioritizes the larger good over individual interests.
c. Rivers are over-permitted/people are diverting too much water. Lack of local data and science. Groundwater districts are afraid to deny or reduce permits—they are not sure to what extent they can regulate. Many groundwater districts do not have sustainable management goals.
d. Surface and groundwater interconnection is not fully documented across all basins and aquifers; the general public is not well educated about the relationship of these two categories of water; Texas manages most groundwater by way of balkanized districts drawn/designed on political boundaries rather than aquifer or surface-water basin boundaries; the Rule of Capture still holds in those parts of the state outside of groundwater management districts; regulatory approval of surface-water permits and groundwater withdrawals take little, if any, account of the effects on the other category of water.
e. Fragmented water governance and groundwater management in particular. Inconsistent approaches over the same/shared water without science-based explanations of differences. Fragmented legal framework: In parts of the state, surface and groundwater have significant interaction, but are managed separately. The Texas Water Development Board provides groundwater conservation districts with unbalanced information, providing total estimated recoverable storage, but not a figure of what sustainable pumping looks like. Not everyone believes sustainability should be the goal re: groundwater, so no requirement to manage to sustainability. No accountability for managing sustainability or consistent way to measure this among water management entities. Need compiled data to understand/ measure our progress toward sustainability. Texas isn't counting environmental needs as a real need in planning and management processes.
f. Value of water (undervalued). Fixed cost needed to be recovered for developed sources. Desire to make money from sales of water—particularly at utility levels. Private ownership of water. Lack of enforcement to recapture and reallocate water, including for the environment.

What would it take to influence or change these conditions or remove or reduce these obstacles?

a. Surface water: Endangered species issues; lawsuits; changes to statute Groundwater: Lawsuit overthrowing Rule of Capture; requiring groundwater pumping to limit impacts on surface water.
b. (1) A concerted communications effort to demonstrate how the failure to treat surface water and groundwater as separate resources can negatively affect surface water rights holders and groundwater permit holders, (2) more scientific validation of the potential impacts of reduced environmental flows and groundwater levels on species habitat and species population viability, (3) financial incentives for surface water rights holders and groundwater permit holders to dedicate a portion of their rights to water trusts or other mechanisms to meet environmental water needs and species maintenance.

a. Requirement that environmental flows be considered in all existing permits; Incentives for permittees to return more flows to rivers. Local, site specific science is needed to understand groundwater and surface water connections in river basins. More monitoring, dye tracing, groundwater/surface modeling. Groundwater conservation district funding to compensate for takings. Clarification in the law that a groundwater conservation district can reduce a permit and it is not a taking. Landowners can conserve groundwater in place. - Permitting caps. Desired future conditions that are tied to spring flow.
b. Comprehensive, statewide scientific studies that document the type and degree of inter-relationships between surface-water and groundwater; public education campaign to help lay people understand the interconnectedness of water; change groundwater management districts so that boundaries are based upon water resource considerations (aquifers, river basins) rather than political boundaries.
c. Overhaul of legal framework to provide for holistic management of surface and groundwater in areas of significant interaction. Consideration of the environment's needs in water management and planning. Management of groundwater on an aquifer-wide basis. Promotion of integrated water management approaches at the local level. Clarity on state rules for reuse and clear data/understanding of downstream impacts of reuse. New mechanism for protecting source water (land) to promote sustainable future water sources. Accountability for water management entities to manage sustainably. Consistent measure (locally and statewide) of progress toward sustainability.

What would it take to accomplish/advance these changes? How do we get leverage to advance these changes?

a. (1) philanthropic funding for a communications campaign on the interconnection between surface water and groundwater, (2) legislative funding to Texas Water Development Board, Texas Parks and Wildlife Department, and university research institutions for additional research on the potential impacts of reduced

environmental water needs and reduced groundwater levels, and (3) legislative funding for incentives for the dedication of surface water rights and groundwater permits for environmental water needs and maintenance of species.

b. Legislation to make environmental flows a requirement on existing permits; Funding to incentivize water right donations. Funding for local groundwater conservation districts, Texas Commission in Environmental Quality and River Authorities to develop needed data and models. The right lawsuit. A groundwater conservation district that reduces or denies a permit and this decision is upheld; funding for takings lawsuits. Legislation establishing caps on groundwater permits/production; methods of measuring Desired future conditions.
c. State funding for scientific studies; a 21st century version of the San Antonio catfish farm fiasco (i.e., a highly visible and understandable waters/withdrawal situation that evokes justifiable outrage by the general public); state and foundation funding for public education campaign.
d. Coalitions; better education.
e. Solutions will require market-based incentives for existing sources. Policy makers will need to specifically make sustainable development a goal/requirement for new source development. Caution that this will be viewed by some as antidevelopment and land use protection/intervention. So a clear understanding that sustainability transcends planning horizons will be required.

What data/science/information/studies/policy-analyses are we missing to advance this goal?

a. Surface water: an analysis of how far we have to go to achieve the science goals in Senate Bill 3; policy study on options to advance e-flow protections. Groundwater: How far are we managing sustainably? What are other options to the Rule of Capture.
b. This is really already covered in the responses above.
c. We need local, site specific science to better understand groundwater and surface water interactions.
d. See above re: scientific studies of surface-water/aquifer interaction and effect of withdrawals.
e. Statewide compiled data on groundwater use and permits. Statewide compiled data on variations in groundwater management approaches (permit rules, lengths, allocations). Definition and identification of areas of significant groundwater/surface water interaction and policy analysis of alternative regulatory/management structures? Analysis of impact of reuse on downstream water availability. Identification of any state financial program barriers to integrated water approaches.
f. Studies identifying how rapidly we are depleting sources of water, or those are declining by other means, including climate change. Mandated policy, similar to subsidence areas requiring development of new sources of water (this time sustainable) and a move away from reliance on singular existing source(s).

What can you do to create the conditions that would set these forces in motion? What strategy could you use to propel that change?

a. We can assemble a coalition of organizations to develop a common agenda to promote awareness of the connections between surface water and ground water and to highlight the problems caused by the lack of existing laws and institutions to reflect those connections.
b. Engage entities with the financial ability and desire to fund water right donations. Analyze budgets of groundwater conservation districts and science needs/data gaps. Educate groundwater conservation districts on takings law and extent of their authority; research possible funding options for takings suits with stakeholders. Conduct a pilot study/research project/model on the results of capping permits in the Trinity Aquifer in Hays County. What would it cost to so this? Who would be most impacted?
c. Collaborative funding for neutral organizations to research data or policy from an objective standpoint.
d. Participation in policy discussions and call for policy advancement on these critical issues.

Ensuring adequate investment in water, infrastructure, and conservation to meet demands

Describe your goal for this challenge. What does success look like?

a. Dollar investments (appropriations and legislation) in these issues that can have a meaningful impact on a large scale, including funding of SCIENCE to actually understand the needs and resources available to meet demand in a sustainable way.
b. Shoot! Well I guess I answered all of this in the previous section. Sorry!
c. All water needs, including water for fish and wildlife, are identified with implementation plan for meeting them that includes cost projections for water supplies, conservation measures, and infrastructure.
d. The goal is for public officials to understand the need for investment by learning of the consequences of not making the investment.
e. I will have to submit this half of the survey later. Robert's idea of doing this in words in now making sense!
f. The primary areas where there is inadequate investment are rural areas. Success looks like planning that protects rural supplies and planning to meet rural demand.
g. I'm sure there is a lot to do here, but my priority would be to make it easier to use the tools that the state has to implement new techniques such as drip irrigation and municipal conservation strategies. The State has one hand tied behind it's back when it comes to helping with conservation activities. Also, there needs to be more grant monies in the overall system. Some worthy projects do not lend themselves to borrowed funds. (Get it? Lend themselves) [Ha! -editor]

h. Committed projects and funding for projects within a specific catchment or basin to achieve the 50 percent excess capacity 10 years in advance of the anticipated need for the geography and demographics.
i. Same goal: Texas can balance water demands and water supply in the face of booming population growth and dramatic weather variability. Infrastructure and conservation seem like potential solutions to Goal #1.
j. Make water sexy inviting proper valuation and public and private investment in sustainable water strategies (development, conservation, conveyance, environmental protection, etc.).

How do you define reaching that goal successfully? Over what time frame?

a. Investing enough money in science as well as the solutions that the best research dictates. Ensuring sustainable use or use that meets the needs of today's residents/ ecosystems, while not threatening future generation's ability to meet their/those needs.
b. Comprehensive needs assessment by 2023. Implementation plan with infrastructure needs and funding approach by 2026.
c. Investment is made before limitations occur.
d. More emphasis on planning for rural supplies during the upcoming Statewide Water Plan would be a success.
e. Find examples of how new rules would enhance the quicker implementation of new methods and technologies.
f. Timelines and glide paths for major infrastructure projects are quite long. Projects to be committed 10 to 15 years in advance with construction completed and capacities demonstrated 5 to 10 years in advance.
g. Same measure: Zero projected water need in a drought of record conditions in the current decade.
h. Over the next decade, incentivize and reward water strategy implementation that demonstrates sustainable and efficient use of water and is coupled with private capital investment that leverages public funding—thus increasing rate of project implementation and extending capacity of existing public funding sources.

