



Gulf Coast Water Authority

Drought Contingency Plan Update

Response to Funding Announcement: R16-FOA-DO-005

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Executive Summary

Gulf Coast Water Authority – Drought Contingency Plan Update

Date: April 11, 2016
Applicant Name: Gulf Coast Water Authority
Texas City, Galveston County, TX

Proposal Summary:

The Gulf Coast Water Authority (GCWA) provides water on a wholesale basis to customers in Galveston, Fort Bend, and Brazoria Counties (TX), including municipalities (e.g. Galveston, Sugarland, Missouri City) as well as petro-chemical industries (e.g. Dow-UCC, Valero, INEOS, Marathon, Ascend). The majority of GCWA's water is diverted from the Brazos River, and the location of its diversions in the Lower Brazos basin cause GCWA's water availability to be dictated both by natural streamflow variations and the water usage behavior of upstream entities. Texas regulations require that GCWA develop and routinely update basic drought contingency plans to aid in mitigating the effects of drought on customers. The existing GCWA plan, however satisfying state criteria, does not include all standard drought contingency practices as endorsed by the US Bureau of Reclamation. Through this proposal, GCWA will update its plan to better satisfy its customer's needs and expectations, and will exceed standard practices required by the Bureau of Reclamation. The proposed plan will integrate four critical components:

1. Drought severity assessment through data gathering and analysis,
2. Planning to conjunctively utilize available groundwater during periods of drought,
3. Developing/implementing infrastructure monitoring and mitigation activities to reduce water loss, and
4. Incorporating standard drought contingency planning elements into GCWA's existing plan.

GCWA's expected Response and Mitigation Actions will be thoroughly investigated, and will include a detailed evaluation of the availability of locally-sourced groundwater suitable for supplementing surface water sources during periods of drought. Additionally, GCWA will refine water loss monitoring procedures, geared to minimize demands for additional Brazos River water, thereby making such water available for other users within the Brazos Basin. GCWA has received verbal and written support for its proposed plan update from numerous customers, including the San Leon MUD, Galveston County MUD #12, and the City of League City. We expect additional support from GCWA's industrial and agricultural customers, as well as regional entities such as the Lower Brazos River Coalition, the Brazos Watermaster, and the Harris-Galveston Subsidence District. Pertinent aspects of the GCWA plan will be submitted for incorporation in the Brazos H Regional Water Plan and ultimately the state water plan.

Timeframe for Plan Update Completion:

The proposed update to the GCWA Drought Contingency Plan will be completed within 24 months. The expected plan completion date is July 2018, with plan updates submitted annually to the Texas Commission on Environmental Quality (TCEQ) as required by Texas statutes. Portions of the plan suitable for incorporation into the regional and statewide water planning process will be submitted to appropriate entities prior to July 2018, yet will not be officially incorporated into those plans until closer to the end of the current 5-year regional planning cycle.

Bureau of Reclamation Projects within the Brazos River Basin, TX:

No Bureau of Reclamation projects are located within the immediate vicinity of GCWA's operational area. However projects do exist within the Brazos River Basin, and therefore will potentially benefit from GCWA's expected drought contingency operations. Three projects within the Brazos River Basin are:

- *Flat Creek Water Reuse Project – (2008) – A feasibility study for local water reuse*
- *Lake Waco Wetlands Project – (2014) “Investigating an Innovative Constructed Wetland Design for Attenuating Endocrine Disrupting Compounds from Reclaimed Wastewater” under the Bureau of Reclamation’s Science and Technology Program*
- *McLennan County Drought Contingency and Water Supply Resiliency Plan - (2015) A project undertaken with a WaterSMART Drought Contingency Planning Grant from 2015.*

Background Data

The Gulf Coast Water Authority (GCWA) serves water on a wholesale basis to customers in Galveston, Fort Bend, and Brazoria Counties (TX). GCWA employs a combination of canal conveyance, raw water pipeline infrastructure, and treated water production and conveyance facilities to serve a combination of industrial, municipal, and agricultural demands across these counties. Customers served by GCWA include municipalities (e.g. Galveston, Sugarland, Missouri City) as well as petro-chemical industries (e.g. Dow-UCC, Valero, INEOS, Marathon, Ascend). A map of GCWA operations is provided in Figure 1. As GCWA is a wholesale provider, it is not clear how many end-users obtain their water from GCWA sources. GCWA provides water to over 45 entities, with the exact number fluctuating from year to year.

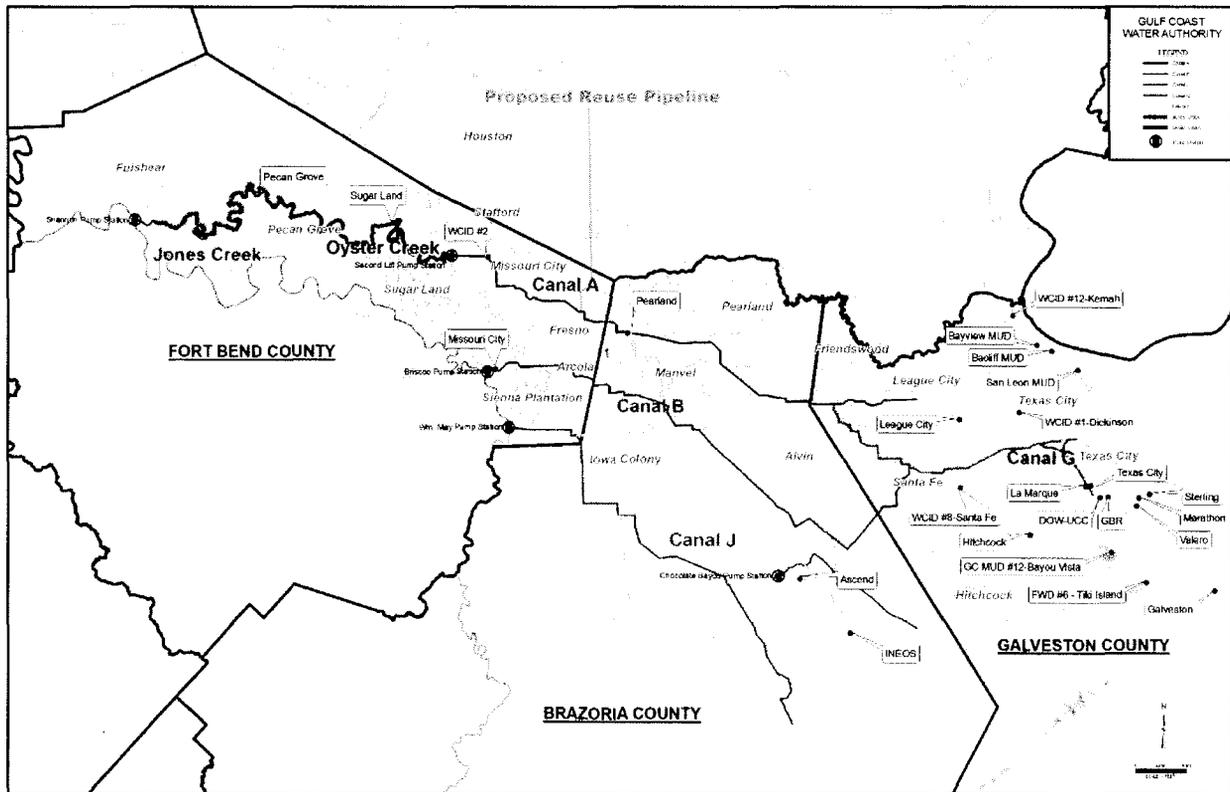


Figure 1 – Map of GCWA canal infrastructure and water customers.

The majority of GCWA’s water is diverted from the Brazos River, as authorized for diversion by the Texas Commission on Environmental Quality (TCEQ) under certificates of adjudication (CoA) 12-5168, 12-5171, and 12-5322. GCWA also has access to water from Chocolate, Mustang, and Halls Bayou (under CoA 11-5357) and from Jones and Oyster Creek (under CoA 11-5169),

although water from these sources is not always reliable and may be of limited utility due to saline-water intrusion. To supplement water available under these certificates, GCWA also maintains long-term water purchase agreements with the Brazos River Authority (BRA), who releases water from upstream reservoirs when requests are made by GCWA.

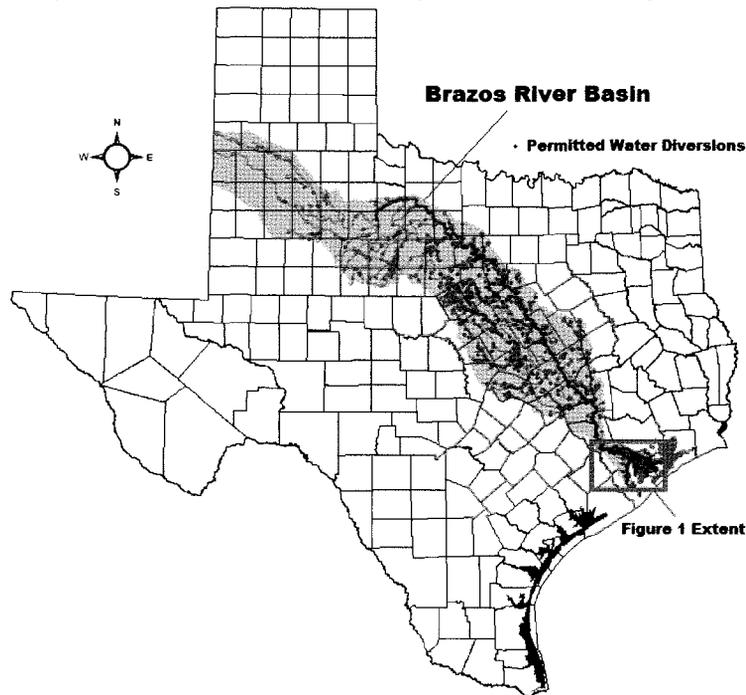


Figure 2 – Texas map showing the Brazos River Basin and the location of GCWA’s service area downstream of over 1,400 permitted water diversions. .

As shown in Figure 2, the GCWA service area is located at downstream end of the Brazos River basin, with over 1,400 permitted water users located upstream from GCWA’s diversion locations. All water users in the basin (with exception of those located upstream of Possum Kingdom Reservoir) are under the jurisdiction of the Brazos Watermaster, who dictates water availability according to prior-appropriation doctrine. As GCWA has relatively senior water rights, the Watermaster, in times of drought, will likely have to restrict upstream water usage in order to provide water for GCWA usage. Therefore any means undertaken by GCWA to supplement or reduce Brazos River water needs during drought periods could benefit users further upstream in the basin, as those users may be able to divert water rather than let it pass downstream to GCWA.

According to the 2016 Region H Regional Water Plan, GCWA will need to identify and obtain additional sources of reliable water in order to satisfy expected water demands for the period from 2020 to 2070. These expected demands, shown by county in Table 1, include demands for industrial, municipal, and irrigation usage. Irrigation is typically for rice production, although water is also used to grow grass and occasionally for other commercial crops. In 2015, GCWA provided users with 152,771 acre-ft of water, including 54,647 acre-ft for municipal usage, 21,091 acre-ft for agricultural usage, and 77,032 acre-ft for industrial usage. In 2011 GCWA

provided customers with 316,297 acre-ft of water, with 94,411 acre-ft, 96,346 acre-ft, and 125,540 acre-ft for municipal, industrial, and agricultural purposes. Usage in 2011 was the highest ever achieved by GCWA, and usage in subsequent years has been reduced due to an overall reduction in irrigated acreage and general conservation measures by municipalities and industries. The projected needs shown in Table 1 are relative to GCWA’s average current needs for the period 2011-2015.

