

## Exhibit C

### 2011 COASTAL BEND REGIONAL WATER PLAN REGION N

#### *CONTRACT SCOPE OF WORK*

##### **ADMINISTRATIVE AND PUBLIC PARTICIPATION ACTIVITIES FUNDING BASE**

**Total Cost \$40,900**

Administration, including scope of work development, meetings related to scope of work, public participation, and expenses related to the development of two newsletters for public outreach.

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##### **STUDY 1: Gulf Coast Groundwater and Garwood Supplies**

**Total Cost \$70,000**

Conduct a detailed study of additional water supplies to be delivered via Mary Rhodes Pipeline. This study will include potential groundwater supplies from the Goliad Sands Gulf Coast Aquifer, potential additional supplies from Lake Texana, and surface water supplies from the Garwood Project (Colorado River).

##### *Work Plan*

The San Patricio Municipal Water District and the City of Corpus Christi plan to send untreated groundwater supplies and surface water supplies from Colorado Basin (Garwood) through the Mary Rhodes Pipeline. The Mary Rhodes Pipeline currently delivers raw surface water supplies from Lake Texana and is an attractive delivery option due to its proximity to projects and excess pipeline capacity. Prior to delivering groundwater supplies and surface water supplies from the Colorado River through the Mary Rhodes Pipeline, groundwater and surface water quality constituents need to be evaluated to address potential blending issues or additional treatment requirements. Evaluating various operating and delivery scenarios for the Gulf Coast groundwater supplies, Garwood supplies, and additional Lake Texana supplies will help support more effective and efficient management of regional and interregional water supplies.

Task A. Evaluate potential issues associated with blending raw groundwater and surface water supplies

- Water quality data will be compiled for groundwater in Bee and San Patricio Counties near the identified wellfield areas, the Colorado River near Garwood, and Lake Texana near the dam. Water quality data to be collected include turbidity, temperature, alkalinity, hardness, pH, total organic carbon, ultraviolet absorbance, total dissolved solids, chloride, bromide, iron, radium-226, radium-228, gross alpha, radon, uranium, arsenic, and manganese and will be used as available.
- Based on the range of water quality values from collected data, a resulting blended water quality will be calculated for up to four combinations for the two

new water sources. A model previously developed for the City of Corpus Christi will be used to determine chemical doses necessary for water treatment and compare to treatment processes currently utilized at the O.N. Stevens Water Treatment plant. Parameters which may exceed drinking water standards will be identified.

- Water treatment costs will be calculated for each blending option based on chemical dosage requirements. Also, the water quality model will be utilized to assess anticipated treated water quality for the blended waters and the potential for additional treatment to meet regulatory requirements.

Task B. Evaluate various Gulf Coast groundwater supply operating scenarios.

- A series of up to three operating scenarios using varying amounts of groundwater supply, in addition to existing Lake Texana supplies, will be considered for utilizing groundwater supplies based on water quality analysis (Task A) and pumping costs.
- A series of graphs (2-5) will be provided comparing water quality, supply, and costs for each operating scenario. An additional graph will be included to show average available capacity in the Mary Rhodes Pipeline with delivery of Gulf Coast Aquifer Supplies.
- A series of figures (2-5) illustrating project impacts relative to a baseline will be prepared to show additional water supplies and changes to Nueces Bay and Estuary freshwater inflows with the groundwater project.

Task C. Evaluate reservoir system operations with Garwood Project

- A model run will be performed to include the Garwood Project in the City's reservoir system. A series of figures will be prepared to show additional water supplies and changes to Nueces Bay and Estuary freshwater inflows with the Garwood Project.

Task D. Evaluate reservoir system operations with additional Lake Texana supplies

- A model run will be performed to include additional Lake Texana supplies in the City's water supply system based on additional water supply opportunities (e.g. stage II Lake Texana and/or additional unappropriated surface water) under consideration by the Lavaca Navidad River Authority (LNRA). A series of figures illustrating project impacts relative to a baseline will be prepared to show additional water supplies and changes to Nueces Bay and Estuary freshwater inflows with the Lake Texana supply.

Task E. Regional Water Planning Group (RWPG) meeting(s) and preparation of report

- Two meetings to present study results to Coastal Bend Regional Water Planning Group (CBRWPG) and receive feedback.
- Prepare a draft and final report to include the following sections: executive summary, purpose of study including how the study supports regional water planning, methodology, results, and recommendations, if applicable. Report will be prepared to include description of model simulations, project implementation

considerations (i.e. permitting, environmental impacts, etc), methodology and approach for evaluating water quality, calculations for determining blended water quality and treatment required, and model results of various operating scenarios.