What are the obstacles to achieving that success? Who/or what is in the way? What conditions are preventing the realization of that success?

a. Political will. Lack of science-based decision making. Changing where our state makes investments. Need for increased corporate taxation to accomplish these goals and a current lack of willingness to do that.
b. Lack of funding to undertake the required analyses. Lack of financial incentives for water suppliers to invest aggressively in conservation. Lack of shared goals for a comprehensive approach.
c. Competition for financial resources.
d. Large demand centers (big cities) dominate the planning process. Market forces encourage shifting water from rural demand to higher-paying municipal demand.

e. Lawyers
f. Related to Challenge No. 1. We need to have sufficient science and studies completed to understand the actual water balance within a catchment or basin compared to its demands. Desired future conditions with continued chronic depletion is not a sustainable solution. Appropriate funding public and or private may not be available to achieve the goal.
g. Texans need pricing that reflects the value of water to promote greater conservation and more thoughtful approaches to water supply solutions Financial limitations for cities and small water systems to make infrastructure improvements and meet growing needs Too many small water systems without financial and other means to maintain or build infrastructure.
h. Local politics that want to "control" water. Regulatory processes that are based on singular project delivery mechanisms that reward inefficient public procurement with cost overruns and lack of efforts to reduce development risk.

What would it take to influence or change these conditions or remove or reduce these obstacles?

a. Shifting balance in the legislature. Political pressure. Education of existing lawmakers. Working with corporate partners, who are also interested in advancing these goals, to help influence and advocate for government action. (pie in the sky, granted...).
b. Knowing the consequences of not making the investment.
c. Require an emphasis on planning and protecting rural areas by encouraging alternative supplies for the large demand centers.
d. Overrule the lawyers.
e. Governance modified to address the catchment and basin rather than geopolitical boundary.
f. Sufficient availability of low-cost water financing and subsidies for small systems with severe violations that threaten public health. Additional private capital Greater technical and managerial assistance to help small systems find resources Stricter financial scrutiny on new and existing small water systems and to encourage consolidation of small systems.
g. Conditioned public funding for implementing projects to a requirement that risk transference and alternative delivery mechanisms for needed water projects are properly evaluated including total project and life cycle costs.

What would it take to accomplish/advance these changes? How do we get leverage to advance these changes?

a. Public education on issues and importance. Or most likely, a water crisis would force a change in behavior. Advances in technology would also help and more funding would be needed for that also. Texas has to invest real money in this and start regulating water as the essential, public commodity that it is....not as someone's personal property.

b. Education of public officials.
c. Texas Water Development Board could emphasize the need to address rural water shortages.
d. New rules and regulations. Perhaps new laws in some cases.
e. Alignment with other leading indicators of the Texas economy will require sufficient water resources to drive growth. Possible alignment with Economic Development Corporation partnerships to promote conservation and investment.
f. Promote use of public-private partnerships to bridge the gap in water infrastructure financing needs. Talk to the business community/private investors and Texas Water Development Board.

What data/science/information/studies/policy-analyses are we missing to advance this goal?

a. Analysis of what the true long-term needs are in balance with expected/actual population growth. Willingness to increase funding for science for technological advancement. Once we know what we need to do to achieve this -based in science and having data to back it up- then we can move to policy advancement.
b. An economic impact study such as San Antonio Water System did but for the entire State.
c. A study of the economic impact of the state water plan on rural Texas might help.
d. It's really a matter of legal impediments. And just because we have those impediments today does not mean that they cannot be changed.
e. Additional data transparency needed from the agricultural and industrial users to generate accurate water balance to identify true additional capacity requirements to ensure sustainability.
f. Figure out how we could reshape requirements and incentives within state water financing programs to promote greater private capital Survey water systems (capture feedback by size) on the greatest impediments to infrastructure improvements.
g. Delayed implementation impacts analysis. Risk transference valuation methodologies to incentivize private capital infusion. Analysis of public vs private capital procurement processes that take into account life cycle costs.

What can you do to create the conditions that would set these forces in motion? What strategy could you use to propel that change?

a. Work with colleagues to support these efforts in public sphere. Work with and talk with legislators to find champions.
b. Obtain $1 million in grant funds to have the Meadows Center with Texas Tech, A&M, and the University of Texas perform such an analysis.
c. Encourage Legislative appropriation to study the water plan's impact on rural Texas.
d. Educate the Texas Water Development Board and the Legislature of the need for change to meet the needs of the future. We are simply restrained by antiquated red tape and we can change it if we want to.

e. Continued stakeholder engagement at all levels to drive the conversation around conservation, stewardship and sustainability to change the outlook.
f. Coalition-build.
g. Highlight "cost" to Texas and Texans of failure to implement sustainable water policies and timely implementation risk transferred delivery of needed water projects.

Fostering public awareness of water issues to advance conservation and investment in sustainable water management

Describe your goal for this challenge. What does success look like?

a. A public educated on water.
b. Broad-based understanding of Texas' key water challenges by policymakers & key stakeholders (public, business community).
c. Similar to San Antonio—have Texans from all corners of the state have a clear understanding of their source(s) of water, how we each impact its use/depletion and what we can all do to better preserve our limited resource—particularly when compared with high cost of new development of water.

How do you define reaching that goal successfully? Over what time frame?

a. A public engaged in water; next 20 years (but probably perpetual).
b. Diverse participation in development of water policy (geographically, water use groups, business, environment, public, politically, culturally).
c. This goal should be set to be well established if not achieved by 2030.

What are the obstacles to achieving that success? Who/or what is in the way? What conditions are preventing the realization of that success?

a. It's a busy world and water, for the most part is 99.9% reliable--hard to hold the public's attention. The hydro-illogical cycle: people care about water when their behavior is modified by it.
b. Very technical subject matter. Lack of objective materials describing key water challenges (without slant from interest groups).
c. Complacency. Texans expect water availability all the time without questioning where it comes from, what it takes to develop it and treat it for desired use and how we are depleting these sources.

What would it take to influence or change these conditions or remove or reduce these obstacles?

a. Take advantage when the attention door is open! Continue to put stories out there on water supplies, sustainability, and security.

b. Nonpartisan group produces one or two pagers that highlight key water challenges and data visualizations to display takeaways of problems, where appropriate. Water caucus at Legislature; public education campaigns (must be limited to key messages).
c. Mindset change in value proposition from what we pay for water for our use to water's value for all uses including preservation of resource and environmental concerns.

What would it take to accomplish/advance these changes? How do we get leverage to advance these changes?

a. A broad strategy from pre-K to grey on getting the word out.
b. Partnerships from nonpartisan groups - Potentially philanthropic funding to support.
c. See response above regarding influence factors. We get leverage by changing the trajectory of the discussion to the influence factors.

What data/science/information/studies/policy-analyses are we missing to advance this goal?

a. Teaching and communication approaches to be the most effective. Using Facebook/Google diagnostics to pinpoint certain users. Employing Water IQ the way it was intended.
b. Polling on what Texans get and don't get/where to target efforts.
c. Value of water studies. Data that identifies areas where water is most undervalued or where a use has not been recognized and thus by ignoring it use we have no concept of its value/impact. Policy discussion on these factors.

What can you do to create the conditions that would set these forces in motion? What strategy could you use to propel that change?

a. Nonpartisan group produces one or two pagers that highlight key water challenges and data visualizations to display takeaways of problems, where appropriate. Water caucus - Public education campaigns (must be limited to key messages).
b. Call for action in both discussion of need to properly value water, invest in required studies/science development and policy changes that call for the same.

Protecting water quality to meet human and environmental needs

Describe your goal for this challenge. What does success look like?

a. Texans are able to fish and swim in bodies of surface water that were historically available for contact recreation with the exception of waters that are now industrial in nature (for example, the Houston Ship Channel; but these waters adjacent to industrial operations are clean enough to support vibrant fish and wildlife habitat.

b. Clean, healthy, life-rich waters in all Texas creeks, rivers, lakes and coasts. Ensure thriving landscapes and cityscapes that will produce/deliver clean water to our waterways.
c. Water should be non-polluted to the point that it is healthy to use the water. Success is healthy water ways.
a. Improved awareness and best management practices for land application and effluent discharge, particularly with respect to agricultural and emerging contaminants (nitrate, PFAS [per- and polyfluoroalkyl substances], perchlorates, etc.). Development of economical, rapid assessment tools which can be deployed at the local farm or business level (which are largely exempt or unregulated at this time).
b. Note that comments here are focused on wastewater discharge issues in the Hill Country - Wastewater over karst terrains is treated to a level that is protective of human and environmental health and the aesthetic beauty of limestone springs and rivers.
c. Demonstrate reports, data, findings, and actual field evidence that our water sources are not being degraded as it relates to water quality by human activities and naturally occurring events. That anti-degradation as called for in Clean Water Act is actually working!
d. Texas has clean, safe water for the public and environment.
e. All Texas waters are fishable and swimmable.

How do you define reaching that goal successfully? Over what time frame?

a. By 2040 all rivers and streams with the exception of those classified for industrial use based upon existing uses have water quality standards that are classified for attainment and maintenance of contact recreation, and all stream segments classified for industrial use (based on currently existing uses) have water quality standards that support the maintenance of at least intermediate and preferably high quality aquatic habitat.
b. Waters that meet/exceed Clean Water Act standards all the time, everywhere. Though, with long standing issues with agricultural run-off, urban draining and waste-water issues, and a variety of non-point pollution concerns, this is a long-term goal.
c. Water can be used for the benefit of people and the environment without massive clean up....now.
d. Reduced contaminant discharge to surface-water and groundwater sources over the next 10 years.
e. Elevated standards for wastewater treatment in karst terrain by 2025.
f. Marked reductions within 303d list evaluation cycles of impaired bodies of water—particularly those that are human caused impacts. Marked reductions in my mind would be >15-20% from cycle to cycle.
g. Goal = 100% of Texans have access to clean, safe drinking water, improved sanitation/wastewater systems, and water bodies are fishable and swimmable.

h. By 2050, all Texas waters meet the U.S. Environmental Protection Agency water quality criteria for being fishable and swimmable.