Table 1 – GCWA Projected Needs from the 2016 Region H Water Plan

County	GCWA Needs (acre-ft/yr)					
	2020	2030	2040	2050	2060	2070
Fort Bend	875	4,054	4,154	6,949	8,789	10,926
Brazoria	634	2,108	4,327	7,103	10,646	14,688
Galveston	3,895	4,448	4,559	4,763	5,009	5,253
Total	5,404	10,610	13,040	18,815	24,444	30,8067

Technical Project Description

This project description provides details on the planned UPDATE to GCWA’s existing Drought Contingency Plan (Task B). It describes the current drought contingency plan, and how the update will result in a much improved plan, incorporating the US Bureau of Reclamation’s six required elements. This description also contains details on how GCWA expects to apply each required element to its service area and to the entire Brazos River Basin affected by GCWA water usage operations. The goal of this drought contingency plan update is to provide GCWA and its customers assurance that all possible actions are being undertaken to maximize the likelihood that sufficient water will be available during future drought periods in the Brazos River Basin.

GCWA expects to undertake this project using some of its own staff, but also relying heavily on a private consultant with significant experience working in the Lower Brazos Basin. GCWA and the consultant will organize the stakeholder process in developing the plan updates, and as described below will rely heavily on stakeholder participation to achieve project goals. Numerous GCWA customers have already expressed interest in supporting the project, and more are expected to provide support once the project commences.

GCWA’s Existing Drought Contingency Plan

GCWA’s existing drought contingency plan, as provided with this proposal, was created in 2012 and satisfies all plan requirements stipulated by the Texas Administrative Code (§288.20-§288.22). Under the plan, the general manager of GCWA is given the authority to impose voluntary and mandatory water usage reductions on its customers,

based upon unspecified drought forecasts/triggers and specified water usage rate values. The plan defines four stages of drought response, with increases in curtailment with increases in drought severity. The plan also addresses public/stakeholder involvement in the planning process, obtaining variances from plan requirements, penalties for non-compliance, and how the plan will be periodically updated and reviewed. The plan is sufficiently general in that GCWA retains great flexibility in deciding how to implement the plan, and exactly what actions are to be undertaken at each plan stage. Through this project, GCWA will specify in greater detail what actions are to be taken during each drought stage, and how those actions will be carried out. This update will also serve as the update required by the Texas Commission on Environmental Quality (TCEQ) prior to September 20, 2017.

Areas of Improvement Needed in the Drought Contingency Plan

During the creation of the existing GCWA drought contingency plan, there was much discussion between GCWA and its customers regarding plan contents and the impact required curtailments would have on customer service areas. In general, it was decided that the plan should outline actions to be taken at each drought stage, but that strict definitions of each drought stage were not to be specified. This allows GCWA flexibility in its methods for assessing hydrologic conditions, defining drought, and taking action to ensure reliable water supplies. Through this proposed plan update GCWA will develop and implement three project components designed to minimize drought impacts on its customers. These components include means for better identifying and assessing drought conditions, mitigating drought impact through development of emergency water supplies, and improving delivery efficiency through GCWA infrastructure.

Using Dashboards for Drought Assessment

Currently GCWA staff relies on hydrologic information from a variety of sources (NOAA, TWDB, USGS, NWS, TCEQ, USDA etc.) to make assessments of drought conditions. Often these data sources are large in scale, and not necessarily focused to GCWA’s area of interest. GCWA must spend significant time and energy assessing publically available data sources, synthesizing hydrologic data, determining its impact to the GCWA service area, and ultimately making decisions regarding drought severity. Through this project, GCWA will develop an automated, map-based, web-enabled drought assessment tool (or “dashboard”) through which GCWA will easily be able to assess drought severity and likelihood over the next year. The envisioned dashboard will be similar to the hydrologic dashboards used by the Colorado Water Conservation Board, will access publically available data, and will synthesize

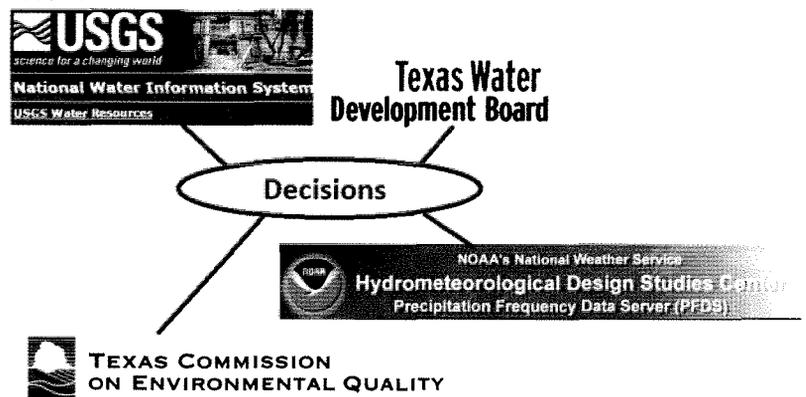


Figure 3 – Hydrologic Data Sources driving GCWA decisions

the data for GCWA to aid in the drought evaluation process. The dashboard will be web-accessible and site secured through user-logins, which will be provided to GCWA customers as well as members of the Drought Task Force and other stakeholders interested in the project. GCWA envisions that the dashboard will evolve in content over the course of this project, with suggested content and analyses provided through numerous meetings between GCWA, project consultants, and project stakeholders.

Conjunctive Use of Locally Available Groundwater

While the first project component strives to aide in drought assessment, this second component works to mitigate water curtailment requirements during more severe drought conditions. Specifically GCWA will investigate the possible use of locally available groundwater to supplement surface water sources during times of drought. The GCWA service area overlies the Gulf Coast Aquifer, which has significant groundwater resources yet sustains limited and controlled pumping due to subsidence concerns. Most municipalities and industries in the area had previously used or installed groundwater wells for their water supplies, yet have been forced to switch to surface water sources per regulations mandated by the Harris-Galveston Subsidence District. GCWA will identify these wells, determine requirements to bring the wells up to operating standards for use in supplementing water supplies, and will determine any infrastructure needs necessary to convey any groundwater supplies into GCWA’s larger distribution system. GCWA will also investigate any permitting requirements for such groundwater usage, including necessary limits on the usage in order to minimize subsidence concerns.

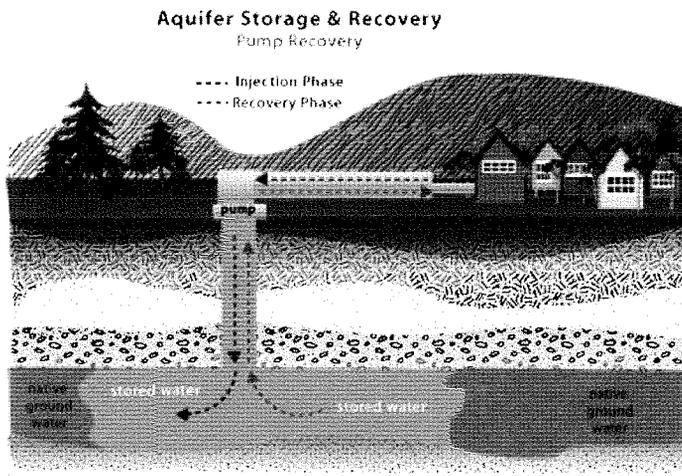


Figure 4 – ASR Concepts for potential use by GCWA

For this project to be successful, GCWA will rely heavily on input from the planned Drought Task Force, expected to consist of GCWA customers who will own and operate the subject wells. Part of the project will involve negotiating terms with each well owner, once all permitting and infrastructure issues have been studied and reported. GCWA has already polled its customers regarding their interest in this line of investigation, and has received both verbal and written affirmations of support.

GCWA also envisions investigating aquifer storage and recovery (ASR) possibilities within the project area. During times with high surface water flows, ASR activities could be used to replenish any groundwater depletions made during severe drought periods. Such a project would likely require the installation of injection wells adjacent to extraction wells utilized to supplement GCWA supplies. This project would assess the utility of such a scheme, and would develop project designs for future implementation as deemed beneficial by GCWA and project stakeholders.

For this task, GCWA and its consultant will work closely with project stakeholders, including regulators at the Harris-Galveston Subsidence District. District rules will have to be carefully evaluated, and GCWA will have to develop means for monitoring impacts of any groundwater withdrawals used to supplement GCWA supplies. This project component is expected to require the largest effort from project members.

Conveyance Loss Assessment and Mitigation

The third planned component of this proposed drought contingency plan update is the development and implementation of a conveyance loss monitoring system. In 2013 and 2015, GCWA conducted small studies designed to assess water losses within its canal system. Through the studies, GCWA was able to identify portions of its clay-lined canal system where losses regularly and periodically occurred. GCWA has identified the causes of some of these losses, and is working to minimize them. Yet other causes (leaks, thefts, etc.) have not been identified. The losses, while always undesirable, are most detrimental during times of drought. Through this drought contingency plan update, GCWA will develop and describe new procedures for loss detection and mitigation along its canal systems. The procedures will be implemented periodically irrespective of drought condition, so that mitigation actions can be put in place prior to drought events. Additional measures will be taken to monitor for new loss sources during drought conditions, and these measures will be outlined as part of the drought contingency plan.

Through loss mitigation, GCWA customers will benefit as their water needs can be satisfied when less water is available from GCWA sources. Loss mitigation will also benefit all users upstream within the Brazos Basin, who may not be required to pass as much streamflow down to GCWA, should GCWA require less flow to satisfy its needs.

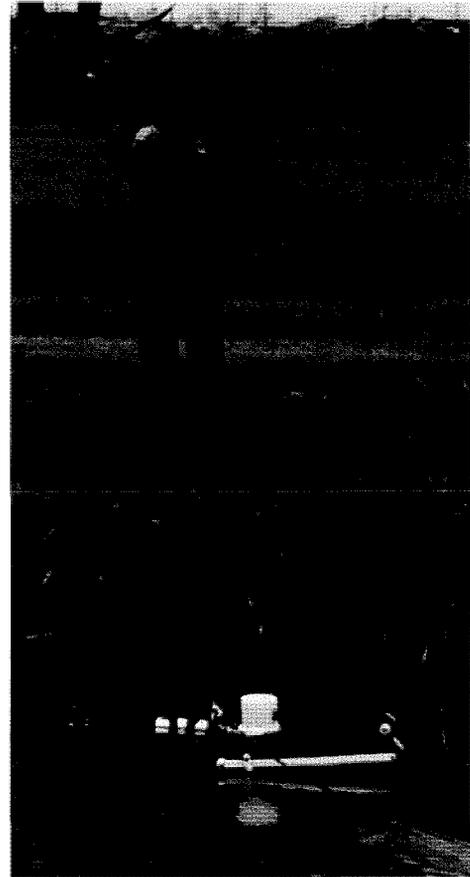


Figure 5 – GCWA Flow metering

Integrating Drought Contingency Planning Elements Applying the Six Drought Planning Elements

As mentioned above, the plan updates to be made by GCWA will enhance the existing plan to better integrate the US Bureau of Reclamations six standard but essential drought contingency planning elements. The six elements outlined in the FOA will be used as a guide and adapted appropriately for application to the GCWA service area. Many of the required elements are already present in the existing plan to a greater or lesser degree, and the plan updates will only enhance their importance.