- The report will be submitted per Texas Water Development Board (TWDB) requirements and results from this study will be included in the 2011 Coastal Bend Water Plan. The development, analysis, and reporting of results will follow methodologies and guidance according to Exhibit B, and agency rules.

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## **STUDY 2: Optimization and Implementation Studies for Off-Channel Reservoir**

**Total Cost \$58,000**

Conduct a site-specific study to determine optimal off-channel storage and pump station capacity, preferred location and site conditions, and evaluation of alternative reservoir operating parameters.

### *Work Plan*

In order to facilitate implementation of this water management strategy, a more detailed study of the off-channel reservoir (OCR) is necessary. The off-channel reservoir study performed for the 2006 Regional Water Plan will be used as a baseline for further analysis. This work item will include site-specific studies to determine optimal off-channel storage and pump station capacity, preferred location and site conditions, and evaluation of alternative reservoir operating parameters to best manage water supply, water quality, and ecosystem restoration benefits. These work items do not duplicate previous or ongoing planning activities.

#### Task A. Optimize off-channel capacity and pipeline delivery rate

- A series model runs (2-4) will be performed to evaluate a range of off-channel storage capacities (between 200,000 acft and 300,000 acft) and pipeline delivery rates (between 750 and 1,500 cfs).
- Planning level cost estimates will be developed for the range of reservoir sizes and transfer facilities so that approximate unit costs can be estimated for the purpose of selecting an optimum size.
- A series of figures (2-5) will be prepared to compare volume of water pumped to/from off-channel reservoir (OCR), change in streamflow downstream of Lake Corpus Christi (LCC), increase in water supply, and changes in freshwater inflows to the Nueces Bay and Estuary.

#### Task B. Identify preferred location for off-channel reservoir and environmental impacts

- Topographic maps, reported local groundwater level measurements, and TWDB Volumetric Survey of LCC will be used to identify a suitable location for the intake and pump station to deliver water to the OCR.
- Site reconnaissance of preferred location will be performed to:
  - Identify dominant vegetation and habitat types present on the site(s),
  - Evaluate the suitability of those habitats for use by the numerous endangered and threatened species known from the region,
  - If necessary, consult with US Fish and Wildlife Service and Texas Parks

- and Wildlife Department to develop endangered species survey/monitoring work plans to determine presence or absence in potential habitat,
- Identify and delineate waters of the US and jurisdictional wetlands potentially affected by the OCR and pipeline,
  - Identify and characterize cultural resources potentially affected by the OCR and pipeline,
  - Identify and evaluate the potential for mitigating unavoidable impacts to environmental and cultural resources.

Task C. Evaluate alternative reservoir operating parameters

- A series of model runs (2-4) will be performed to evaluate the impact of modifying Choke Canyon Reservoir (CCR)/LCC system operating parameters, such as changing triggers for CCR releases, and trigger levels to pump to/from OCR. The goal of this work task is to provide information to assist with effective management of system storage, minimize evaporative losses, optimize additional water supply yields, and minimize impact to the environment by maintaining and possibly enhancing flows to the Nueces Estuary under critical conditions and evaluating the potential to stabilize LCC reservoir levels.
- A series of graphs (2-5) will be prepared to show the relationship of alternative reservoir operating parameters, additional water supplies, changes to Nueces Estuary inflows, and changes in LCC reservoir levels.

Task D. RWPG meeting(s) and preparation of report

- Two meetings to present study results to CBRWPG and receive feedback.
- Prepare a draft and final report to include the following sections: executive summary, purpose of study including how the study supports regional water planning, methodology, results, and recommendations, if applicable. Report will be prepared to include the approach used to optimize OCR, discussion of site selection and local considerations, and results showing the impacts of alternative reservoir operating parameters.
- The report will be submitted per TWDB requirements and results from this study will be included in the 2011 Coastal Bend Water Plan. The development, analysis, and reporting of results will follow methodologies and guidance according to Exhibit B, and agency rules.