What are the obstacles to achieving that success? Who/or what is in the way? What conditions are preventing the realization of that success?

a. (1) A presumption by Texas Commission in Environmental Quality & others that if a stream is currently not being used for contact recreation because it is polluted —even though historically it was used for contact recreation—that stream should not receive the highest level of water quality protection through the setting of the most protective water quality standards for bacterial pollution. (2) A stance by many but not all wastewater dischargers that they should not have to meet the highest level of wastewater treatment nor seek alternatives to wastewater discharge because the costs are "too high;" (3) the lack of broad public and nonprofit participation in the surface water quality standard setting process in Texas.
b. Lack of enforcement of regulations (and funds/staff to do so); lack of effective regulations; lack of understanding of how seemingly small individual impacts join together to create disastrous collective results for water quality and ecosystems (and that those things will in turn negatively impact our overall quality of life, our economy).
c. As in the first part of the survey, a lack of knowledge of the cost of not having acceptable water quality is a hindrance from maintaining good water quality.
d. Appropriate governance and funding for economical methods to monitor irrigation and rapid assessment technologies for data collection.
e. (1) State resistance to boutiquing water-quality standards to different geographies (2) Downstream water users concerned about lower return flows from land application (3) Costs of additional treatment.
f. Loss of natural habitat that assists in water protection and quality restoration. Regulatory processes that fail. Lack of investment in required protective and compliance measures.
g. Afford-ability of properly maintained drinking water and wastewater systems, either poor/aging infrastructure due to low population density/high costs, access to services at all, or lack of clean water supply. Aging storm and flood infrastructure that overflows or is inadequate to handle needs.
h. (1) Nonpoint source pollution is lightly regulated (at best) by the state and the U.S. Environmental Protection Agency; (2) Texas Commission in Environmental Quality is reluctant to impose strong waste discharge permit requirements; (3) non-point source pollution is not well understood by members of the public; (4) water right permits allow such significant diversions from Texas streams that wastewater discharges often make up the bulk of flow in many watersheds, especially during summer months; and (5) urban dwellers often do not make the connection between fertilizer/pesticide runoff from lawns and receiving waters downstream (at the end of the drainage pipe).

What would it take to influence or change these conditions or remove or reduce these obstacles?

a. (1) a state legislative directive that Texas Commission in Environmental Quality set surface water quality standards that are protective enough to assure that all Texas rivers and streams - with the exception of streams currently used for industrial purposes - are available for contact recreation and for streams currently used for industrial purposes are sufficiently stringent to maintain healthy populations of fish, wildlife, and plant species.
b. Political will to make this a priority and to hold folks accountable. Like I recently saw on a bumper sticker: Make America Green Again.
c. Education and money.
d. A change of mindset through information and awareness campaigns or more stringent regulation.
e. (1) State and federal law requiring higher water-quality standards for karst terraine; education on why karst terrains are different than non-karst terrain on water quality concerns; personal stories about why this is important (2) Develop treatment standards that allow for surface discharge (3) Economic analysis of costs and benefits of additional treatment.
f. Recognition that water quality degradation results in additional loss of available water supply and increased costs to treat water for human consumption and the environment as compared to costs to actually prevent the impacts.
g. Additional grant funding for small, rural systems. Increased requirements for approval of new small systems and encouragement of small water system consolidation. Continued Economically Distressed Areas Program funding. Requirements for capital improvement/asset management plans and minimum requirements for investment in maintenance/operations for water systems. Better flood planning and financing options.
h. (1) Strengthen permitting requirements for waste discharges to Texas waters; (2) educate citizens about the connections between their daily activities and water quality impacts (e.g., pesticide/herbicide/fertilizer application, antibiotics flushed down toilet, etc.); (3) better assess the relative impacts of point and non-point source pollutants on Texas waters - which causes what kind of adverse impacts and to what degree; (4) make it easier for affected citizens and public groups to protest discharge permits and become parties to contested case hearings at Texas Commission in Environmental Quality; (5) provide incentives for agriculture to minimize non-point source pollution.

What would it take to accomplish/advance these changes? How do we get leverage to advance these changes?

a. (1) a state legislative majority which actually made environmental protection a higher priority than support for polluting industries; (2) an engaged, informed public putting pressure on policymakers to improve water quality; and (3) an

aggressive and pro-active U.S. Environmental Protection Agency to require Texas Commission in Environmental Quality to set stringent surface water quality standards.

b. Build trust with private landowners so that we can effectively educate on impacts of practices or encourage better ways of doing things. We need political needles to move in the direction of environmental concern and action.
c. Water quantity and quality are joined at the hip.
d. Many of these contaminant issues are going through the courts currently. The 303(d) impaired list provides a minimum baseline but largely is used to develop industrial permit limitations and total maximum daily load which do not address the actual point and non-point sources of the contaminants into the watershed.
e. (1) Lobbying!, assessment of why karst is different; solicitation and collection of stories (2) Evaluate different levels of treatment (and associated costs) for surface discharge.
f. Use some SWIFT funding? Form coalitions to approach the legislature?
g. (1) Legislation to strengthen water quality discharge permit requirements and to loosen limits on public participation as parties in contested case hearings; (2) funding for studies to assess current water quality impacts from point and non-point sources in Texas (not funded by dischargers); (3) foundation funding for statewide education efforts about the state of Texas water quality and how to improve it; (4) "Don't Mess With Texas Water" campaign; (5) funding for studies to demonstrate cost savings from agricultural practices that minimize pesticide/herbicide use; (6) promotion of organic/"natural" foods (that have not been subject to herbicides and pesticides) as healthy for the consumer and Texas waters.

What data/science/information/studies/policy-analyses are we missing to advance this goal?

a. Scientific studies that clearly show what is needed to restore currently polluted streams to water quality standards that would allow and protect human contact recreation; strategies to restore Texas rivers and streams to those conditions.
b. I am not sure, but I would imagine much of the data is there, perhaps not where advocates can easily find it and not communicated in a way that legislators and the public can understand enough to be compelled to take action.
c. same as above
d. We need economical, rapid assessment tools that can provide the appropriate level of data. Agricultural irrigation and effluent monitoring is limited to only the largest operators. We need to be able to address and mitigate the contaminants at the source.
e. A review of what other states have done in karst terrains (for example, Florida has different standards for pristine stream areas); an assessment of risks and concerns of wastewater discharge (both stream and land) on water quality; solicitation (and water sampling?) of affected water wells; scientific studies on in-danger streams to assess pre and post conditions.

f. Aside perhaps from the recommended comparison of cost to treat versus cost of impact due to degradation of water quality, I think we have the data we need. Making it accessible and relatable to the public is a different matter.
g. Mapping/visualization of data to prove the problem. For example, map the most common or worst infrastructure-related drinking water or wastewater violations (rural v. urban? By region? By size? etc.). Mapping of water body impairments by cause of impairment and suspected sources? Flood mapping tools for the state and local regions to make informed decisions on priority investments (monitor implementation of flood legislation).
h. (1) Studies that identify and differentiate between point and non-point source pollution sources in each Texas watershed; (2) studies to demonstrate cost savings/economic benefits from agricultural practices that minimize pesticide/herbicide use; (3) studies that document cost savings of innovative water quality efforts by cities, industry, and agriculture.

What can you do to create the conditions that would set these forces in motion? What strategy could you use to propel that change?

a. Support and work to elect state legislative candidates who favor the environment over the interests of polluting industries and other polluters. Support and work for state legislative appropriations and other funding to to make a compelling case for government action to clean up polluted stream. mobilize grassroots supporters to demonstrate the public support healthier water quality in streams and rivers.
b. Perhaps we need strategic partnerships with universities/institutes and non-governmental organizations and communications experts to advance shared goals and research findings in a compelling way that people can understand. Foundation and public funding to support. Look to what is happening in Houston post-Harvey as an example.
c. same as above in flows.
d. Continue to support the Alliance for Water Stewardship certification which includes focus and collective action to create shared value in the catchments and communities where we operate. Continue to support awareness efforts, the Water Grand Challenges and education of future environmental scientists.
e. Assist with studies.
f. More than willing to advance discussions on these topics—particularly as it relates to a public outreach campaign that would incentivize or create the political and regulatory will to propel the needed changes. Texas 2036 efforts certainly come to mind as a great example of a path forward.
g. Joint funding of studies, visualizations, one-pagers to clearly articulate the problem to policymakers. Once you have a proposed recommendation, determine who will be most impacted and talk to them/try to compromise ahead of time.
h. (1) Create quarterly top ten list of cities/farms/businesses that practice outstanding/innovative water quality measures (and publicize it widely); (2) create similar quarterly list of entities causing water quality problems (grossly

violating discharge permits, spills, etc.) without any remedial requirements from Texas Commission in Environmental Quality; (3) share information on successful water quality improvements, both in-state and outside Texas; (4) engage Texas Medical Association/doctors/nurses/pharmacists to remind everyone to properly dispose of unused antibiotics (don't flush!); (5) partner with Texas Farm Bureau and Texas A&M to identify economic benefits of good water quality practices.