Element #1 - Drought Monitoring

Drought monitoring activities are not specifically mentioned in GCWA’s existing plan, and will be greatly enhanced through this update project. Through the creation and use of the dashboards described above, GCWA will have synthesized access to available hydrologic information, and can therefore make more informed decisions regarding water supply management. GCWA’s General Manager, or his designee, shall use the dashboards to monitor key water supply and demand conditions within both the GCWA service area and the larger Brazos River Basin, and (when possible) will coordinate drought response actions with the Brazos Watermaster and officials at the Brazos River Authority. GCWA will also closely coordinate with the Harris-Galveston Subsidence District and monitor local aquifer levels and groundwater usage to ensure any groundwater augmentation of surface water supplies during droughts remains within required limits.

For GCWA, the objectives of the Drought Monitoring are twofold: 1) to identify and reliably predict drought conditions, and 2) to guide the implementation and optimization of the conjunctive use of groundwater and surface water within GCWA’s service area. The relative availability of each supply source prior to and during drought mitigation efforts will need to be closely monitored, in conjunction with GCWA customer demands.



Drought Monitoring Tasks



Develop Hydrologic Dashboards

- *Collect Available Hydrologic Data*
- *Spatially Correlate Data & Customer Usage Trends*
- *Make Informed water supply decisions*

Track Groundwater Availability & Needs

Share Dashboard Information With Other Entities

Within the planned drought monitoring dashboard, GCWA will develop short-term (1-6 months) water availability forecasts for use in better informing GCWA regarding the likelihood of meeting its customer’s needs from readily available sources. By necessity, GCWA will develop a database of recent (since 2008) water usage patterns from its customers and from other water

users in the Brazos Basin, and will combine these patterns with assessments of hydrologic trends and water usage decisions dictated by the Brazos Watermaster and the prior-appropriation system. This will allow GCWA to statistically assess likely water availability, and thus better manage available water supplies in response to observed climatic conditions. Through the dashboard process, GCWA will also be able to share its hydrologic analyses with other water users in the region, and thereby also enhance their ability to effectively manage the available water supplies.

Element #2 - Vulnerability Assessment

The vulnerability of supply sources will be assessed based on information obtained from the drought monitoring dashboards, and will assess both surface water and groundwater sources. Through dashboard usage, GCWA will be able to continuously gage the vulnerability of their surface water supplies (as well as their demand needs), and will be able to develop triggers at which groundwater usage will be implemented. GCWA will also continuously monitor groundwater usage and availability to ensure subsidence district rules/limits are not being approached. Groundwater usage will have to be mitigated under such conditions, and in developing the vulnerability assessment processes GCWA will develop separate groundwater triggers dictating its use during drought conditions.

Element #3 - Mitigation Actions

GCWA's updated drought contingency plan will include the specific actions and tasks discussed above, designed to mitigate the impacts of expected future droughts. Actions will be implemented to reduce water demands during all times (i.e. through customer conservation, alternative processes) and to ensure water availability to sustain customer needs. The actions that will be assessed initially include the following:

- Utilizing groundwater to supplement surface water supplies and meet demands
- Canal loss monitoring to ensure available water reaches customers
- Public information and outreach efforts prior to and during drought conditions, and
- Coordination between GCWA and stakeholders through the drought planning taskforce.

Mitigation activities will be included within the drought monitoring dashboard, and will be available for review by the drought planning taskforce. The dashboard will include listings and descriptions of all pertinent actions undertaken according to the updated drought contingency plan, including mitigation actions, response actions and plan updates (described below).

Element #4 - Response Actions

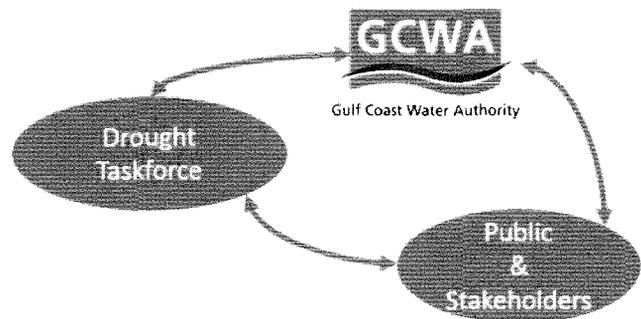
Appropriate response actions that can be implemented prior to and during drought conditions will be identified through the plan update process. Several of these actions, including conjunctive use and improved canal loss monitoring, have been discussed above. Other actions, including a significant public outreach effort, will be included in the response actions considered by GCWA.

The evaluation of response actions will necessarily consider the timeframe required to implement the actions. This is especially true for the use of groundwater supplies to supplement GCWA’s surface water supplies. In developing the plan update, GCWA will have to evaluate all groundwater infrastructure (wells, pipelines, etc.) and determine what system modifications are needed to bring these potential supplies online during times of drought. Hence it is likely that alternative response actions (such as demand reduction, or obtaining other surface water supplies) be identified and evaluated so that they may be utilized while groundwater supplies are being evaluated and ultimately made available.

The current GCWA plan specifies basic methods for ensuring public awareness of drought conditions, and these methods will be refined and developed through this update. Central to this process will be the creation of the drought task force and the coordination between the task force, GCWA, and other stakeholders and members of the public. An overall strategy for implementing, coordinating, and making the public aware of drought response actions will be developed. Emergency response actions will be coordinated by GCWA and the drought task force, as outlined in the proposed plan update.

Element #5- Operational and Administrative Framework

GCWA will provide implement the plan and have ultimately responsibility for all drought management activities and water supply decisions. GCWA will develop the drought taskforce, to consist of interested stakeholders (likely GCWA customers) who will represent their entities in discussions with GCWA regarding the drought planning process.



The administrative framework will consist of the following layers of responsibility

- *GCWA – General Manager or Designated Authority – Full Plan Implementation*
- *GCWA Service Area Task Force – Plan Support & Review*
- *Public/Stakeholder Involvement – Review of plan, drought information, feedback*

The operations framework will provide for the implementation of plan elements:

- **Drought Monitoring – GCWA to create dashboards, data retrieval and analysis, with data review by drought task force**
- **Response Actions – Implemented by GCWA, yet initiated by either GCWA or per request of the drought task force**
- **Mitigation Actions – Implemented and identified by GCWA, with approval sought from the drought task force**
- **Plan Review & Updates – Undertaken by GCWA after review and discuss by drought task force, stakeholders, and the public.**

Element #6 - Plan Update Process

The TCEQ requires updating drought contingency plans every 5 years, and GCWA’s next plan update is due by September 20, 2017. The updates proposed herein will be incorporated in the updated plan to be submitted to TCEQ by this date, even though this project will not be fully completed until July 2018. Updates to GCWA’s plan implemented through this project effort will become GCWA operating procedures upon review by GCWA and the Drought Task Force. Updates will be submitted to TCEQ as required on a 5-year basis or at shorter intervals determined by GCWA. GCWA envisions regular updates or periodic revisions based on interim plan evaluations to be completed on the following schedule:

Item	Timeline
Routine Update for TCEQ	Every five (5) years
Evaluation Reviews:	
After Plan Implementation due to severe drought	Monthly during the plan implementation, with a full review conducted within 1-year of drought cessation
During Prolonged non-drought periods	Annual review of plan components
Public Outreach Effectiveness	Annual review

Evaluation Criteria

Evaluation Criterion A – Need for a Drought Contingency Plan or Plan Update

GCWA needs to update its drought contingency plan for three basic reasons:

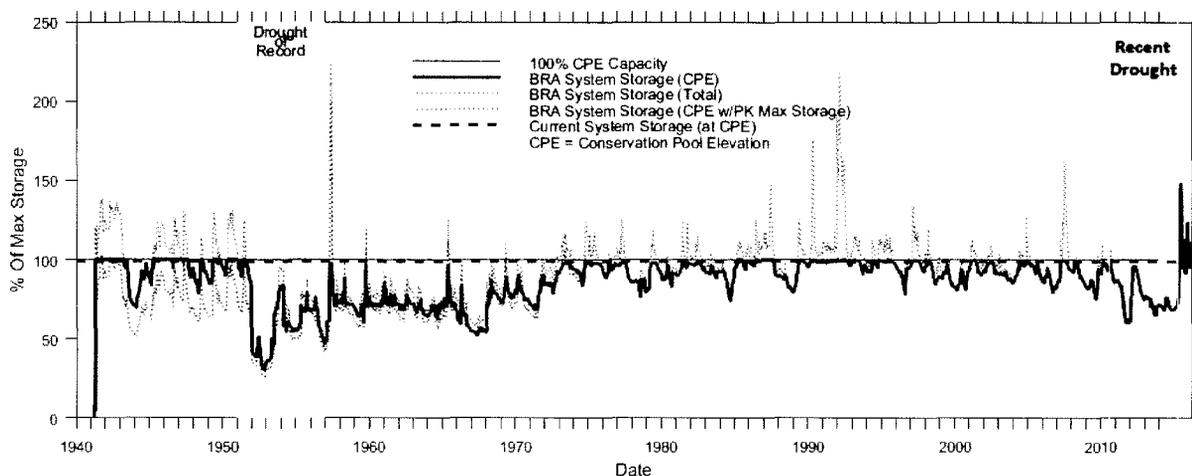
1. TCEQ requires an update prior to September 20, 2017
2. Droughts will occur within GCWA’s service area in the near future, and
3. Over 1 million people and industries vital to the US economy depend on GCWA for their water supplies

The existing plan, while sufficient per state law, does not adequately address issues related to drought monitoring and supply planning and does not provide entities with great confidence that their livelihoods can be sustained through future dry periods. It is GCWA’s statutory responsibility to do everything possible to sustain and enhance their service area’s water supply. This drought contingency plan update is one step toward in this mission.

Existing and Recent Droughts

Texas is not immune to droughts, and this is certainly true for the lower Brazos basin from which GCWA delivers water to sustain three populous and rapidly growing counties. With the recent rains in 2015-2016, GCWA currently enjoys what is likely to be a brief respite from

worrying about water security – which is the perfect time to update a drought contingency plan. Based on historical climate records, GCWA’s service area has been routinely plagued by drought, and that any short wet periods are more likely to be the exception rather than the rule. GCWA’s location near the bottom of the Brazos Basin also makes them more susceptible to drought, as upstream water users by definition have first access at available streamflows before they reach GCWA. This was evident during the most recent drought in 2011, during which over 88% of Texas was classified as being in a state of exceptional drought. It was estimated that the 2011 drought causes over \$8 billion in losses to the Texas economy. Numerous water systems statewide were impacted, with many unable to maintain water for public health and safety needs. Fortunately GCWA had planned sufficiently to sustain itself through the 2011 drought, but had the drought continued even GCWA’s resources would have been depleted, causing service disruptions and outages.



One method for assessing drought is through review of reservoir storage levels in a region. As shown above, the storage levels for major reservoirs affecting GCWA water supplies have fluctuated between 50% capacity and over 100% capacity, with the greatest deficits occurring recently and during the 1950’s drought of record. The recent drought period, extending from 2009 through 2015, was the most severe and prolonged dry period since the late 1970’s. What is not indicated, however, is how more recent water supplies need to sustain a greater population and number of vital industries – thus making the economic and human-hardship aspects of recent droughts more damaging. This was evident in both 2009 and 2011 when low streamflows caused GCWA and others in the Lower Brazos Basin to force TCEQ to curtail diversion rights for entities lawfully permitted to use water further upstream in the basin. The resulting regulatory chaos led to the creation of a Brazos Watermaster in 2014, whose role is to allocate scant water resources amongst all water right holders. GCWA is currently under the jurisdiction of the watermaster, and has had to adjust operations plans accordingly.