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**STUDY 3: Implementation Analyses for Pipeline from CCR to LCC, including  
Measurement of Channel Losses  
Total Cost \$85,000**

Conduct detailed analyses of channel losses for the reach between Three Rivers and Lake Corpus Christi to quantify reduced streamflow in the Nueces River when delivering water supplies to Lake Corpus Christi through the pipeline rather than river channel.

*Work Plan*

In order to facilitate implementation of this water management strategy, a more detailed

analysis of the CCR/LCC pipeline and river channel between CCR and LCC is necessary. This work item will include a more rigorous analysis of channel losses, optimal pipeline routing, capacity, and evaluate impacts of reduced streamflow between CCR and LCC. A more detailed analysis will be conducted for conjunctive operation of the OCR and CCR/LCC pipeline to include prioritization of projects and establishing timeline for implementation. This work item does not duplicate previous or ongoing planning activities.

Task A. Evaluate impacts associated with reduced streamflow between CCR and LCC

- USGS gaging station data for Nueces River at George West will be compiled from December 2000 to present.
- A channel loss analysis will be performed on the reach downstream of the Three Rivers gage by making a 2 to 3 week high flow rate release from Choke Canyon Reservoir when flows on the Nueces and Atascosa Rivers are minimal. Groundwater migration to channel during low flow will be considered, including potential water quality issues. Technical services and field measurements will be coordinated with the City of Corpus Christi.
- A delivery factor will be calculated based on volume of water received at Three Rivers and inflow to Lake Corpus Christi.
- Based on delivery factor, the resulting channel losses will be analyzed and used to estimate the portion of losses contributing to recharge to the Gulf Coast Aquifer. Upon completion of this channel loss survey and favorable channel sampling conditions, the referenced reach between CCR and LCC should require no further future channel loss studies by the TWDB.
- The City of Corpus Christi Water Supply Model will be updated with new channel loss data.
- The CCR/LCC pipeline will be simulated using the updated City of Corpus Christi Water Supply Model and calculated streamflow will be used to determine volume of water received at Three Rivers with CCR/LCC pipeline operation. After considering delivery factor from Three Rivers to LCC, the reduced channel losses will be used to calculate changes in recharge to the Gulf Coast Aquifer with operation of CCR/LCC pipeline.
- A series of graphs and tables (2-5) will be prepared to compare streamflow and Gulf Coast aquifer recharge between CCR and LCC with and without the CCR/LCC pipeline for the 1934 to 2003 period.

Task B. Optimize pipeline capacity and location towards project implementation

- A series of model runs (2-4) will be performed for up to three pumping rates to evaluate a more detailed range for pump station and pipeline sizing.
- Preliminary cost estimates will be developed for the range of pipeline sizes and transfer facilities so that approximate unit costs can be estimated for the purpose of selecting an optimum size.
- A series of figures (2-5) will be prepared to compare the volume of water sent through CCR/LCC pipeline, change in streamflow downstream of CCR, increase in water supply, and impacts to the Nueces Bay and Estuary.

- Topographic maps and recent digital elevation model (DEM) will be used to identify a suitable location for CCR/LCC pipeline.
- A model run will be performed operating the CCR/LCC pipeline conjunctively with the off-channel reservoir.

Task C. RWPG meeting(s) and preparation of report

- Two meetings to present results to CBRWPG and receive feedback.
- Prepare a draft and final report to include the following sections: executive summary, purpose of study including how the study supports regional water planning, methodology, results, and recommendations, if applicable. Report will be prepared to include the methodology used to optimize pipeline, approach for calculating delivery factors and channel losses for Nueces River reach between Three Rivers and LCC, and discuss possible impacts associated with operating the CCR/LCC pipeline (such as reduced aquifer recharge).
- The report will be submitted per TWDB requirements and results will be included in the 2011 Coastal Bend Water Plan. The development, analysis, and reporting of results will follow methodologies and guidance according to Exhibit B, and agency rules.

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**STUDY 4: Water Quality Modeling of Regional Water Supply System to Enhance Water Quality and Improve Industrial Water Conservation**  
**Total Cost \$80,000**

Update Corpus Christi Water Supply Model (for monthly simulation from 1934 to 2003) to include calculation of total dissolved solids and chloride concentrations for Lake Texana, Lake Corpus Christi, and at the Calallen Pool for various operating conditions.