Appendix C

Notes from the Meetings

Session 1: Meeting the Needs of 50 Million Texans by 2070 – August 19, 2019

- General outline for discussion
    - What is our goal?
    - What is the theory of change?
        - What's keeping us from achieving this goal?
        - What is needed to achieve this goal?
- Meeting the needs of *all* of Texas - should this be more explicit?
    - Needs of Texans for a healthy environment - defining it as the needs of Texas including those things
    - Sustaining outlook - meet those needs in a very constrained resource
        - Physically, only so much water + climate change (will need more water to do things) — physical factors need to be taken into consideration
            - (worried about population growth)
        - "Looking at water needs in a more comprehensive way" Need to put all of it into the plan
    - Non-people needs are on either side of the equation
        - Need to meet these but do we want them on the front end as a quantifiable thing or as a consequence?
- Looking at timeframe…
    - People are alive already that will be there in 2070, so what happens after 2070? Does this mean if we solve for 2070 it's solved forever?
        - Should be wrapped up in the definition of the goal—to meet it for 2070 and have something sustainable
        - Having good systems set up for perpetuity is the goal—2070 is goal for 50-year horizon for water plan
    - We've got a window of time where we've got to get it right—we want this to have people supporting *all* ecological/people needs of water--it's all interwoven
        - Constituency is larger when you approach it that way—ecological needs supporters aren't enough
            - Need everybody to support everybody in this—current climate of Texas, hard to imagine state maintaining enviro flows and cities running out of water
    - What seems sustainable or efficient today is going to seem antique in 50 years
        - Will be orders of methods to our perceptions and use of water—long-term challenge is getting through a smooth transition to thinking this way

- Having to choose between one thing and another means we've already failed; without one you don't fundamentally have the other
    - Need to get beyond the municipal use versus enough water for a city
        - How do we get there? more challenging
- Research comment—we need to have knowledge, but we also need to face facts we already know
    - Hard for us to solve the problem if we don't know exactly what the problem is
    - *However*, there's not enough water to meet all these needs—can't let it stop us from moving us forward
        - Example: "How much water is in the aquifer" can be twisted for other purposes
- Response 4 (from the survey)--enough water is available for all Texans for all needs, so as not to constrain the economic future of the State…
    - "All needs" needs to be updated—current idea of needs is wrong
    - Taking out "economic" because that's not the only focus
    - Adding in starting clause from survey response 6
        - "Access to adequate and sustainable water supplies for all Texans so as not to constrain the future of the state"
- Is this the overarching goal of the Water Grand Challenges?
    - There isn't necessarily one for ag/industry
    - Shifting towards this—need to have enough water for Texas to continue to thrive in the way that it is
    - Other "grand challenges" are the ways we move it that direction
    - How are we going to change our lifestyles and our habits so that everyone can meet their needs?
        - Efficiency concept/behavioral changes are going to be a big part of it
    - Maybe comprehensive is the idea
- Demographic estimate—60 million by 2070—where do we hit that intersection?
    - Is this a paradigm shift or is this stuff like low flow toilets?
        - Do people have to think about it or do we just make it the easier/mandated way of doing things?
    - Business as usual path—current population use, scaled up to a bigger level—business as usual path is almost never sustainable, so what does a different path look like?
        - Both an educational way of looking at something and a "do something" plan—becomes basis of theory of change
- State water plan that Texas Water Development Board puts out: Consensus—we need a better state water plan
    - Big unmet need—agriculture
        - By 2070, ag won't have enough water—Ogallala is no longer as available/economic for water

        - Are we managing our resources today in a way that we meet those goals in 2070?
            - A lot of aquifers are not managed sustainably
    - Climate change impacts
    - Environmental needs are not considered
- Uncomfortable with 2070—what if really bad things are going to happen before? No water by 2050—great to have a plan to solve the problem when we're all dead—there's no sense of urgency with 2070
    - We know with climate change that until it is staring you right in the face, nothing is going to be done
    - Things are going to happen before 2070—if you wait until then, you've missed the boat
    - Define it to include a more comprehensive approach
        - As we move forward, we're going to get better with appropriate uses of a finite resource
        - The "drought of record" approach isn't enough
    - Need some kind of ability to have metrics—even if the 60 million and the 2070 are out there, they're important for measurement—so maybe expand the goal and include the numbers in the definition
        - Have the big broad goal and then define underneath it—short to mid-term goals
            - What are activities we can do over the next few years to start getting us there
        - Need to also map out impediments to achieving
        - Want to make sure we include something so that a "wet year" doesn't make us just say "OK, we're good."
    - What did our first plan look like versus where are we today? Things haven't changed a lot, reservoirs from the '60s are still up, etc.
        - Regardless of how you say it, we've got problems—none of it really works, because the math is already getting tighter
            - Like the idea of elements—not necessarily something that fits on a bumper sticker
        - More curious to see what our ideas are—we need more ideas; we have little and big but not big enough to make a big jump in the legislature
- Need to ensure water for Texans now and into the future; need to address policies
    - Idea generation—how do we get there? We've provided sustainable water for 2070 on
        - There are new innovations where we could create new supply from municipal needs
        - Need to address demand
        - Fundamental challenges along the regulatory structure

        - Challenges around planning and research—not accounting for climate change
        - Public awareness—how do we engrain in every Texan that water is precious? Cultural shift
    - Political will to make the changes. What do we need to take that next step in the legislature?
        - Often times need a study to back it up in the legislature
        - Need to set things up for moving forward
            - No statewide study on what is/isn't being managed sustainably/not for groundwater
- We're already behind the ball—25 million Texans by 2020
    - There's already been a tradeoff—we've already cut off rice farmers
        - We're already using water in West Texas for energy
        - May or may not have enough water for the environment
    - In state water plan since then, statewide we're falling more and more behind in terms of needs of growing population
        - Not just conceptually accurate, there are lots of examples to point to
            - What would have happened to Austin if there weren't the Highland Lakes during the 2011 drought? No water.
        - Last drought we did better in than the one in the '90s that led to developing a water plan
            - We had communities that didn't run out that had in the past, but in terms of "getting ready for the big one" we're falling behind
- Timeline is wrong—much more urgent, and we need to convey that
    - Sense of urgency and need to move things forward on a quick pace
    - Research that helps us move policy forward—strong role for research—direct line for policy change
        - Need to build up advocates to do that
    - Cannot happen on 2070 timeframe—needs to happen on every legislative session leading up to that
    - Regional water planning process—good but fraught with problems—get things better incrementally
        - If this is going to be the vehicle, it's a really incomplete picture
- We're already in this—this is now
    - We already know what the challenges are—we know what needs to be fixed; not in the future: it's now
        - Next legislative session, not the one in 2050

<u>Obstacles and Obstructions</u>

- Economics/industry/commerce
    - Friction point for all public policy points against natural resources issues

        - Fighting the big influential industrial stakeholder puts public policy makers in uncomfortable spot
    - "Growth at all costs" policy is going to underpin a lot
- Cost
    - Even with an ideal scenario, biggest issue is paying for it
    - Funding for water—what is short term versus long term?
    - True cost of providing water and rate structures of water
    - Lack of expertise on this
        - Looking at true costs and explaining effectively is helpful to our cause
- Regulatory structure
    - Groundwater-surface water disconnection
    - Variable approaches to groundwater management
- Lack of diversity…
    - … of decision-makers—decision-making power is very concentrated
    - … in spread of where the power is
    - … in representation of diverse stakeholders
- No clearly defined/innovative game plan
    - For providing water to produce energy
    - To shift water use in agriculture and protect economy of agriculture
    - We react to others big ideas—don't always have our own
        - Guiding principles aren't leading to one big functioning system attempting to accomplish one goal
- Climate change is not included
    - Working around it, not being explicit and acknowledging it
    - "If you don't acknowledge it, you can't address it"
- Finding solutions that don't create winners and losers
    - Shifting needs so we get what we *need* and that's defined—not necessarily by "wants"
- Continuing efforts
    - Finish up something with environmental flows—then you think "it's done' when it's not
- Rural/urban imbalance
    - Legislation is more split between rural and urban than between Republican and Democrat
        - Recreational, environmental, agriculture—all in rural areas
        - Industrial--in urban
            - What happens when this is the one that gets all the representation?
            - Rural folks can't compete with urban water pushes
    - Power dynamics shifting from agriculture to industry, rural to urban
        - Urban dwellers often don't know/care where water is coming from
        - Focusing efforts on supply in rural areas and efficiency in urban areas

        - First legislative session where there was no rural representation on water resources panel
            - If water is in the rural areas, it's not well represented—just the users of water are well represented
- Legal/constitutional challenges
    - Rule of capture
    - Constitutional rights
    - Rural water associations—buying groundwater rights from landowners
- Science
    - At a statewide level it exists, but we're not doing it
    - Many models: "If climate conditions are such..." etc.
    - Is it the lack of science or is it *using* it that's the problem?
        - The tools are there, but no one has run the models in terms of groundwater
- Lack of intellectual bandwidth/willingness to invest on the issue
    - Maybe the science hasn't been presented in an effective enough, articulate way
        - We need to do a better job of what the standards are
            - Here are x things to be done, and if we don't here's what's going to happen
            - "Gotta be so simple that [anyone] could get it."
    - Don't think it's a lack of political will—they just don't have the solutions
        - Easy to plan around a natural disaster because it's in your face
        - Coming up with solutions proactively is harder
        - We tend to present all our issues to the decision makers with less focus on how to solve
            - Need to include solutions rather than just highlight problems
            - We have a tendency to use big criticisms that don't end in a legislative solution
    - Push for education should be with decision makers, not general public
        - More important to focus efforts on leadership
- Thinking and mentalities
    - Long-term planning is an obstacle to short-term needs
    - Business as usual mentality
    - Resistance to change
        - Every way you try to fix something, you're going to offend an existing stakeholder
        - Deconstruct the established territory through diversity of decision-makers

<u>Strategies</u>

- Anticipating the next steps
    - Politically—policy development for new legislators that come in
    - Education
        - Decision makers

            - Mobilizing influence. What motivates and what would cause decisionmakers to think in a different way?
        - Translating science into a readable format for legislature and general public
            - Example: We do studies on what's sustainable for an aquifer—take it the next step
                - What does that mean for water usage? Property rights?
                - How does it affect different sectors?
- Revise environmental flows revision processes
- Addressing the industry economics/political machine
    - Identify unintended consequences (Example: Water markets)
        - Example: Disenfranchised rural communities—big urban populace has the votes, has the power
    - Is there a strategy or should we think of a strategy to engage urban decision makers?
        - How do we translate things to the interest of urban decisionmakers?
    - Disenfranchisement isn't just rural—some will be urban
        - Need to link these different groups
- Educating on what's at stake
    - Shoot straight—don't overstate the loss scenario and be wrong
    - Focus on the strategy and opportunities for engagement
- What are the bills?
    - Private land environment and our urbanizing state
- What mix of legislators, who do we pull? what do we engage in?
    - Engaging in the flood flows legislature
        - What happens *after* the bill is passed is very important
        - State-wide flood fund (if it passes) is *huge*
    - What is the collective thought process on desalination?
    - What are some of the big things that come up every session?
        - During an interim—what can we do to come up with good ideas?
    - We need a much longer on ramp and a more coordinated effort to move things forward
        - Hopefully this and other processes will get us there to move things forward
        - Us having a strong voice in how rules are implemented is important
    - Unless you create political will, you're not going to get this to happen
        - Engaging industry and urban interest—cheap water
        - Create common interest in the people that influence the lawmakers
        - Goals are looking at:
            - Strategy is going to cost money—where's it coming from?
            - Developing a regulatory scheme—how is it going to get accepted/enforced?