Future Droughts and Climate Impacts

Future population and water demand projections for the GCWA service area indicate even greater water stress for the region, thus making excellent planning now a requirement for future drought survival. All indications suggest that the lower Brazos Basin will have to “do more with less” as future demands are to be incurred at times when streamflows are likely less. This concept has been further quantified by leading experts, including staff from Dow Chemical, one of the largest industries within the GCWA service area. During a 2011 legislative briefing, Dow staff testified that due to climate change, by 2050 total annual flows in the Brazos River could be **reduced by 20-26%**, with most flows occurring in large pulses, largely unusable by the water users in the lower basin.

Drought Risks

GCWA is largely at the mercy of the Brazos Watermaster in its ability to utilize its rights to water from the Brazos River. The watermaster is tasked to apply prior-appropriation doctrine to allocate water amongst users based on needs and seniority of their water rights. GCWA does have relatively senior water rights, yet its location at the downstream end of the basin, causes it to be subject to the diversion practices of those upstream. Currently there are 1400 permitted water users upstream of GCWA, including many municipalities and agricultural interests with junior water rights. It is as of yet unknown whether the Brazos watermaster will curtail these upstream rights in times of drought, so that GCWA and others downstream may exercise their rights and provide water to customers. Due to this uncertainty, it is imperative that GCWA assume future Brazos River water available to be less than current, and thus to develop detailed contingency plans to mitigate the lower available streamflow. This drought contingency plan update will serve as a big step forward in implementing “drought-proofing” measures, while inoculating GCWA from the whims of the watermaster and potentially reducing downstream water demands so that greater demands from upstream water right holders may be satisfied.

Economic Impacts

The GCWA service area to be covered by this drought contingency plan update makes up a portion of the Texas Region H water planning area, described as “an economic powerhouse critical to the Texas and national economies.” Adequate water supplies are essential to the continued economic health and to the region’s future growth. Two thirds of all US petrochemical production and almost a third of the nation’s petroleum industries are located

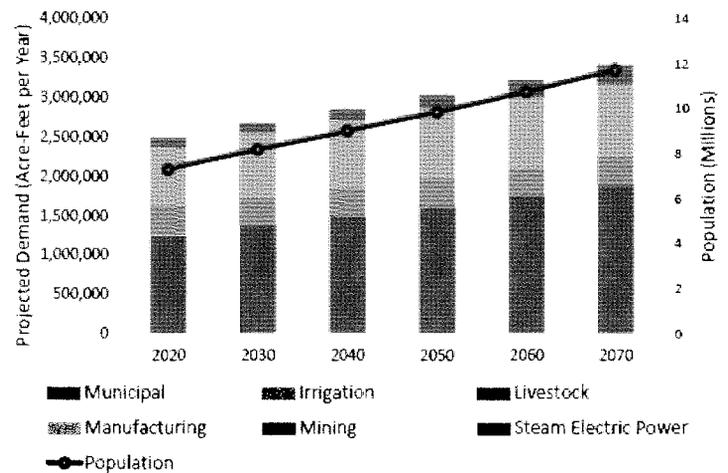
Projected Climate Change Impacts to GCWA’s Service Area
(source: NCA2014.globalchange.gov)

By 2070:

- 13-19 days exceeding the current hottest daily temperature
- 35-45 nights exceeding the current hottest night temperature
- Increases of 2-4 days between rainfall events

By 2100:

- Average 15% decrease in precipitation
- Soil moisture decreases 5-10%



within and around the GCWA service area, and all these industries cannot function without adequate water supplies. Disruption of water services for even short periods would necessitate plant closures, causing deleterious ripple-effects across the US economy and the nation. It is only through adequate contingency planning that such events may be avoided in the future.

GCWA's Existing Drought Contingency Plan and Long-term planning efforts

GCWA is continually studying ways to further ensure a reliable water supply for its customers. Development of the current GCWA "Long Range Water Supply Study" commenced in 2011. The plan undertook a multi-faceted approach where consultants familiar with GCWA operations and Texas water resources worked in parallel. INTERA was hired to model GCWA system needs and quantify the amount of additional water needed to meet expected GCWA demands. INTERA was also asked to identify water supply sources that could be obtained by GCWA over timeframes of less than three years. Freese and Nichols was tasked with identifying and evaluating longer-term strategies for meeting expected future needs. Of the conclusions drawn by these firms, drought demand reductions and decreases in canal conveyance losses were deemed most beneficial and easiest to implement. These concepts form the basis for the proposed lines of inquiry included in this proposal, and will continue to form the base of GCWA drought contingency planning into the future. Additional long-term planning efforts focus on obtaining water from Non-Brazos River sources, including groundwater and surface water transferred from other basins. Usage of groundwater, as proposed herein, has been considered both a long-term and short term solution, due to the relative ease of implementation and the reliability of the supplemental supply to GCWA.

As previously stated, GCWA's existing drought contingency plan is adequate per state law, yet lacking in detail to provide much confidence in GCWA's ability to ensure supplies. Through this update, the plan details will be developed, data analysis plans will be formulated, and public involvement will be included at every step. GCWA will be able to provide its customers greater assurance their supplies will be reliable, thereby ensuring health and prosperity to the region.

Evaluation Criterion B – Inclusion of Stakeholders

Within GCWA's Service area, there is a diverse set of potential stakeholders to this project. The set includes all of GCWA's current and potential future customers, who are and will be directly governed by the actions incorporated into the plan. Many of these stakeholders are already committed to the planning process described herein, and most were also participants in the development of the existing plan. GCWA fully expects each of its customers to participate in the plan update process, and to form part of the drought task force established to direct and review the planning process. Additional stakeholders are likely to include the Brazos River Authority, Texas Parks and Wildlife Department, the Houston-Galveston Subsidence District, the National Wildlife Federation, the Sierra Club, the Lower Brazos River Coalition, and interested members of the general public. Upon receipt of this planning grant, GCWA's first course of action will be to announce the grant to all potential stakeholders, and to solicit their participation in this important regional process.

Stakeholders Identified To Date

GCWA Drought Contingency Plan Update - Participants							
Entity	Level			Primary Interest			
	Commit	Interest	Expected	MUN	IND	IRR	ENV
San Leon MUD	X			X			
Galveston County Mud #12	X			X			
Bayview MUD	X			X			
City of League City	X			X			
City of Missouri City		X		X			
City of Sugarland		X		X			
Ascend Performance Materials		X			X		
Marathon Petroleum		X			X		
INEOS		X			X		
Dow Chemical		X			X		
NRG Energy		X			X		
Brazos River Authority			X	X	X	X	
Lower Brazos River Coalition		X		X	X	X	X
Harris-Galveston Subsidence District			X	X	X	X	
Texas Farm Bureau			X		X	X	
Texas Parks And Wildlife			X				X
Texas Water Development Board			X	X	X	X	X

Details regarding this proposal were presented to the GCWA municipal customer meeting on March 9, 2016. All participants in that meeting voiced approval for the proposal, yet many stated they would not be able to provide written approval prior to the submission deadline. Upon receipt of the award, GCWA will re-contact all customers and solicit their assistance with the plan update. GCWA will also organize multiple public meetings regarding plan update, and will advertise such meetings in order to obtain beneficial project results. During this first solicitation and at the first subsequent public meeting, GCWA will identify potential members for the drought task force, and will explicitly request participation as such from each identified party.

Evaluation Criterion C – Project Implementation

Addressing the Six Elements

Although this proposed project is an update to an existing drought contingency plan, GCWA considers its existing plan to be lacking detail in all six of the planning elements required by US Bureau of Reclamation. As such, this project will update the plan and enhance all six of the planning elements. As described in the *Technical Proposal* section herein, GCWA will organize a drought task force comprised of interested stakeholders to review and guide plan development efforts. GCWA will develop the plan largely through efforts of a hired consultant with expertise in the Lower Brazos Basin, water availability modeling, groundwater subsidence, wellfield evaluation, and data analysis through dashboard creation. The consultant will work with GCWA and the Drought Task force to organize stakeholder meetings and to develop a work plan identifying how all plan updates will be accomplished. The consultant will work closely with drought task force members, especially on evaluation of groundwater infrastructure to be utilized in supplementing streamflows during drought. Public input will be included in the work plan development. The **drought monitoring** element will be defined by data collection and assemblage/analysis within a web-based GCWA dashboard, will utilize publically available drought data, and will synthesize all available data into a meaningful and comprehensive short term water availability assessment for GCWA. Water availability models used by the Brazos River Authority, the TCEQ, and possibly the US Army Corps of Engineers will be incorporated into the dashboard as appropriate. The dashboard will also utilize data to determine water supply risks during the **vulnerability assessment**, and will also monitor impacts of supplemental groundwater withdrawals on local subsidence. The drought task force, GCWA, and public will also be relied upon to express vulnerability concerns. The **mitigation actions** will include means to reduce canal losses within the GCWA system, and will be directed by the project consultant. **Response actions** will be developed by GCWA and the drought task force based on recommendations of the project consultant, who will facilitate public/stakeholder meetings on this aspect of plan development. The consultant will build a suggested set of actions and triggered responses, with an initial prioritization of actions. The actions and priorities will then be thoroughly reviewed and ultimately endorsed by the drought task force and GCWA.

Project Schedule

GCWA and its project consultant have developed a proposed project schedule (see below) which is ambitious yet achievable, and yields completion of a majority of the plan updates prior to the September 20, 2017 TCEQ-imposed deadline for GCWA plan revision. For the period between September 2017 and the project completion date (July 2018), GCWA and the project consultant will make further plan refinements, will improve the project dashboard, and will fully implement the water-loss mitigation/monitoring program. Public/stakeholder input opportunities will be held regularly, initially at 3-month intervals pending public enthusiasm. Project materials and status updates will be made available via an online-project website, developed as part of the dashboard creation process. GCWA will be provided monthly update

on the project status, including consultant work plans and project budget.

	Preliminary Project Timeframe																								
	2016						2017												2018						
	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J
Drought Task Force Appointed																									
Administrative Tasks**																									
Work Plan Development																									
Public/Stakeholder Plan Development																									
Reporting																									
Progress Reporting																									
Finance Reporting																									
Final Reporting																									
PLAN ELEMENTS																									
Drought Monitoring																									
Vulnerability Assessment																									
Mitigation Actions																									
Groundwater Usage Plan																									
Loss Mitigation Plan																									
Other Actions																									
Response Actions																									
Operational & Administrative Framework																									
Schedule for Plan Updating																									

Staff Expertise

GCWA employs two staff engineers tasked with maintaining the GCWA canal system and operation. These engineers guide a support staff of canal runners, operators, water treatment professionals, and maintenance technicians. All staff will be able to assist in the development of this plan update, yet the majority of the project effort will be undertaken by a project consultant hired specifically for this project. Consultant expertise will be provided by LRE Water, LLC, in turn lead by Dr. Jordan Furnans PE, PG, CFM. Dr. Furnans has been a consultant to GCWA continuously since 2010, and has assisted GCWA in water availability assessment, water rights litigation, groundwater supply evaluations, canal system evaluations, loss mitigation, and other areas. Dr. Furnans has been professionally active in the Brazos River basin since 2003, and is a recognized expert in numerical modeling for water resources applications. His company, LRE Water LLC, has developed dashboards used by agencies throughout Colorado, including the Colorado Division of Natural Resources and private water authorities similar in mission to GCWA. LRE Water’s groundwater services group will perform the groundwater related portions of this project. All project tasks will be overseen by Dr. Furnans, who will be responsible for coordinating project efforts and will lead all public/stakeholder meetings along with GCWA staff. LRE Water, LLC will manage the project from their office in Round Rock, TX yet may open a Texas City, TX temporary office in order to facilitate this project effort.