*Work Plan*

In order to accomplish the above evaluation, the City of Corpus Christi Water Supply Model will be updated using historic, hydrologic conditions from 1934 to 2003 and improved to include calculation of total dissolved solids and chloride concentrations for Lake Texana, Lake Corpus Christi, and at the Calallen Pool. Under this enhancement the model would have the ability to calculate total dissolved solids and chloride concentrations for the 1934 to 2003 simulation period for any operation plan. As part of the US Army Corps of Engineers (USCOE) Nueces Feasibility Study, the model will be updated to include similar water quality calculations for Choke Canyon Reservoir. This work item does not duplicate previous or ongoing planning activities.

Task A. Prepare a water quality database for the City of Corpus Christi Water Supply Model

- A monthly water quality database will be developed for inflows to Lake Corpus Christi, Calallen Pool, and Lake Texana for the 1934 to 2003 period based on regression equations for Nueces and Navidad River flows. Water quality data and streamflow measurements included in the 2001 and 2006 Plan will be used together with USGS and other data for the Lower Nueces River (downstream of Lake Corpus Christi to Calallen).

- New model code will be developed to integrate the water quality database into the City of Corpus Christi Water Supply Model.

Task B. Evaluate reservoir operating scenarios and impact on total dissolved solids and chloride concentrations using the City of Corpus Christi Water Supply Model with long term (monthly) simulation from 1934 to 2003

- A series of model runs will be performed for up to four system operating scenarios to evaluate the impacts of changing the trigger level for water delivery from Choke Canyon Reservoir to Lake Corpus Christi, safe versus firm yield, constant versus seasonal monthly delivery pattern from Lake Texana supplies while maintaining pass-thru targets to the Nueces Bay and Estuary per 2001 Agreed Order. At least one run will consider monthly variable Lake Corpus Christi target levels.
- A series of figures (2-5) will be prepared to show the relationship between storage levels in Lake Corpus Christi and total dissolved solids and chloride concentrations. Similar figures will be prepared to compare storage levels in Lake Texana and streamflow at Calallen Pool to total dissolved solids and chloride levels.

Task C. RWPG meeting(s) and preparation of report

- Meeting to present study results to CBRWPG and receive feedback.
- Prepare a draft and final report to include the following sections: executive summary, purpose of study including how the study supports regional water planning, methodology, results, and recommendations, if applicable. Report will be prepared to include description of the model updates, methodology, and model operating scenario results with summary tables and graphs.
- The report will be submitted per TWDB requirements and results from this study will be included in the 2011 Coastal Bend Water Plan. The development, analysis, and reporting of results will follow methodologies and guidance according to Exhibit B, and agency rules.

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**STUDY 5: Region-Specific Water Conservation Best Management Practices (BMPs)**  
**Total Cost \$40,000**

Develop a list of most important water conservation BMPs for the Coastal Bend Region, send to each water user group in the Coastal Bend Region, and solicit feedback regarding their water conservation programs.

*Work Plan*

To encourage more effective water conservation, this study will include developing a list of most important and effective water conservation best management practices for the Coastal Bend Region. This list will then be sent to each water user group in the Coastal Bend Region and each entity will be contacted to determine their interest in participation and/or types of water conservation programs that are currently being implemented. This work item does not duplicate previous or ongoing planning activities.

Task A. Develop a list of water conservation best management practices for the Coastal Bend Region and solicit feedback from water user groups

- Review water conservation techniques identified by the Water Conservation Task Force and water conservation plans submitted to TCEQ for water user groups in Coastal Bend Region.
- Based on provided information, approximately ten water conservation techniques will be selected by the Regional Water Planning Groups to promote conservation within the Coastal Bend Region.
- Send list of recommended water conservation practices to all water user groups in Coastal Bend Region with information about various BMPs and potential savings and receive feedback regarding their current water conservation programs and interest in participating in water conservation techniques identified by the Regional Water Planning Group.
- Compile results from surveys and evaluate water savings associated with recommended water conservation techniques.

Task B. RWPG meeting(s) and preparation of report

- Two meetings to present results to CBRWPG and receive feedback.
- Prepare a draft and final report to include the following sections: executive summary, purpose of study including how the study supports regional water planning, methodology, results, and recommendations, if applicable. Report will be prepared to include the recommended list of water conservation best management practices for the Coastal Bend Region, results of water user group surveys, and calculated water savings associated with selected water conservation programs.
- The report will be submitted per TWDB requirements and results from this study will be included in the 2011 Coastal Bend Water Plan. The development, analysis, and reporting of results will follow methodologies and guidance according to Exhibit B, and agency rules.