        - Example: Waco
            - No watering schedule, no extra charges, not well valued
            - Outside of Austin/San Antonio water bubble, there's no aquifer protection like ours
        - Do we have sufficient groups? What groups are missing?
            - Texas Municipal League, cities, San Antonio Water System, businesses, Texoma, etc.
    - Who do we hand the bill off to?
        - About six people in the legislature that people look to as the water experts
- Focused a lot on policy/regulatory framework
    - What ways to get involved through non regulatory means—engaging cities/builders/etc.?
        - Maybe be realistic and say regulatory framework is the best
        - Groups will get involved but they'll ask about the cost to them and how to fund it
            - Example: SWIFT Funds—need a public entity and many groups don't want to take that on
            - Have to lead by example in some level—state needs to show/pay for some examples
                - Hard to get people to go towards innovation when there's not something regulatory pushing them
            - Need something in a grant type program, instead of a low interest loan
            - Having a grant fund to apply to that would support local initiatives (Example: Wimberley One Water School)
- Census is coming up
    - Need to make sure that hard to measure rural Texans are counted
    - Redistricting
- SWIFT is not easily accessed—how can we make it more accessible for agriculture and water conservation?
    - Other water projects are getting funding but not these two
    - Would be a good package to focus on
        - Maybe add an endowment for rural Texas (communities, agriculture)
            - Adding funding capacity for managing these things—staff wise
    - The Board has more funding for flood fund—could be a good model for the future
        - Getting into the habit of recognizing changing conditions rather than just reacting
- Environmental flows—case will definitely have to get built as to why what was intended didn't play out
    - Can imagine opposition saying that we're not accepting compromise
    - Need to get the facts—need a longer lead time with a multi-session try

        - Influencing the process and figuring out how we're going to manage it

Session 2: Ensuring adequate investment in water, infrastructure and conservation to meet demand – August 19, 2019

Goals

- Efficiency
    - Aging water infrastructure is addressed
    - Reducing water infrastructure loss, leaky infrastructure
        - Some kind of limit—have to take care of what water is in your community before you're allowed to build a new dam (no more than x% links)
            - Research here would be useful—be able to say how much water we're using from leaky infrastructure
- How we're using water outdoors
    - Can be a lot less investment than fixing infrastructure
- Wastewater Quality—standardized across the board
- Grants/available financing for projects
    - Regulatory hurdles are a stop to this
        - Example: groundwater permitting
- Enforceable regulation
    - Lack of willingness to fix leaks unless absolutely necessary
- Need for water for the environment
    - How do we pay for that?
        - Some of that is going to have to come from using infrastructure major water supplying companies have
- Accessibility—everyone has access
- Ensuring investment first in making our communities more efficient and infrastructure better (reframing the statement)
    - MORE: investing in the right stuff
        - LESS: just investing
    - Show hierarchy of investments
    - Rate structures
        - Ensuring enough investment for everything
            - Including environmental flows, agriculture

Obstacles and Obstructions

- What is keeping the state from doing this?
    - Lack of a dynamic, dependable funding source
        - Need something dedicated to water

        - A lot of things cannot be paid through a loan program
            - Example: environmental needs
        - Need an ongoing program to help this
    - Lack of managerial/technical know-how. Communities don't always have the resources
        - People don't know how to access programs where there are resources available
        - Lack of a cost benefit analysis for what this will mean down the road
    - Urbanization of the state—exacerbates the project
    - Conserving water has a cash disadvantage for some—get less money for selling less water
    - Regulatory hurdles for businesses that are interested in making a One Water/innovative campus
        - Different ways of delivering water, takes some control out of the hands of the water supplier
            - Example: looking at onsite reuse
            - Comfort level in Austin has gotten a lot better since the 2011 drought
                - Moving from water supply system and treatment plant to on-site treatment/collection
                - People can capture rainwater, treat gray water, meet non-potable water use by generating on site
        - Utilities know that they're going to have to look at this for water supply management in urban areas
    - Lack of financial incentives to *not* pump water
        - Regions G and M have the least progress on a water conservation front
            - Utility directors in the valley think "Our people are poor." and don't want to raise rates
                - Although the irrigation programs definitely do stuff differently
        - Need better ways to retain value by not selling
            - Example: Post Oak aquifer conservancy program
    - Agriculture is very diverse across the state—variety of water challenges

<u>Sidenotes</u>

- The Nature Conservancy has been working on agriculture—engaging producers, creative uses
    - What ways have they improved investment in agricultural efficiency with water?
        - SWIFT funding—enable things that could be good solutions
        - Agriculture likes to get the facts
            - Urban/ agriculture conversation—don't want it to end up like it did in California

        - What are the facts around agriculture? What innovations have occurred? What reductions? What gaps?
    - Most agriculture water is being used in Panhandle—lowering population, you would help the region economically
    - Agriculture is very diverse across the state
    - Is there a way to show agricultural water use across the state?
    - A&M has a resource on this—statewide, grouped by regional planning group
        - Lots of deficit irrigation in high plains—use smart tech to do moisture mapping, etc.
    - Who actually comes up with the benefit?
- Water vulnerabilities in Austin
    - Drought and flooding and zebra mussels
        - Zebra mussels etc. are causing native mussel declines
            - Endangered species act is going to come in—using surface waters from rivers
            - Would be better to avoid them getting listed in the first place
    - Irrigation systems still go in as a default on sites
        - Austin homebuilders put in "Sensible landscapes package," but still all of them include irrigation

<u>Strategies</u>

Infrastructure Discussion

- Is it cheaper to lose the water than it is to fix the infrastructure?
    - Seems like it, at this point
        - Cross-point: spend more on infrastructure than makes economic sense
            - Example: some rural communities lose 80% of the water that they pump around—still charge customers
            - There's no incentive to deal with water loss
        - At the state, if you come to the board for a loan, your water loss needs to be below a certain point
    - Smaller communities don't really even look at water loss
        - Just look at charging and whether they're charging enough to bring back money
        - Example: one utility—for every 100 gallons they put in, they were getting 120 back—bad data exists
    - Solution: Incentivize problem solving to encourage cities to tackle this problem
        - It's an economic issue - Texas Water Development Board is mandated to fix leaks and fund programs
            - If it doesn't make financial sense for the city, they won't pursue it

        - Require or incentivize proper management/updates in asset management or capital improvement plan
            - Public/private partnerships can be a hinderance
- Do we fix our infrastructure prior to making investments in other types of water supply projects?
    - Law in legislature that said if it was above a certain percent, you need to address that first
        - Has this trigger been met? Has the board been lenient?
    - Programs like this have promise, but we need to see how they work in practice
    - Legislative oversight doesn't always solve the water loss issue
        - There are lots of little things, but we need to look at a big thing that we need
- Are these strategies enough to get us to the point that there's enough water?
    - Moving with the water loss example
        - Is the goal to publicize water loss data so we can then get communities to not accept that —> shift consensus —> get state to less than 5%
    - Even if we implemented a huge laundry list of changes, how will we be resilient in the future?
- Rethink the way we look at water infrastructure in the state
    - Answering a question that may not be the right question
    - Maybe the state water plan is a piece of "infrastructure" that needs to be updated?
        - Yes—something that would need to be updated for the future
        - Would value from having a look at it
- Revisit the state water planning process
    - Loans not grants and not having capacity
        - Story of why you invest in resiliency
    - State water plan and sustainability
        - Managing surface water
            - Sustainable, if you leave out environmental flows (so it's not sustainable)
        - Groundwater
            - not sustainable
            - Agriculture has issues—mostly with Ogallala
        - Climate change is also not included—so it's not sustainable
        - Should be able to pull in desalinated sea water—piped in
            - Lots of issues with this
- Infrastructure strategies/takeaways
    - New and improved state water plan--It is a piece of "infrastructure" that needs to be updated
        - Improve "sustainability"
            - Include environmental flows in surface-water sustainability

        - Examine/improve sustainability of groundwater
    - Incorporate climate change
    - Funding improvements
- Improve flexibility and efficiency of existing funds and funding mechanisms
    - Make SWIFT funds available as grants for infrastructure
    - Available for training and capacity building in communities
        - Use to bring more local control over the management of wastewater infrastructure
        - Need upfront capitol—lots of small towns don't have it
            - Example: Wimberley wastewater
- Use data on utilities and water use collected by state to leverage changes in policy process
- Create standards for allowable water loss before other investments
    - Research is needed to describe what allowable levels are
- Incentivize problem solving to encourage cities to tackle leaky infrastructure problems
- Potentially require or incentivize proper management/updates in asset management or capital improvement plan