Evaluation Criterion D – Nexus to Reclamation

No Bureau of Reclamation projects are located within the immediate vicinity of GCWA's operational area. However projects do exist within the Brazos River Basin, and therefore will potentially benefit from GCWA's expected drought contingency operations. Three projects within the Brazos River Basin are:

- *Flat Creek Water Reuse Project – (2008) – A feasibility study for local water reuse*
- *Lake Waco Wetlands Project – (2014) “Investigating an Innovative Constructed Wetland Design for Attenuating Endocrine Disrupting Compounds from Reclaimed Wastewater” under the Bureau of Reclamation’s Science and Technology Program*
- *McLennan County Drought Contingency and Water Supply Resiliency Plan - (2015) A project undertaken with a WaterSMART Drought Contingency Planning Grant from 2015.*

GCWA's work plan for updating its drought contingency plan was based heavily on the proposed approach by McLennan County in their successful 2015 proposal. GCWA will interact directly with the McLennan County Water Resources Group throughout this project to learn from their experiences and thus make the GCWA plan update process more efficient.



Gulf Coast Water Authority

Drought Contingency Plan Update

GCWA Board Resolution

Applicant:

Gulf Coast Water Authority
Ivan Langford, General Manager
3630 FM 1765
Texas City, TX 77591

Project Manager:

Jordan Furnans, PhD, PE, PG, CFM
1000 Heritage Center Circle, Suite 141
Round Rock, TX 78664
Email: Jordan.Furnans@lrewater.com
Phone: 512-736-6485

April 11, 2016

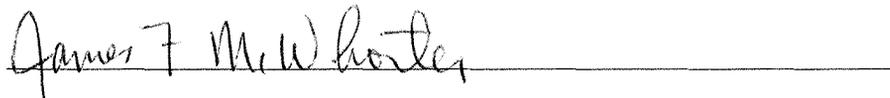
APPLICANT RESOLUTION

Resolved that the governing officials for the Gulf Coast Water Authority have:

- Reviewed and support the application submitted under the WaterSMART: Drought Contingency Planning Grants for Fiscal Year 2016 (FOA No. R16-FOA-DO-005),
- The capability to provide the amount of funding and/or in-kind contributions specified in the funding plan (minimum 50% cost share, with grant funding not to exceed \$200,000), and
- Will work with Reclamation to meet established deadlines for entering into a cooperative agreement.

We certify that the above constitutes a true and correct copy of the resolution approved by the governing officials of the Gulf Coast Water Authority.

James McWhorter



President
Gulf Coast Water Authority Board of Directors

March 17, 2016





Gulf Coast Water Authority

Drought Contingency Plan Update

GCWA Letters Of Support

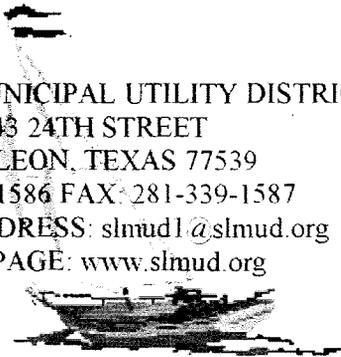
Applicant:

Gulf Coast Water Authority
Ivan Langford, General Manager
3630 FM 1765
Texas City, TX 77591

Project Manager:

Jordan Furnans, PhD, PE, PG, CFM
1000 Heritage Center Circle, Suite 141
Round Rock, TX 78664
Email: Jordan.Furnans@lrewater.com
Phone: 512-736-6485

April 11, 2016



SAN LEON MUNICIPAL UTILITY DISTRICT
443 24TH STREET
SAN LEON, TEXAS 77539
281-339-1586 FAX: 281-339-1587
EMAIL ADDRESS: slmud1@slmud.org
WEB PAGE: www.slmud.org

March 23, 2016

Mr. Ivan Langford
General Manager
Gulf Coast Water Authority
3630 FM 1765
Texas City, TX 77591

Re: Gulf Coast Water Authority Drought Contingency Plan Update Project

Dear Mr. Langford:

On behalf of the Board of Directors of the San Leon Municipal Utility District (San Leon MUD), I am writing in support of the Gulf Coast Water Authority's (GCWA) grant application to update its existing drought contingency plan so as to better prepare our community to handle future expected droughts. I believe that an updated drought contingency plan, on that includes specific reference to usage of available ground water, is the correct first step.

San Leon MUD provides water and wastewater services to over 2600 home and businesses in an unincorporated area along the western shore of Galveston Bay. Our current population is estimated to be in excess of 5,000 people, many of whom are economically disadvantaged.

A flexible and user-friendly drought plan will help GCWA, its customers, and residents to more effectively manage water demand through increased local efficiency and resource utilization, as well as pave the way for water efficiency actions and activities for future development. It will require a concerted effort by GCWA and all communities served by GCWA to manage water during future droughts that are projected to affect Texas in the near future. We are willing to do our part, and will support GCWA in its efforts to do likewise.

I am fully supportive of GCWA's application for grant funding for drought contingency planning, and am willing to serve, as needed, on a project stakeholder committee to help ensure project success.

Respectfully,



Joe Manchaca
President
San Leon MUD

Galveston County Municipal Utility District no. 12
2929 Highway 6, Suite 300
Bayou Vista, Texas 77563

Telephone: (409) 935-6111

Fax: (409) 935-4340

March 10, 2016

Mr. Ivan Langford
General Manager
Gulf Coast Water Authority
3630 FM 1765
Texas City, TX 77591

Subject: Gulf Coast Water Authority Drought Contingency Plan Update Project

Dear Mr. Langford:

On behalf of the Galveston County MUD #12, I am writing in support of the Gulf Coast Water Authority's (GCWA) grant application to update its existing drought contingency plan so as to better prepare our community to handle future expected droughts. I commend the authority's actions to be proactive in the fight against the effects of drought in Texas and believe that an updated drought contingency plan, one that includes specific reference to usage of available groundwater, is the correct first step.

Galveston County MUD #12's service area is the City of Bayou Vista, Original Bayou Vista and Omega Bay with a combined population of approximately 2,500. The District provides service to 1,513 connections. The water purchased from Gulf Coast Water Authority is used for drinking, cooking, bathing, watering of vegetation, the filling up of pools; power washing of homes and the washing of vehicles.

A flexible and user-friendly drought plan will help GCWA, its customers, and residents of the entire Brazos River basin to more effectively manage water demand through increased local efficiency and resource utilization, as well as pave the way for water efficiency actions and activities for future development. We know that it will require a concerted effort by GCWA and all communities served by GCWA to manage water during future droughts that are projected to affect Texas in the near future. We are willing to do our part, and will support GCWA in its efforts to do likewise.

I am fully supportive of GCWA's application for grant funding for drought contingency planning, and am willing to serve, as needed, on a project stakeholder committee to help ensure project success.

Respectfully,



Bill Alcorn, President
Galveston County MUD #12
Board of Directors

Bayview Municipal Utility District

309 Miles

Bacliff, TX 77518

Phone - 281-339-1959

Fax - 281-339-3083

***Billy Woolsey Jr., President
Troy Bradfield, Vice-President***

***Linda Elliott, Secretary
Leonard Loukanis, Director
Ron Williams, Director***

March 23, 2016

**Mr. Ivan Langford
General Manager
Gulf Coast Water Authority
3630 FM 1765
Texas City, TX 77591**

Subject: Gulf Coast Water Authority Drought Contingency Plan Update Project

Dear Mr. Langford:

On behalf of the Bayview Municipal Utility District Board of Supervisors, I am writing in support of the Gulf Coast Water Authority's (GCWA) grant application to update its existing drought contingency plan so as to better prepare our community to handle future expected droughts. I commend the authority's actions to be proactive in the fight against the effects of drought in Texas and believe that an updated drought contingency plan, one that includes specific reference to usage of available groundwater, is the correct first step.

The Bayview MUD services the northern part of Galveston County with approximately 2300 residents with 684 connections. The number consists of roughly 95% residential use for personal consumption and irrigation and 5% commercial.

A flexible and user-friendly drought plan will help GCWA, its customers, and residents of the entire Brazos River basin to more effectively manage water demand through increased local efficiency and resource utilization, as well as pave the way for water efficiency actions and activities for future development. We know that it will require a concerted effort by GCWA and all communities served by GCWA to manage water during future droughts that are projected to affect Texas in the near future. We are willing to do our part, and will support GCWA in its efforts to do likewise.

We are fully supportive of GCWA's application for grant funding for drought contingency planning.

Respectfully,

**Billy Woolsey, President
For the Bayview Municipal Utility District Board of Supervisors**



John Baumgartner
Deputy City Manager
300 W Walker
League City, TX 77573

Main: 281.554-1411
Direct: 281.554.1414

www.leaguecity.com

March 23, 2016

Mr. Ivan Langford
General Manager
Gulf Coast Water Authority
3630 FM 1765
Texas City, TX 77591

Subject: Gulf Coast Water Authority Drought Contingency Plan Update Project

Dear Mr. Ivan:

I am writing in support of the Gulf Coast Water Authority's (GCWA) grant application to update its existing drought contingency plan so as to better prepare our community to handle future expected droughts. I commend the authority's actions to be proactive in the fight against the effects of drought in Texas and believe that an updated drought contingency plan, one that includes specific reference to usage of available groundwater, is the correct first step.

The City of League City currently serves a population of approximately 100,000 residents and is located in Northern Galveston County along the I-45 corridor. Neighboring communities include, Friendswood, Webster, Clear Lake City, Kemah, Nassau Bay, and Dickinson. Major sectors of the City's economic base include aerospace, petrochemical, health care, upscale commercial, boating, and visitor attractions. GCWA serves as League City's contracted surface water purveyor and currently provides up to 25.044 MGD of treated surface water from the Southeast Water Purification Plant and the Thomas Mackey Water Treatment Plant. The City currently has approximately 32,000 active water connections serving an average daily demand of 10 million gallon per day and seasonal peak demands of up to 21 million gallons per day.

A flexible and user-friendly drought plan will help GCWA, its customers, and residents of the entire Brazos River basin to more effectively manage water demand through increased local efficiency and resource utilization, as well as pave the way for water efficiency actions and activities for future development. We know that it will require a concerted effort by GCWA and all communities served by GCWA to manage water during future droughts that are projected to affect Texas in the



near future. We are willing to do our part, and will support GCWA in its efforts to do likewise.

I am fully supportive of GCWA's application for grant funding for drought contingency planning, and am willing to serve, as needed, on a project stakeholder committee to help ensure project success.

Respectfully,

A handwritten signature in cursive script, appearing to read "John Baumgartner".

John Baumgartner
Deputy City Manager

JB: dao

**DROUGHT
CONTINGENCY PLAN
FOR GULF COAST
WATER AUTHORITY**



October 2012

Prepared for:

**GULF COAST WATER
AUTHORITY**

2012/10/12

Jason D. Afinowicz, P.E.

FN0908

Prepared by:

Freese and Nichols, Inc.
10497 Town and Country
Way
Suite 600
Houston, Texas 77024
(713) 600-6800

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EXHIBITS

Exhibit 1 Overall System Map

APPENDICES

Appendix A Texas Commission on Environmental Quality Rules on Drought Contingency Plans

Appendix B Quick Reference Guide

Appendix C Resolution Adopting Drought Contingency Plan

Appendix D Letter to Region H Water Planning Group

1.0 INTRODUCTION

The purpose of this drought contingency plan (the Plan) for Gulf Coast Water Authority (GCWA) is as follows:

- To conserve the available water supply in times of drought and emergency,
- To maintain supplies for domestic water use, industrial use, sanitation, and fire protection,
- To protect and preserve public health, welfare, and safety,
- To minimize the adverse impacts of water supply shortages,
- To minimize the adverse impacts of emergency water supply conditions, and
- To satisfy the requirements set forth by TCEQ and other agencies.

A drought is defined as an extended period of time when an area receives insufficient amounts of rainfall to replenish the water supply, causing water supply shortages. In the absence of drought response measures, water demands tend to increase during a drought due to the need for additional outdoor irrigation. The severity of a drought depends on the degree of depletion of supplies and on the relationship of demand to available supplies.

2.0 TCEQ REQUIREMENTS FOR DROUGHT CONTINGENCY PLANS

This Plan is consistent with Texas Commission on Environmental Quality (TCEQ) guidelines and requirements for the development of drought contingency plans by wholesale water suppliers, contained in Title 30, Part 1, Chapter 288, Subchapter B, Rules 288.20–288.22 of the Texas Administrative Code. These rules are included in *Appendix A*.

3.0 PUBLIC INVOLVEMENT

Opportunity for the public and GCWA's water customers to provide input into the preparation of the Plan was provided by GCWA through the following measures:

- Providing written notice of the proposed plan and the opportunity to comment on the plan by newspaper, posted notice, and notice on GCWA's website,

- Making the draft plan available on GCWA's web site,
- Providing the draft plan to anyone requesting a copy, and
- Holding a public meeting.

4.0 WATER CUSTOMER EDUCATION

After the Plan is adopted, GCWA will continue to inform and educate the public about the Plan through the following measures:

- Preparing a bulletin describing the Plan and making it available at appropriate locations,
- Making the Plan available to the public through the web site,
- Including information about the Plan on the web site, and
- Notifying local organizations, schools, and civic groups that GCWA staff are available to make presentations on the Plan (usually in conjunction with presentations on water conservation programs).

5.0 AUTHORIZATION OF DROUGHT RESPONSE

The GCWA General Manager or his/her designee (the GM), is hereby authorized and directed to implement the applicable provisions of this Plan upon determination that such implementation is necessary to protect public health, safety, and welfare. The GM shall have the authority to initiate or terminate drought or other water supply emergency response measures as described in this Plan.

6.0 APPLICATION OF DROUGHT RESPONSE MEASURES

The provisions of this Plan shall apply to all of GCWA's water supply customers. The terms "person" and "customer" as used in the Plan include individuals, corporations, partnerships, associations, municipalities, political subdivisions, and all other legal entities.

The following actions will be taken when a drought stage is initiated:

- The affected public will be notified through local media,

- GCWA's customers who are potentially affected by a drought or emergency (the Affected Customers) will be notified by e-mail with a follow-up letter or fax that provides details of the reasons for initiation of the drought contingency stage, and
- If any mandatory provisions of the Plan are activated, GCWA will notify the Executive Director of the TCEQ within 5 business days.

The GM may decide not to order the implementation of a drought contingency response stage even though one or more of the trigger criteria for the stage are met. Factors which could influence such a decision include, but are not limited to, the time of the year, weather conditions, the anticipation of replenished water supplies, or the anticipation that additional facilities will become available to meet needs.

7.0 CRITERIA AND ACTIONS REQUIRED FOR DROUGHT OR EMERGENCY RESPONSE STAGES FOR AFFECTED CUSTOMERS

This section describes the criteria for and actions required for drought response stages for only Affected Customers based on the concepts of system demand and deliverable capacity, as defined below:

- **Affected Customers:** customers that are impacted by a particular shortage of deliverable capacity compared to system demand.
- **System demand:** demand on the system at a critical point where downstream customers can be affected by a reduction or total loss of service.
- **Deliverable capacity:** the ability to convey water at a given point in the system as limited by river conditions, diversion capacity, conveyance capacity, treatment capacity, etc.

Affected Customers include the customers that have take points downstream of the circumstances that are triggering a drought or emergency response. For instance, GCWA's canal customers may be affected by events impacting river pump stations or canal conveyance to the point of diversion by the customer. Similarly, GCWA treated water customers may be impacted by events concerning the river pump stations and canal conveyances, but also storage in GCWA reservoir, and operation of water treatment and distribution infrastructure. The concept of Affected Customers is intended to limit the scope of drought response to only those customers directly impacted by a significant event, whether it be related to river conditions, pump station capacity, or conveyance and other infrastructure. A summary of the drought stages can be found in *Appendix B*.

7.1 STAGE 1 RESPONSE (MILD WATER SHORTAGE)

A Stage 1 Response for Affected Customers can be triggered when:

- The GM finds that conditions warrant the declaration of a Stage 1 Response or
- System demand exceeds 85% of deliverable capacity for three consecutive days.

A Stage 1 Response may be terminated when the circumstances that triggered the initiation of Stage 1 no longer prevail for seven consecutive days, or at the GM's discretion.

The goal for water use under Stage 1 is a 5% reduction of the use that would have occurred in the absence of drought contingency measures. The GM may order the implementation of any of the following actions deemed necessary:

- Notify all Affected Customers that a Stage 1 drought condition exists,
- Require all Affected Customers to initiate Stage 1 or other appropriate stage in their drought contingency plan,
- Request voluntary reductions in water use by Affected Customers, or
- Increase public awareness of drought condition and measures to reduce demand.

If a Stage 1 drought condition is declared, TCEQ will be notified within five days of initiation and termination.

7.2 STAGE 2 RESPONSE (MODERATE WATER SHORTAGE)

A Stage 2 Response for Affected Customers can be triggered when:

- The GM finds that conditions warrant the declaration of a Stage 2 Response or
- System demand exceeds 90% of deliverable capacity for three consecutive days.

A Stage 2 Response may be terminated when the circumstances that caused the initiation of Stage 2 no longer prevail for seven consecutive days, or at the GM's discretion.

The goal for water use reduction under a Stage 2 Response is a 10% reduction of the use that would have occurred in the absence of drought contingency response measures. If the circumstances warrant, the GM can set a goal for greater water use reduction.

The GM may order the implementation of any of the actions listed below as deemed necessary. The Stage 2 Response measures are as follows:

- Continue or initiate any actions available under Stage 1,
- Notify all Affected Customers that a Stage 2 drought condition exists,

- Require Affected Customers to initiate Stage 2 or other appropriate stage in their drought contingency plan,
- Meet with Affected Customers to determine water use on a weekly basis, identify Affected Customers exceeding 95% of their contract amount, and advise them to reduce their usage,
- Cease issuance of new short-term or interruptible contracts with the exception of emergency conditions
- Terminate existing interruptible contracts, or
- **Requires TCEQ Notification:** Impose mandatory reductions in water use by Affected Customers.

If a Stage 2 drought condition is declared, TCEQ will be notified within five days of initiation and termination.

7.3 STAGE 3 RESPONSE (SEVERE WATER SHORTAGE)

A Stage 3 Response for Affected Customers can be triggered when:

- The GM finds that conditions warrant the declaration of a Stage 3 Response or
- System demand exceeds 95% of deliverable capacity for three consecutive days.

A Stage 3 Response may be terminated when the circumstances that caused the initiation of Stage 3 no longer prevail for seven consecutive days, or at the GM's discretion.

The goal for water use reduction under a Stage 3 Response is a 20% reduction in the use that would have occurred in the absence of drought contingency measures. If the circumstances warrant, the GM can set a goal for greater water use reduction.

The GM may order the implementation of any of the actions listed below as deemed necessary. The Stage 3 Response measures are as follows:

- Continue or initiate any actions available under Stages 1 and 2,
- Notify all Affected Customers that a Stage 3 drought condition exists,

- Require Affected Customers to initiate Stage 3 or other appropriate stage in their drought contingency plan,
- Continue to coordinate with Affected Customers to determine water use on a daily basis, identify Affected Customers exceeding 85% of their contract amount, and advise them to reduce their usage,
- Encourage Affected Customers to engage alternative sources of supply where feasible, or
- **Requires TCEQ Notification:** Impose mandatory water rationing under TWC §11.039 to reduce demand below the Stage 3 trigger point.

If a Stage 3 drought condition is declared, TCEQ will be notified within five days of initiation and termination.

7.4 WATER EMERGENCY RESPONSE (EMERGENCY WATER SHORTAGE)

A Water Emergency Response for Affected Customers can be triggered when the GM finds that conditions warrant the declaration of a Water Emergency Response because:

- A major system failure leading to loss of water service occurs; or
- The water supply becomes contaminated and unusable; or
- Other emergency conditions exist as determined by the GM.

A Water Emergency Response may be terminated when the circumstances that caused the initiation of the Water Emergency Response no longer prevail for twenty-four hours, or at the GM's discretion.

The goal for water use reduction under a Water Emergency Response is subject to the scope of the emergency. The GM may order the implementation of any of the actions listed below as deemed necessary. The Water Emergency Response measures are as follows:

- Continue or initiate any actions available under Stage 1, 2, and 3,
- Notify all Affected Customers that an emergency condition exists and meet with Affected Customers as appropriate to inform them of the specific nature of the emergency condition,

- Require Affected Customers to initiate the emergency or other appropriate stage in their drought contingency plan, or
- **Requires TCEQ Notification:** Impose mandatory water rationing under TWC §11.039 to reduce demand to the appropriate level as determined by the GM.

If an emergency condition is declared, TCEQ will be notified within five days of initiation and termination.

8.0 WATER ALLOCATION

In the event that the triggering criteria specified herein has been met, the GM is hereby authorized to initiate allocation of water supplies on a pro rata basis among all the Affected Customers according to the amount to which each Affected Customer may be entitled so that preference is given to none and all Affected Customers suffer alike, in accordance with Texas Water Code, §11.039.

9.0 ENFORCEMENT

Any mandatory reduction to deliveries from GCWA to Affected Customers shall be distributed as required by Texas Water Code §11.039 (§11.039) and Section 8 above. In addition, every wholesale water supply contract entered into or renewed after adoption of this Plan, including contract extensions, shall include a provision that water will be distributed in accordance with §11.039 in case of a water shortage.

10.0 VARIANCES

The GM may, in writing, grant a temporary variance for existing water uses otherwise prohibited under this Plan to an Affected Customer if one or more of the following conditions are met:

- Failure to grant such a variance would cause an emergency condition adversely affecting health, sanitation, or fire safety for the public or the Affected Customer requesting the variance,
- Compliance with this Plan cannot be accomplished due to technical, legal, or other limitations, or
- Alternative methods that achieve the same level of reduction in water use can be implemented.