Legislation Discussion

- What are the legislative needs? Is it a legislative solution?
    - Create a continuous funding source for sustainable long-term water solutions
        - Example: Florida has a real estate fee to protect Everglades
        - Example: Minnesota has a small tax to protect open spaces and water resources
        - Like to tie funding sources to something it addresses
            - Example: Sales tax on bottled water would raise $100 million a year—could be used for water [Wasn't much support at the legislature for this when the legislature considered funding the implementation of the state water plan. -ed.]
        - There are things that can be done—raising a billion dollars in Texas isn't that hard
        - Coming up with a plan and getting organized, presenting/selling the plan is the hard part
    - Charging a fee for new wells drilled to plug old wells
    - Changing SWIFT to be more grant oriented than loan
        - create a pool of resources to cover that delta
            - Example: Community attempting to manage wastewater
            - Example: One Water school
            - Example: City deciding to go with land application
    - Green Infrastructure bill—following One water approach

        - Tax break for investing in resilient solutions
        - Using Ag bill to advance water conservation
        - Realtors—number one rule is no real estate transaction fees (they do that in South Carolina)
            - Nexus between rollback taxes when land goes from agriculture to other use
                - Would be great to get funding from this, not sure how
- Sometimes the strategy is getting things ready so that when the next big drought rolls around, we send out the big idea to address these issues
- Are there strategies that can be employed to break people/cities out of complacency?
    - Example: Austin got the hell scared out of them—how do we convince the rest?
    - Cost benefit analysis
    - Know your water app—knowing where your water comes from but also knowing if your city is ready for the drought of record
        - At National Wildlife Foundation—doing study to see what climate change will do to water resources in Texas
            - More than hot temperatures, looking at how those will lead to other things that affect day to day life

<u>Wrap-up</u>

- Broad topics with different challenges that come off and different actions that achieve them
    - We are taking what we've heard, will get back to the full group with the takeaways for feedback
- Seems like people are defining it differently
    - Defining our priority list or revamping state water plan? How do we want to define the goal?
    - We can decide later if this is how we want it or if it's not a process but it's a closed loop
- Goal: Having identified strategically what's coming up
    - Feed this to Texas Water Foundation for consensus building with bigger groups
        - Eventually advocate for policy change (this group won't do it)
- Tapping into the list of policy goals
    - What we would want to make happen if we could—single sheet, use to start conversations in simple terms
    - Talk with legislators who are interested but may not understand the urgency
    - May be different opportunities in the future for people to get involved in doing these
        - May have to wait until the opportunity arises, we have a plan so then we can go
        - Going forward may have to wait a bit, whereas other times it may not

- A lot of this comes down to a sense of urgency—people need to care but it's not being communicated
    - Some legislators are still concerned about drought
    - Texas Water Resource Network meeting
        - Need a caucus on these issues—need to build up champions on this topic/issue
        - Benefit of people in place that know a lot about this stuff—has kept water policy coming out
    - The faster we can get to implementing some of this stuff, the better
    - Action item that we should spin off an effort for NOW—SWIFT funding, water caucus creation
        - Shouldn't be waiting to implement this stuff

Session 3: Ensuring Flows to Sustain Healthy Ecosystems – September 16, 2019

Discussion on Challenge

- Keywords
    - Scientifically sound
    - System of ensuring/protecting environmental flows to guide water planning and management
    - Goal of something about healthy ecosystems
- Wording
    - We want scientifically-sound environmental flows that are equally prioritized within an enforceable regulatory framework
        - Maybe broaden this out a bit
        - Also want to include people that don't care about the end, but enjoy having water on their property
            - Sustain environmental flows throughout the basin

Goals

- Making healthy ecosystem aspect an equal aspect of the planning process instead of an afterthought
    - To do that we need the metrics/definitions/etc.—"healthy ecosystem" is broad
    - Two kinds of answers—science answer and policy answer
- The State should make policy and regulatory decisions based on sound science
    - Worry—senate bill process set up to support (to a degree) dealing with best available science
    - Urgency of getting this right—new perfect science could take decades, but then you may miss opportunity to meet flow needs

        - Do *not* want to adopt a position where "well science isn't good enough yet" -better to go from where we are

Discussion Points

- Is the current environmental flows process—working with best available science—the way to go?
    - Currently they manage whatever species is threatened etc.
    - Seems better to look at overall health of bays/estuaries
        - Seems like they focus more on indicator groups with the assumption that will help all of them
        - Yes—they use a suite of species as representative in the bay and in some instream species
    - The question of insuring flows is regulatory—here we fail miserably
        - How were these findings received? Do people question the science?
        - Science seemed to be accepted—science committee for environmental flows sounded good
        - What was widely scattered was how different basins that had to prioritize environmental flows were
            - Some basins that said "We don't know what we want." Really big basin: "Give us ten years."
    - We're not dealing equitably with all of the basins
- Are we comfortable with the science?
    - No—there was recognition that we need to have this but no clarification on how it's going to work/funding/etc.
    - There was a place where the science team split for San Antonio
        - Folks in water supply saying we needed a low number
        - Academic side is saying you need a higher number because system needs water
        - How to fix that?? Not a simple fix
            - San Antonio also came back with different definitions on consensus—only Matagorda/Lavaca had a consensus
    - There is a whole lot of uncertainty on the water demand side—looking out 50 years
        - We still move forward with that because we have to
            - That level of prioritization is missing here (for ecosystem health)
        - You can't eliminate all the uncertainty—seems like at some point we just need to move forward and manage for it in terms of ecosystem health
    - They need a chairman to divorce out the policy implications of the science rather than looking at implications, figure out what species need then let policy folks have at it
        - This is what they've done in Edwards

- Policy side—real protection of environmental flow —> real protection and enforcement
    - Currently environmental flows are not prioritized
    - Need to value environmental flows
        - Does environment need to be at the same level as human? Unanimous yes.
    - If you come in for a water right, should put environment in at the same level as municipal right (beats agriculture every time, by statute). Should let it carry the same priority when it comes in, rather than devalue it
        - Do not treat environmental needs as a subset of something you need to take into account for
        - Example: When you come in for a permit, environmental is something that's just a subset/catch all
- What can we do to meet the ecosystem needs for our planning and for our source of water?
    - Proactively plan and look at overall spectrum for how to address issues ahead of time
        - Less: "We're gonna keep enough flowing."
        - More: "How and when can we do releases at important times to help species that need it during a drought?"

<u>Obstacles and Obstructions</u>

- Maintaining water quality standards
- Elected leaders
- No consensus on definitions for healthy ecosystems
- No surface-water rights for environmental flows
- Property rights and groundwater
- Water suppliers
- Drought
- Not having shared values
- Cost to buy water rights
- Combined rights for e-flows
- People not understanding value of environmental flows
- Broader themes of obstacles
    - Rights/doctrine/use
    - Lack of value
- Primary obstacle: (don't value) A large amount of available water is already dedicated to consumptive uses
    - Protecting water for environmental flows involves some sort of reallocation of these flows
        - People don't agree here—think of it as property
        - Fight between consumptive uses and need for water reserved for environmental flows

        - A lot of the water is already spoken for—so what does it take to achieve some kind of rebalancing
            - Legislatively directed reallocation
            - Water market driven approach
        - "Most water is allocated for consumptive uses."
        - Don't say reallocate—we are late to the game—given an unattainable path through Senate Bill 3
            - "Can't touch water rights listed before 2007."
            - Re-appropriation is allowed—better than reallocate
        - Bad we're late—our water sources are declining—going to make gap even worse
            - Especially if we allow use of surface water in a hands-off approach: "We can't touch it."
        - Takings
        - Not just regulatory use allocations; it's also the legal doctrine
        - Broad theme but specific enough you can identify an approach—then themes are on the wall
        - Groundwater as a property right; aka, the Rule of Capture
- Data gaps
    - Groundwater/surface water connection
    - Separation of regulatory groups for groundwater and surface water
        - Groundwater management groups choose not to
- Idea that "Water going to the gulf is wasted"
- Not valuing environmental flow is an extension of not understanding environmental flows
- Ecosystem services component—services environmental flows provides (gap here in science)
    - Lack of basin wide organization/interest group to advocate
    - Who needs to be educated first?
        - Shrimpers/recreational fishers/people with economic interest
- Political climate around environmental flows
    - There's only one legislator that people think about—need more up and coming people on that level
- Idea that what people need and what the environment needs are opposing sides
    - Until we combine "what people need" and "what the environment needs" we'll have problem
    - Drought is one example when we do have to choose
- Water planning process
    - Done on political boundaries rather than natural boundaries
    - Drought drives fear/scarcity-based planning
    - Planning process doesn't consider environmental flows
    - Don't value environmental flows but also don't value the environment legally speaking

7

Groups of themes

- Thinking—Values & Myths = **10 votes**
    - Values
        - Lack of value for environmental flows
            - No shared values
        - Not valuing environmental flow is an extension of not understanding environmental flows
            - Folks understand the threat
        - Political climate
    - Myths
        - Idea that "water going to the gulf is wasted"
        - Senate Bill 3 took care of environmental flows
        - You have to choose the environment or people
- Advocacy—Broadcasting the Thinking = **5 votes**
    - Lack of basin wide organizations/interest groups to advocate
    - No new policy advocates
- Data = **8 votes**
    - Data gaps to define environmental flows
    - Climate change
        - For various reasons, we're losing supply—this is one of those reasons
- Planning = **6 votes**
    - Planning process doesn't account for environmental flows
    - Water planning process is done on political boundaries rather than natural boundaries
    - Drought drives fear/scarcity-based planning
- Consumption/Surface Water Rights/Groundwater = **13 votes**
    - Consumption
        - Most of our water is allocated to consumption
        - We're late to the game
    - Rights
        - Water right system for environmental flows
        - Takings claims
        - Separation between groundwater and surface water regulations
    - Groundwater
        - Groundwater as a property right—Rule of Capture