Variations shall be granted or denied at the discretion of the GM. All petitions for variations should be in writing and should include the following information:

- Name and address of the petitioner(s),
- Purpose of water use,
- Specific provisions from which relief is requested,

- Detailed statement of the adverse effect of the provisions from which relief is requested,
- Description of the relief requested,
- Period of time for which the variance is sought,
- Alternative measures that will be taken to reduce water use, and
- Other pertinent information.

11.0 SEVERABILITY

It is hereby declared to be the intention of the GCWA that the sections, paragraphs, sentences, clauses, and phrases of this Plan are severable and, if any phrase, clause, sentence, paragraph, or section of this Plan shall be declared unconstitutional by the valid judgment or decree of any court of competent jurisdiction, such unconstitutionality shall not affect any of the remaining phrases, clauses, sentences, paragraphs, and sections of this Plan, since the same would not have been enacted by GCWA without the incorporation into this Plan of any such unconstitutional phrase, clause, sentence, paragraph, or section.

12.0 IMPLEMENTATION

This plan was adopted by Gulf Coast Water Authority via a resolution passed by the Board of Directors on September 20, 2012. A copy of this resolution may be found in *Appendix C* of this document.

12.1 COORDINATION WITH REGIONAL WATER PLANNING GROUPS

The service area of GCWA is located within Region H as defined by the Texas Water Development Board. GCWA has provided a copy of this drought contingency plan to Region H, along with the letter shown in *Appendix D*.

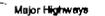
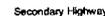
12.2 REVIEW AND UPDATE OF DROUGHT CONTINGENCY PLAN

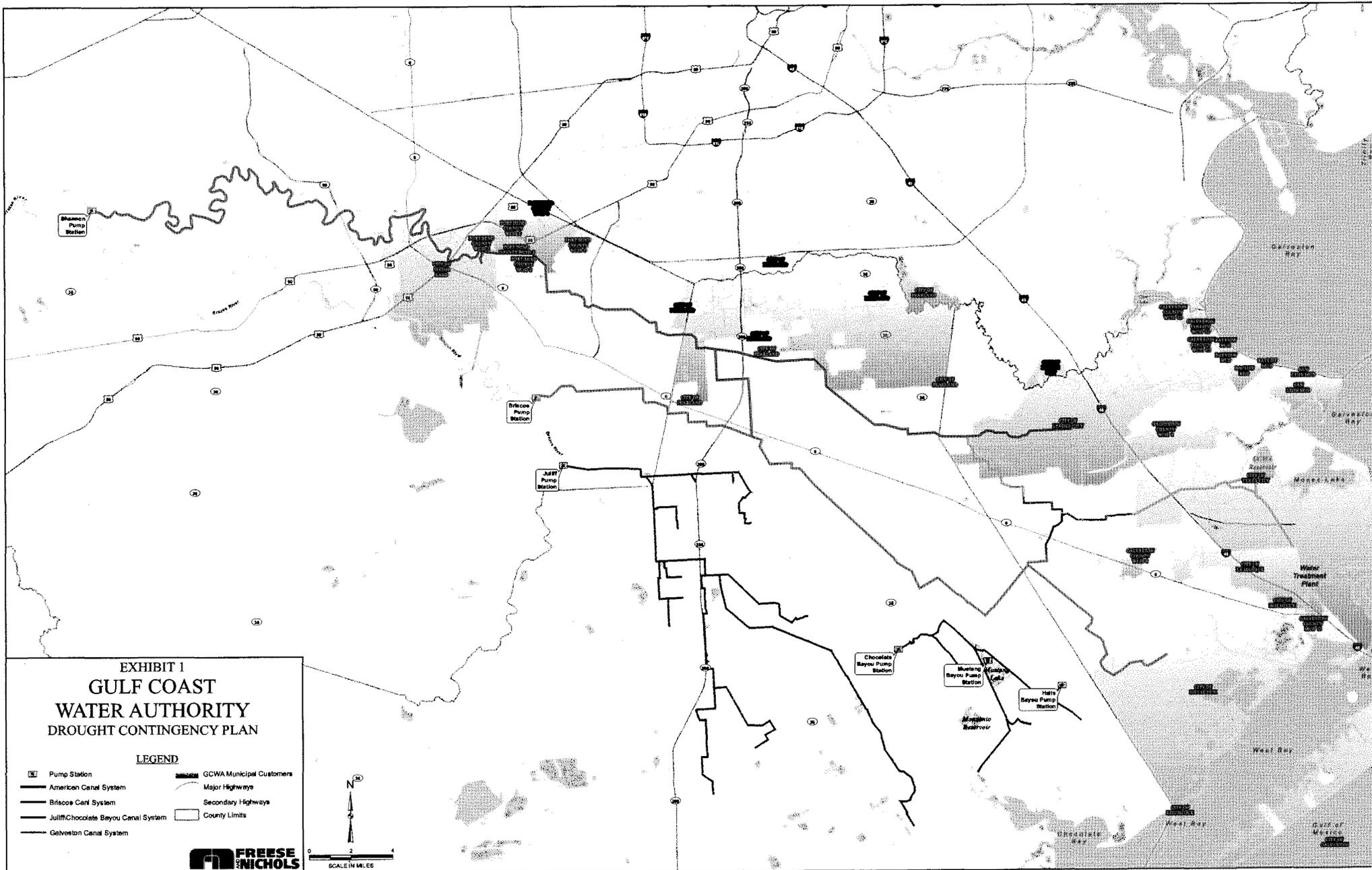
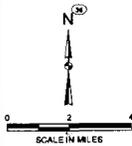
As required by TCEQ rules, GCWA will review and update this plan, as appropriate based on an assessment of any other new or updated information. GCWA will review and update the Plan no later than September 20, 2017, and every five years after that date to satisfy TCEQ requirements.

Exhibit 1
Overall System Map

EXHIBIT 1
**GULF COAST
 WATER AUTHORITY**
 DROUGHT CONTINGENCY PLAN

LEGEND

- | | |
|--|--|
|  Pump Station |  GCWA Municipal Customers |
|  American Canal System |  Major Highways |
|  Britcoe Canal System |  Secondary Highways |
|  Jullim/Chocolate Bayou Canal System |  County Limits |
|  Galveston Canal System | |



Appendix A

**Texas Commission on Environmental Quality Rules on Drought
Contingency Plans**

TITLE 30 ENVIRONMENTAL QUALITY
PART 1 TEXAS COMMISSION ON ENVIRONMENTAL QUALITY
CHAPTER 288 WATER CONSERVATION PLANS, DROUGHT CONTINGENCY
PLANS, GUIDELINES AND REQUIREMENTS
SUBCHAPTER B DROUGHT CONTINGENCY PLANS
RULE §288.20 **Drought Contingency Plans for Municipal Uses by Public Water
Suppliers**

(a) A drought contingency plan for a retail public water supplier, where applicable, must include the following minimum elements.

(1) Minimum requirements. Drought contingency plans must include the following minimum elements.

(A) Preparation of the plan shall include provisions to actively inform the public and affirmatively provide opportunity for public input. Such acts may include, but are not limited to, having a public meeting at a time and location convenient to the public and providing written notice to the public concerning the proposed plan and meeting.

(B) Provisions shall be made for a program of continuing public education and information regarding the drought contingency plan.

(C) The drought contingency plan must document coordination with the regional water planning groups for the service area of the retail public water supplier to ensure consistency with the appropriate approved regional water plans.

(D) The drought contingency plan must include a description of the information to be monitored by the water supplier, and specific criteria for the initiation and termination of drought response stages, accompanied by an explanation of the rationale or basis for such triggering criteria.

(E) The drought contingency plan must include drought or emergency response stages providing for the implementation of measures in response to at least the following situations:

(i) reduction in available water supply up to a repeat of the drought of record;

(ii) water production or distribution system limitations;

(iii) supply source contamination; or

(iv) system outage due to the failure or damage of major water system components (e.g., pumps).

(F) The drought contingency plan must include specific, quantified targets for water use reductions to be achieved during periods of water shortage and drought. The entity preparing the plan shall establish the targets. The goals established by the entity under this subparagraph are not enforceable.

(G) The drought contingency plan must include the specific water supply or water demand management measures to be implemented during each stage of the plan including, but not limited to, the following:

(i) curtailment of non-essential water uses; and

(ii) utilization of alternative water sources and/or alternative delivery mechanisms with the prior approval of the executive director as appropriate (e.g., interconnection

with another water system, temporary use of a non-municipal water supply, use of reclaimed water for non-potable purposes, etc.).

(H) The drought contingency plan must include the procedures to be followed for the initiation or termination of each drought response stage, including procedures for notification of the public.

(I) The drought contingency plan must include procedures for granting variances to the plan.

(J) The drought contingency plan must include procedures for the enforcement of mandatory water use restrictions, including specification of penalties (e.g., fines, water rate surcharges, discontinuation of service) for violations of such restrictions.

(2) Privately-owned water utilities. Privately-owned water utilities shall prepare a drought contingency plan in accordance with this section and incorporate such plan into their tariff.

(3) Wholesale water customers. Any water supplier that receives all or a portion of its water supply from another water supplier shall consult with that supplier and shall include in the drought contingency plan appropriate provisions for responding to reductions in that water supply.

(b) A wholesale or retail water supplier shall notify the executive director within five business days of the implementation of any mandatory provisions of the drought contingency plan.

(c) The retail public water supplier shall review and update, as appropriate, the drought contingency plan, at least every five years, based on new or updated information, such as the adoption or revision of the regional water plan.

Source Note: The provisions of this §288.20 adopted to be effective February 21, 1999, 24 TexReg 949; amended to be effective April 27, 2000, 25 TexReg 3544; amended to be effective October 7, 2004, 29 TexReg 9384

TITLE 30 ENVIRONMENTAL QUALITY
PART 1 TEXAS COMMISSION ON ENVIRONMENTAL QUALITY
CHAPTER 288 WATER CONSERVATION PLANS, DROUGHT CONTINGENCY
PLANS, GUIDELINES AND REQUIREMENTS
SUBCHAPTER B DROUGHT CONTINGENCY PLANS
RULE §288.21 **Drought Contingency Plans for Irrigation Use**

(a) A drought contingency plan for an irrigation use, where applicable, must include the following minimum elements.

(1) Minimum requirements. Drought contingency plans for irrigation water suppliers must include policies and procedures for the equitable and efficient allocation of water on a pro rata basis during times of shortage in accordance with Texas Water Code, §11.039. Such plans shall include the following elements as a minimum.

(A) Preparation of the plan shall include provisions to actively inform and to affirmatively provide opportunity for users of water from the irrigation system to provide input into the preparation of the plan and to remain informed of the plan. Such acts may include, but are not limited to, having a public meeting at a time and location convenient to the water users and providing written notice to the water users concerning the proposed plan and meeting.

(B) The drought contingency plan must document coordination with the regional water planning groups to ensure consistency with the appropriate approved regional water plans.

(C) The drought contingency plan must include water supply criteria and other considerations for determining when to initiate or terminate water allocation procedures, accompanied by an explanation of the rationale or basis for such triggering criteria.

(D) The drought contingency plan must include specific, quantified targets for water use reductions to be achieved during periods of water shortage and drought. The entity preparing the plan shall establish the targets. The goals established by the entity under this subparagraph are not enforceable.

(E) The drought contingency plan must include methods for determining the allocation of irrigation supplies to individual users.

(F) The drought contingency plan must include a description of the information to be monitored by the water supplier and the procedures to be followed for the initiation or termination of water allocation policies.