Split into groups for focused discussion

- Following notes are consolidated from Posters generated in session

Values & Myths

Problems:

- Lack of value for environmental flows
- Lack of shared values
- Unfriendly political climate
- Environment vs. people (false choice)
- Senate Bill 3 has "taken care of environmental flows"
- Lack of understanding of threats

False Assumptions

- Need data/science readyto deliver at opportune moments
- Needs stories and strategies to communicate the issues

Societal Values

- Consider environmental justice impacts
- Educate
- Increase prioritization of environmental flows and environment

Play into… Political Climate

- Environmental apathy or hostility
- Crease diverse advocates to broaden the discussion
- Need the "right" messages

Actions

- Better study/calculation on true economic values and impacts of ecosystem services + downstream impacts + whole system impacts
- "Human" translation of studies + personal stories so "regular folks" can understand
    - Define what the two to three key messages are that we need to communicate
    - Education of "decision-makers" and people who elect them
- Planning groups need to diversify stakeholders at the table
    - Better inclusion of diverse socio-economic/working class interests
    - Example: Representatives at water planning groups for agriculture, fisheries, urban planning, environmental justice
- Diversify and empower advocates and champions that can engage on this
    - Identify who the best people are to "move the needle"

Data – Concrete Steps & Solutions

- More studies on surface water and groundwater interaction
    - Also—Compilation of existing studies
- Making data that exists more accessible so we can show when environmental flows standards are not met
    - Example: LCRA's hydromap
- Statewide standards considering climate change impacts on surface water and groundwater
- Counteract myths and assess implications with:
    - Analysis of where we are in achieving e-flows as recommended by basin and bay expert science teams, basin and bay advisory stakeholder committees, and the Texas Commission on Environmental Quality
    - Analysis of how sustainably we're managing aquifers
- Economic analysis of "true value" of environmental flows
- Economic analysis of achieving environmental flows
    - Impacts on underserved urban and rural communities
- Economic cost-benefit of proactive management
    - Example: Potential species listings—cost to avoid listing versus cost to treat post-listing

Water Rights

- Water for environment co-equal to other uses
- Return flow subject to cancellation
- Return flow transactions
- Cancellations directed to environmental flows gap
    - Maverick irrigation district example
- Low environmental flows as drought contingency trigger
    - Add-in to groundwater management→ rights are curtailed when drought creates/triggers at some level

Session 4: Protecting water quality to meet human and environmental needs – September 16, 2019

- Water quality is more advanced than e-flows
- Tend to think of on a surface water level - don't think about groundwater
    - worth thinking - is it worth it? fracking etc. stuff that can be groundwater threats —> surface water impacts
- In addition to use protection
    - do we want to define degradation/where are we today and how to not get worse?

        - At TEXAS COMMISSION ON ENVIRONMENTAL QUALITY they would use this when it impacts groundwater but never went beyond that
- Comments on last statement in survey responses: “all Texas waters are fishable and swimmable"
    - Leaning towards bigger & broader statement
        - U.S. Environmental Protection Agency has water quality standards to make things fishable and swimmable
        - that doesn’t address issues like wastewater discharge in hill country
    - Fishable/swimmable has specific meaning under CWA and it doesn’t mean what it seems like it means
    - There is a direct correlation between Federal CWA and state authority to define parameters
        - what does degradation mean? limited set of parameters
        - even if you remove human impacts, some places are NOT fishable or swimmable
    - This is an existing framework that wasn’t fully implemented
        - In a public view standpoint - this translates really well
- Wordsmithing around phrasing
    - “All Texas waters” could be interpreted to include aquifers
    - "Life sustaining”
    - "All Texas waters are clean, healthy, and life sustaining"

<u>Obstacles and Obstructions</u>

- Summary of obstacles in survey
    - Texas Commission in Environmental Quality
    - Lack of broad public & nonprofit participation in surface water studies
    - Lack of enforcement
    - Lack of regulations
    - lack of understanding the cost of impaired water
    - lack of monitoring
    - Lack of habitat
    - Cost of maintaining drinking/wastewater
    - Aging infrastructure
    - Non-point & point surfaces of pollution
    - Too many surface water diversions

<u>Themes from Discussion:</u>

- Regulatory
    - Regulation doesn’t account for nutrients
    - Fractured regulatory system (separate agencies/groundwater & surface water/etc.)
    - One size fits all

    - Insufficient regulations (Example: land application/direct discharge in Hill Country)
    - Not proactive - based on allowable maximums rather than ideal minimums
        - It's the limit at which you are protected—you can't regulate to zero risk
    - Agriculture and oil and gas are underregulated
    - County authority is cut off
    - Federal and state regulations on discharge differences for produced water
- Infrastructure
    - Lack of agricultural infrastructure
        - Agriculture—irrigation districts, lining canals, limiting loss - incentive on increasing efficiency
    - Aging infrastructure/deferred maintenance
    - Flood and famine—how you deal/how infrastructure handles it
    - Lack of efforts to protect headwaters/upstream
- Politics of Poo/Political Culture
    - No political will to build water/wastewater infrastructure
    - Political culture is so that local control/regionalization is not viable
- Education
    - Lack of understanding on individual roles and water quality issues. Example: Non-point source pollution
    - Cultural paradigm: "Not my problem."
    - Disconnect from natural systems in urban areas
- Science
    - Not considering climate change
    - Undefined parameters—what is baseline for degradation?
        - Lack of data on nutrient parameters
    - Water-quality standards
        - Science that shows why increased standards should help
- Economics
    - Water treatment is expensive
    - Study of the value of wastewater
    - Lack of understanding—bigger picture of the cost for treating wastewater versus potable water
    - Shifting of cost burdens—goes towards the public and the industry doing it isn't paying for it
        - Industry and agriculture "get away with" not paying the cost of their pollution
            - Lack of accountability. Externalization of industry cost
    - Few incentives for agricultural and gas stuff
    - Lack of funding availability for increasing standards/updating etc. in smaller cities

- Myth
    - River cleans itself
    - Texas isn't as big as we think it is

Discussion

- Small communities struggle to meet wastewater and water quality standards
- Need to get creative - should have some incentive-based approaches rather than just all for regulatory
- Problem: water is bad when it gets to you
    - no regulatory mechanism for degradation
    - land outside of municipalities have no land use authority (counties don't have that power)
- Solution: communities/utilities/etc. making investments upstream at headwaters
    - Example: State of Georgia - dedicated funding for protecting water supplies - passed with lots of support
    - Example: Florida has some stream segments prioritized, different on case-by-case basis
- "It's not that Texas is too big, it's that it's so big"

Split into groups for focused discussion

- (Following notes are consolidated from Posters generated in session)

Votes

- Regulatory: 13
- Economics: 10.5
- Infrastructure: 7
- Science: 2.5
- Education: 2
- Politics of Poo: 2
- Myth: 1

Science + Economics

Studies

- Analysis of the full cost of growth (ties to each permit)
    - How do we "walk back" from overallocation?
- Economic analysis on shifting costs/externalization of industry costs → people
- Data/study on nutrients – where do you draw the line?
    - Often not required or taken as seriously in Texas
- Cost to treat wastewater vs potable water

    - Statewide and/or at local scale
- Cost of enhanced treatment/infrastructure building
- ALL studies with various scenarios/levels should incorporate climate change impacts
- Climate change impacts should also be built into policy requirements for all new permits

Actions

- Create/modify existing state funding source for small cities
    - Tapping into federal level – FEMA/Recovery
    - State level – need more dedicated funding (this is a problem)
- Translate study results to:
    - Decisionmakers – state legislators and regulators
    - Local policymakers
    - General public – connect dots upstream and downstream
- Disseminate best practices to rural/ag communities
    - Working with local partners – someone OUTSIDE of NRCS
- Develop/discover funding streams → new incentives

Myth, Education, & Politics of Poo

<u>Problems:</u>

- Politics of Poo – no political will, local control/regionalization
- Education – lack of awareness, "it isn't my problem" philosophy, natural system/urban area disconnect
- Myth – "river cleans itself," "Texas isn't as big as we think it is"

<u>Solutions:</u>

- Politics of Poo
    - Make wastewater an "electable" factor
    - Create & promote wastewater champions – Example: "Poo kings"
    - Support water + wastewater certification at community colleges
    - Shape rural political ethics to focus on local control and impact on water resources
    - Technical capacity for analysis and alternatives mapping
- Education
    - Awareness campaign on water quality
    - Create more local citizen science/advocate groups
    - Dog owner targeted campaign: pet impact – "The Poo you swim in"
- Myth
    - Education campaigns
    - Texas animation showing it going from open & big → dense and interconnected
        i. Map direct impact pathways

- Orienteering signage and maps for rivers

Regulatory and Infrastructure

- Advance new water quality parameters for streams of significance
- Research study that examines options for water treatment and discharge in Texas
- Use model subdivision rules template program to give counties limited land use authority in order to insure state funding
- Create an evolution of BMPs and financial incentives for agriculture as it relates to NPS
- Research study that creates a baseline of water quality parameters for groundwater
- Explore state funding mechanisms for preserving land for water quality protection (Land Board?)

Session 5: Sustainably Managing Surface-Water and Groundwater – October 15, 2019

- What is the goal? How are we managing surface, groundwater, and both together
    - First, we need to define "managing sustainably"
        - "Sustainably managing" —> sources still can be dry part of the time and be considered sustainable
        - Data tells us we're losing 11 to 17 percent of our supply; doing better on per-capita consumption
            - But there's still a marked increase in what we need with a growing population
            - If everybody exercised their water right, picture would be different than what we see
                - We have a legal measure that is not sustainable
        - If we have something worse than drought of record, things would be worse or if we have a less bad drought, but with a bigger population
    - "Water conservation has to mean that we're conserving water to change the way we use it."
    - Part of purpose is to make sure there is water supply for environmental needs—not just consumptive use
        - Define sustainability for surface water to include environmental needs
            - We're late in the game on environmental flows—majority has been allocated
    - Sustainability now versus 10 years from now
        - Legislature appropriated money to update water availability models
            - Even if we change the model, it doesn't change the permitted amount—we become less sustainable

        - If we don’t address water rights/limit--we have a problem
        - Started issuing permits in 1914 and didn’t consider the environment until 1985(?)
    - Surface-water sustainability goals
        - Consumptive needs met
        - Environmental needs met
        - Drought of record—worse than drought of record—taken into account
        - Future climate scenario taken into account
    - It is unanimously not okay to dry up springs and streams to achieve groundwater sustainability
- Groundwater Sustainability
    - Define sustainability in reverse to avoid undesirable results—define what you don’t want to see
        - Example: Chronic lowering of groundwater levels
        - "The undesirable future conditions”
            - By doing this, it’s more regional/case-by-case specific
    - Prioritization component
        - What does that mean in terms of undesired consequences?
            - Example: Looking at springs
    - Does sustainability include cost of recovery of water?
        - Because we undervalue water, we promote the less sustainable use of it
            - It’s also about protecting the quality of the water—cost to that
            - There’s an equity lens that is important—harder to do in smaller communities
- Groundwater sustainability goals
    - Avoid undesirable results for
        - Spring flows
        - Rivers
        - Affordability
        - Well heads
    - Artesian pressure is being maintained to keep surface water flowing
    - Ensure water levels are maintained for wells throughout the region
    - Barton Springs Example: Work to ensure that that water levels don’t drop below user’s well levels
    - Undesirable results—connects groundwater to surface water
        - Base flow
    - As we continue to develop areas—areas that are "sinks” to recharge zones remove from both groundwater and surface water

Obstacles and Obstructions

- From survey
    - Private ownership
        - Property rights—permits as property rights
        - Difficult to reduce permits
    - Water planning
        - Water undervalued
        - TERS (total estimated recoverable storage) not MESY (maximum estimated sustainable yield)
    - Environment
        - Environmental flows not considered a real need
    - Prevailing mindset that natural resources are to be exploited not sustained
    - Government
        - Fragmented governance between surface water and groundwater and within groundwater
    - Desired future conditions are not sustainable
        - Groundwater conservation districts are afraid to deny/reduce permits
    - Science/data
        - Lack of science/data on groundwater/surface water connection
    - Ability to manage together—local/site-specific
    - Economic impacts
- What are the reasons people aren't looking at groundwater/ surface water interaction?
    - One doesn't have authority to govern the other
    - What's the legal test you have to meet to determine where the authority lies?
- Obstacles identified in discussion
    - Myths/misconceptions
        - Myth/thought that water is always going to be available and cheap
        - Toilet to tap is gross
    - Lack of public awareness of importance/value of environmental flows
        - People do understand the value of recreational use
            - Example: Fisheries in the gulf
    - Political forces that want to maximize water availability
    - Need very strong elected official leadership to change any of this
        - Need "issue champions" on the ground and politically/officially
        - Need people already out there promoting an agenda —> to promote this agenda
    - Funding and philanthropic investment
        - Texas is significantly behind other states in philanthropic dollars that go to water
        - Dedicated funding sources
    - Treatment technologies and beneficial reuse

        - Where the water is needed and for what purpose is not being linked
        - Toilet to tap initiatives
        - Difficulty in measuring whether or not groundwater conservation districts are complying with desired future conditions

    - Regulatory features in place
        - But how is that being implemented/administered on a day to day base?
        - Accountability
    - Lack of holistic water and data management
    - Value component
        - Reluctance to measure and monitor in Texas

Categories

- Legal/Institutional (27)
- Science (15)
- Private Property Rights & Profit (13)
- Social (7)

Split into groups for focused discussion

Following notes are consolidated from posters generated in session

- **Legal/Institutional Solutions**
    - Cancellation (in part) of unused water right
        - To avoid cancellation, water right holder amends right to add use to dedicate portion of water to environmental use
        - Agencies would have to do cancellations at the direction of the legislature
    - Give Texas Water Development Board more authority to manage rights in water trust
        - Rights threatened with cancellation could go into water trust
    - In context of Day decision
        - Landowners to conserve water in place
            - Legislature could better define "beneficial use" to allow environmental benefit
        - Pilot or test cases to value/appraise groundwater in place
    - To balance forces that want to only use water for economic benefit:
        - Build coalition of groups (conservation, responsible business, some municipalities, etc) to balance that influence
            - Groups must be able to think long term and understand relationship of water to long-term economic prosperity of the state

- **Social Issues and Solutions**
    - Issues: Perception Constructs
        - Water is free
        - Water access is reliable
        - Water is a resource to consume/exploit
        - There are no consequences to using water

    - Solutions:
        - Case study on how San Antonio Water System made San Antonio “water aware” and receptive
        - Linking or identifying water quantity used in products
        - Launch Texas Watershed Exchange—focus on protecting source water and connecting rural and urban parties
        - Efficiency rating/scorecard for commercial and residential buildings
            - Develop an economic incentivization program with paybacks for efficiency
        - Empowering issue champions
        - Use consumer power to incentivize responsible water usage and then policy change
        - Education campaign
        - Public shaming versus Champion celebrations
        - Integrating water education in schools and universities (in classes and housing spaces)
- **Other**
    - Creating groundwater conservation incentive
        - Case study on groundwater valuation (find the value of protection)
        - groundwater protection "easement"-like opportunity for interested landowners
    - Do a Senate Bill 3 for groundwater—set aside some groundwater for the environment

Session 6: Fostering public awareness of water issues to advance conservation and investment in sustainable water management – October 15, 2019

What is the goal?

- Get people connected to "their" water
    - Current status of their river, bay, watershed
- Show interconnectedness of our water supplies
- Highlighting the value of water
    - What it takes for the water to get to you
- Stewardship

- Better informed general public
    - Reach all people
        - Environmental justice
            - Water quality
            - Lack thereof
    - Getting water into people's perception in general —> then you can do more targeted info
- Are our goals focused on a strategic engagement targeting the right people?
    - Example: Strategic audience like developers or decisionmakers/interest groups
    - Advance investment in sustainable water management
- Awareness mechanism and solution
    - Only need to identify the source of water if the county develops rule (access to Economically Distressed Area Program)
    - Change rule—all planned developments have to figure out where their water is coming from
- Breaking "public" into different audiences
    - New Texans
        - Address new people moving in by getting to the developers
    - Developers
    - Champions
    - Children
    - Policymakers
    - Underserved communities
    - Media
    - Influencers/Opinion leaders

    - Religious leaders/Faith community
    - Business realm

Obstacles and Obstructions

- Lack of public interest
- Complacency
- Too technical
- Lack of objective materials
- Competing priorities
- Regulatory hurdles
    - Example: County regulations
    - Example: Real estate disclosure on information
    - You only reach the people that look for it—rather than folks that wouldn't think to
- Lack of incentives to make good decisions

- Money
    - Utilities put money into public awareness only when it's mandated
    - Informed businesses who know the risks may avoid the city
- People don't want to recognize crisis
    - Lack of urgency
    - General public doesn't see the problem
- Uninformed legislators
- Lack of trust (in non-governmental organizations in rural areas; in government, etc)

Obstructions grouped into categories:

- Public (7)
- Public sector/administration (26)
- Private (8)
- Everyone/all of the above (19)

Side-talk about San Antonio Water System

- Driver for San Antonio Water System doing what it did was the business community
    - Business community got educated and funded a study —> changed makeup of San Antonio Water System's board
- Can't see the news in San Antonio without seeing something about the aquifer level
- Is the incentive for people not telling the city —> businesses don't come as a result
    - San Antonio had a choice because the businesses that championed this were already established in the city

Split into groups for focused discussion:

Following notes are consolidated from Posters generated in session

- **Public Administration/Institutions**
    - Lack of Legislators with general understanding of water issues to act as thought leaders/champions
        - Launch Water Caucus
            - Neutral/outside organization—create venues for education and do briefings/provide info
            - Texas Water Foundation fills role by sharing research done by other orgs → legislature
        - Promote water focus by other research groups/influencers
    - Increase social and regular media focus on/attention to Texas water
        - Attention to local water issues that make people and their legislators care
            - Bring in the attention of big problems (Example: rainforest burning) to smaller ones happening locally that they can have more impact on
        - Involve celebrities
    - State agencies and local government entities set example of water efficiency with their own facilities
        - Persuade state leaders to do this with examples/case studies and cost-benefit analyses
            - Example: The University of Texas at Austin showcasing water and energy efficiency
- **Private Sector**
    - Case studies
        - Market success stories
            - One Water school in Wimberley
            - San Antonio Water System/Aquifer protection
    - Accreditation Incentives and press
        - Need 3rd party validation
            - "Competitive edge"
            - Motivated to educate—kids and peers
    - Adding Trust
        - Conservation community show value to non-traditional partners
- **General Public**
    - Problems
        - Apathy
        - Knowledge gap
        - Technical barrier to entry
        - Urgency factor

        - Power of influencers
    - Objectives
        - Increase engagement
        - Identify effective influencers
        - Find a message that is accessible and actionable
        - Change how people value water
    - Solutions
        - Influencer celebrities
            - Beyoncé, Matthew McConaughey, JJ, Lizzo, Willie
        - Influencer events
            - Football, rodeos, state fairs, ACL, sports, movie previews
        - Trusted influencers
            - Daily meteorologist, morning shows, faith community
        - App on water knowledge
            - Alerts
            - Local water data—showing source, quality, drought, long-term outlook/local resiliency factor
            - Texas Historical Commission Texas app
        - Public service announcements on social media & television