(G) The drought contingency plan must include procedures for use accounting during the implementation of water allocation policies.

(H) The drought contingency plan must include policies and procedures, if any, for the transfer of water allocations among individual users within the water supply system or to users outside the water supply system.

(I) The drought contingency plan must include procedures for the enforcement of water allocation policies, including specification of penalties for violations of such policies and for wasteful or excessive use of water.

(2) Wholesale water customers. Any irrigation water supplier that receives all or a

portion of its water supply from another water supplier shall consult with that supplier and shall include in the drought contingency plan, appropriate provisions for responding to reductions in that water supply.

(3) Protection of public water supplies. Any irrigation water supplier that also provides or delivers water to a public water supplier(s) shall consult with that public water supplier(s) and shall include in the plan, mutually agreeable and appropriate provisions to ensure an uninterrupted supply of water necessary for essential uses relating to public health and safety. Nothing in this provision shall be construed as requiring the irrigation water supplier to transfer irrigation water supplies to non-irrigation use on a compulsory basis or without just compensation.

(b) Irrigation water users shall review and update, as appropriate, the drought contingency plan, at least every five years, based on new or updated information, such as adoption or revision of the regional water plan.

Source Note: The provisions of this §288.21 adopted to be effective February 21, 1999, 24 TexReg 949; amended to be effective April 27, 2000, 25 TexReg 3544; amended to be effective October 7, 2004, 29 TexReg 9384

TITLE 30 ENVIRONMENTAL QUALITY
PART 1 TEXAS COMMISSION ON ENVIRONMENTAL QUALITY
CHAPTER 288 WATER CONSERVATION PLANS, DROUGHT CONTINGENCY PLANS, GUIDELINES AND REQUIREMENTS
SUBCHAPTER B DROUGHT CONTINGENCY PLANS
RULE §288.22 **Drought Contingency Plans for Wholesale Water Suppliers**

(a) A drought contingency plan for a wholesale water supplier must include the following minimum elements.

(1) Preparation of the plan shall include provisions to actively inform the public and to affirmatively provide opportunity for user input in the preparation of the plan and for informing wholesale customers about the plan. Such acts may include, but are not limited to, having a public meeting at a time and location convenient to the public and providing written notice to the public concerning the proposed plan and meeting.

(2) The drought contingency plan must document coordination with the regional water planning groups for the service area of the wholesale public water supplier to ensure consistency with the appropriate approved regional water plans.

(3) The drought contingency plan must include a description of the information to be monitored by the water supplier and specific criteria for the initiation and termination of drought response stages, accompanied by an explanation of the rationale or basis for such triggering criteria.

(4) The drought contingency plan must include a minimum of three drought or emergency response stages providing for the implementation of measures in response to water supply conditions during a repeat of the drought-of-record.

(5) The drought contingency plan must include the procedures to be followed for the initiation or termination of drought response stages, including procedures for notification of wholesale customers regarding the initiation or termination of drought response stages.

(6) The drought contingency plan must include specific, quantified targets for water use reductions to be achieved during periods of water shortage and drought. The entity preparing the plan shall establish the targets. The goals established by the entity under this paragraph are not enforceable.

(7) The drought contingency plan must include the specific water supply or water demand management measures to be implemented during each stage of the plan including, but not limited to, the following:

(A) pro rata curtailment of water deliveries to or diversions by wholesale water customers as provided in Texas Water Code, §11.039; and

(B) utilization of alternative water sources with the prior approval of the executive director as appropriate (e.g., interconnection with another water system, temporary use of a non-municipal water supply, use of reclaimed water for non-potable purposes, etc.).

(8) The drought contingency plan must include a provision in every wholesale water contract entered into or renewed after adoption of the plan, including contract extensions, that in case of a shortage of water resulting from drought, the water to be

distributed shall be divided in accordance with Texas Water Code, §11.039.

(9) The drought contingency plan must include procedures for granting variances to the plan.

(10) The drought contingency plan must include procedures for the enforcement of any mandatory water use restrictions including specification of penalties (e.g., liquidated damages, water rate surcharges, discontinuation of service) for violations of such restrictions.

(b) The wholesale public water supplier shall notify the executive director within five business days of the implementation of any mandatory provisions of the drought contingency plan.

(c) The wholesale public water supplier shall review and update, as appropriate, the drought contingency plan, at least every five years, based on new or updated information, such as adoption or revision of the regional water plan.

Source Note: The provisions of this §288.22 adopted to be effective February 21, 1999, 24 TexReg 949; amended to be effective April 27, 2000, 25 TexReg 3544; amended to be effective October 7, 2004, 29 TexReg 9384

Appendix B
Quick Reference Guide

Stage	Water Shortage Condition	Trigger	Termination	Goal for Reduction in Water Use
1	Mild	Discretion of GCWA General Manager.	Discretion of GCWA General Manager.	5%
		System demand exceeds 85% of deliverable capacity for 3 consecutive days.	7 days without any trigger conditions.	
2	Moderate	Discretion of GCWA General Manager.	Discretion of GCWA General Manager.	10%
		System demand exceeds 90% of deliverable capacity for 3 consecutive days.	7 days without any trigger conditions	

Appendix C

Resolution Adopting Drought Contingency Plan

CERTIFICATE FOR RESOLUTION 2012-004

STATE OF TEXAS §

COUNTY OF GALVESTON §

I, the undersigned officer of the Board of Directors of Gulf Coast Water Authority, hereby certify as follows:

1. The Board of Directors of Gulf Coast Water Authority convened in regular meeting on the 20th day of September 2012 and the roll was called of the duly constituted officers and members of said Board, to-wit:

Eric Wilson	Vice-President
Rosalyn Sue Edrozo	Secretary-Treasurer
James McWhorter	Assistant Secretary-Treasurer
James R. Cesarini	Director
Bill Eisen	Director
Ray Holbrook	Director
Russell C. Jones	Director
Shane Hamilton	Director

and all of said persons were present, except the following absentee(s):

ERIC WILSON AND ROSALYN SUE EDROZO,
thus constituting a quorum. Whereupon, among other business, the following was transacted at said meeting: a written

RESOLUTION NO. 2012-004

A RESOLUTION OF THE GULF COAST WATER AUTHORITY, ADOPTING THE AUTHORITY'S WATER CONSERVATION AND DROUGHT CONTINGENCY PLANS; PROVIDING THAT THIS RESOLUTION SHALL BECOME EFFECTIVE FROM AND AFTER ITS PASSAGE AND ADOPTION.

was duly introduced for the consideration of said Board and read in full. It was then duly moved and seconded that said Resolution be adopted; and, after due discussion, said motion, carrying with it the adoption of said Resolution, prevailed and carried unanimously.

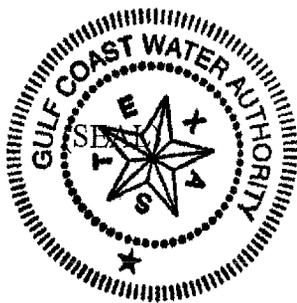
2. That a true, full and correct copy of the aforesaid Resolution adopted at the meeting described in the above and foregoing paragraph is attached to and follows this certificate; that said Resolution has been duly recorded in said Board's minutes of said meeting; that the persons named in the above and foregoing paragraph are the duly chosen, qualified, and acting officers and members of said Board as indicated therein; that each of the officers and members of said Board was duly and sufficiently notified officially and personally, in advance, of the time, place and purpose of the aforesaid

meeting, and that said Resolution would be introduced and considered for adoption at said meeting, and each of said officers and members consented, in advance, to the holding of said meeting for such purpose; that said meeting was open to the public as required by law; and that public notice of the hour, date, place, and subject of said meeting was given as required by Texas Government Code, Chapter 551, and Texas Water Code, Section 49.063.

SIGNED AND SEALED the 20th day of September 2012.



James F. McWhorter
Assistant Secretary-Treasurer



RESOLUTION NO. 2012-004

A RESOLUTION OF THE GULF COAST WATER AUTHORITY, ADOPTING THE AUTHORITY'S WATER CONSERVATION AND DROUGHT CONTINGENCY PLANS; PROVIDING THAT THIS RESOLUTION SHALL BECOME EFFECTIVE FROM AND AFTER ITS PASSAGE AND ADOPTION.

WHEREAS, the Authority recognizes the need for efficient use of existing water supplies and has developed a Water Conservation Plan governing the development of water conservation consistent with guidelines and requirements of the Texas Commission on Environmental Quality (TCEQ); and

WHEREAS, Authority has developed a drought contingency plan consistent with Texas Commission on Environmental Quality (TCEQ) guidelines and requirements for the development of drought contingency plans by wholesale water suppliers, as contained in Title 30, Part 1, Chapter 288, Subchapter B, Rules 288.20–288.22 of the Texas Administrative Code; and

WHEREAS, the General Manager deems it in the best interest of the Authority to adopt these plans and recommends that these plans be implemented accordingly;

NOW, THEREFORE, BE IT RESOLVED BY THE BOARD OF DIRECTORS OF THE GULF COAST WATER AUTHORITY:

SECTION 1: That the Gulf Coast Water Authority hereby adopts its Water Conservation Plan as the official policy of the Gulf Coast Water Authority. A copy of the Water Conservation Plan shall remain on file in the office of the General Manager.

SECTION 2: That the Gulf Coast Water Authority hereby adopts its Drought Contingency Plan as the official policy of the Gulf Coast Water Authority. A copy of the Drought Contingency Plan shall remain on file in the office of the General Manager.

SECTION 3: That the General Manager is directed to take such actions as necessary to implement the above-named plans, in the best interest of the Authority.

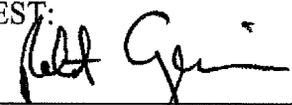
SECTION 4: That this Resolution shall be in full force and effect from and after its passage and adoption.

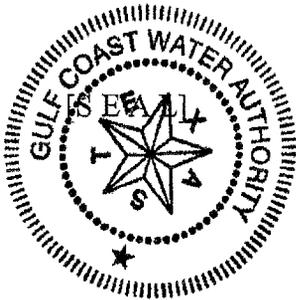
PASSED AND ADOPTED this 20th day of September, 2012.

GULF COAST WATER AUTHORITY


James F. McWhorter
Assistant Secretary-Treasurer

ATTEST:


Attorney for GCWA



Appendix D

Letter to Region H Water Planning Group



Gulf Coast Water Authority

3630 Highway 1765

Texas City, Texas 77591

409.935.2438

fax 409.935.4156

October 12, 2012

Judge Mark Evans
Chair, Region H Water Planning Group
c/o San Jacinto River Authority
P.O. Box 329
Conroe, Texas 77305

RE: Gulf Coast Water Authority 2012 Water Conservation and Drought Contingency
Plan Update

Dear Judge Evans,

Enclosed please find a copy of the following documents:

- Water Conservation Plan for Gulf Coast Water Authority
- Drought Contingency Plan for Gulf Coast Water Authority

We are submitting a copy of these plans to the Region H Water Planning Group in accordance with the Texas Water Development Board and Texas Commission on Environmental Quality rules. The Board of the Gulf Coast Water Authority adopted the attached plans on September 20, 2012.

Sincerely,

A handwritten signature in black ink, appearing to read "Ivan Langford". The signature is fluid and cursive, with a prominent initial "I" and a long, sweeping tail.

Ivan Langford
General Manager
Gulf Coast Water Authority