

Management Strategies for Potential Inter-Regional Cooperation

Prepared for

***Inter-Regional Work Group
South Central Texas Region (L)
Rio Grande Region (M)
Coastal Bend Region (N)
Lavaca Region (P)
Lower Colorado Region (K)
Nueces River Authority
Texas Water Development Board***

Consultants:

**HDR Engineering, Inc.
Moorhouse Associates
Open Forum
NRS Consulting Engineers
Turner, Collie & Braden**

May 2002

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Executive Summary

An Inter-Regional Coordination Workgroup (IRWG) of the five water planning regions of South Texas including: Lower Colorado River (Region K); South Central Texas (Region L); Rio Grande (Region M); Coastal Bend (Region N); and Lavaca (Region P), through a process of facilitated meetings, identified and described water management strategies of potential interest to 2 or more of the Regions for consideration as cooperative, inter-regional water planning efforts during the forthcoming round of regional water planning pursuant to 31 Texas Administrative Code, Chapters 355, 357, and 358, and TWDB Rules, effective March 11, 1998, as amended. The Texas Water Development Board provided financial assistance to enable the regions to undertake this Inter-Regional Coordination (IRC) program. The facilitated meetings were open to the public, and used information about water management strategies that were identified and evaluated in the individual regional water plans that were completed and filed with the Texas Water Development Board (TWDB) in January 2001. The objective was the specification of Inter-Regional Water Management Strategies (IRWMS) to be recommended for evaluation and consideration in 2 or more of the forthcoming regional water plans of the cooperating regions in order to lower the costs, and increase the effectiveness and efficiencies of water plans in the cooperating regions.

The IRWG identified and described the following six potential water management strategies for consideration:

- IRC—1: Gulf Coast Aquifer—Bee, Goliad, and Refugio Counties,
- IRC—2: Lower Colorado River,
- IRC—3: Desalination,
- IRC—4: Palmetto Bend Stage II,
- IRC—5: Optimization of Nueces Basin Yield, and
- IRC—6: Inter-Regional Facilities.

IRCs 1 through 5 are individual strategies to be evaluated as to their respective quantity, cost, and environmental information, with results expressed in terms as of their respective locations. IRC—6, “Inter-Regional Facilities,” is for the purpose of organizing and/or integrating one or more of the individual strategies into one or more operational and management systems for delivery of water to entities in Regions K, L, M, N, and P, as appropriate. Each strategy is described below.

IRC—1: Gulf Coast Aquifer—Bee, Goliad, and Refugio Counties: The Gulf Coast Aquifer in Bee, Goliad, and Refugio Counties contains significant quantities of fresh water, which have not been developed. Local landowners have indicated an interest in selling water from the aquifer, and both Regions L and N included water from this source as a potential option to meet projected needs in their respective regions. The Region N plan includes use of water from the Gulf Coast Aquifer via the Mary Rhodes Memorial Pipeline, which passes through these counties, as one of several potential options to meet needs after 2030. The Region L plan includes diversions from the Lower Guadalupe River, with off-channel storage and well fields in Refugio County to firm up surface water supplies during times of drought, to meet needs in the Bexar County area of Region L by 2010. Neither Region's plan was able to consider the potential effects upon the other's plan, or the possibilities for cooperation to develop the most cost effective and efficient plan.

The principal objective of this strategy is to evaluate it as a potential source of supply for 2 or more cooperating regions, including the calculation of quantities, costs, effects of development upon water levels of the aquifer, potentials for salt water intrusion, potentials for aquifer storage and recovery, and environmental effects, with emphasis upon conjunctive development and use of water from this source of groundwater together with other surface water sources.

IRC—2: Lower Colorado River: Surface water sources of the Lower Colorado River in Colorado, Wharton, and Matagorda Counties are included in the water plans of Regions K, L, and N. The Region K plan uses water from this source to meet projected irrigation needs of the area, however, the Region K plan shows irrigation shortages in latter decades of the planning period. Corpus Christi, of Region N, owns 35,000 acre-feet of run-of-river water rights located in the Lower Colorado River that are included in the Region N water plan as a potential option to meet needs after 2030. Corpus Christi's Mary Rhodes Memorial Pipeline from Lake Texana in Jackson County in Region P, to Corpus Christi in Region N is available to convey water from this source once a 40-mile connecting pipeline from the Lower Colorado River is constructed.

The Region L water plan includes 66,000 acre-feet of supply from the Lower Colorado River to meet projected needs in Bexar County, beginning in 2020, with increases to 132,000 acre-feet per year in 2050. The strategy includes river diversion works, off-channel storage of surface water near the diversion points, well fields within the irrigated areas, and water conservation measures and programs to meet a part of the irrigation shortages in Region K. The Region L water management strategy includes pipelines from the off-channel reservoirs to

convey the water to the Bexar County area. The well fields within the irrigated areas in Region K would supply water to the farmers via existing canals. With the combination of off-channel storage of surface water, well fields within the irrigated areas, and irrigation water conservation, the Region K irrigation needs could be met and 150,00 acre-feet per year could be provided to meet needs in Region L. The San Antonio Water System (SAWS), located in Region L, and The Lower Colorado River Authority (LCRA), located in Region K, are in the process of carrying out a 7-year evaluation of the strategy, including extensive environmental studies.

The objectives of evaluations of this water management strategy for potential inter-regional cooperation are to estimate quantities of groundwater available, taking into account local regulatory policies of aquifer drawdown, and system operations with surface water sources. Effects of development upon water levels of the aquifer and potentials for salt water intrusion would be evaluated, estimates would be made of costs of shared facilities, such as river diversion works, off-channel storage facilities, pipelines and pump stations, and well fields, and environmental effects would be described and quantified. In addition, estimates would be made of cost savings to Regions K, L, M, N, and P through shared facilities and cooperative development and use of water from this potential source of supply.

IRC—3: Desalination : Water supply potentials for Regions K, L, M, N, and P include desalination of seawater, brackish groundwater, and blended seawater and brackish groundwater. Regions L, M, and N individually evaluated desalination strategies for their respective regions, and included desalination in their respective water plans. Region N included a seawater desalination plant near the Barney Davis Steam-Electric Power Plant on the Laguna Madre to supply water as needed beyond 2030. In separate action, the City of Corpus Christi has begun the planning of a 3 MGD to 5 MGD brackish groundwater desalination plant to be located on North Padre Island within the next 5 years.

The Region L plan includes a seawater desalination plant that would be located near the mouth of the Guadalupe River. This plant would obtain feed water from San Antonio Bay, and supply about 56,000 acre-feet per year to Bexar County in Region L in 2040, and 84,000 acre-feet per year in 2050. The Region M plan includes desalination of brackish groundwater from aquifers in Cameron, Hidalgo, and Willacy Counties to meet local municipal and industrial needs.

The objectives of evaluations of this water management strategy for potential inter-regional cooperation are to: (1) update estimated desalt costs that were made by Regions L, M,

and N for a range of sizes of desalination plants (50 MGD, 75 MGD, and 100 MGD) for locations at (a) Barney Davis Steam-Electric Plant, (b) Joslin Steam-Electric Plant, and (c) Region L's site; (2) consider use of brackish groundwater from well fields in coastal counties as desalt plant source water to reduce costs, reduce potential saltwater intrusion into fresh groundwater well fields located inland, and reduce costs of brine disposal; (3) determine costs to inland water users to supply de-salted water to coastal users in exchange for inland freshwater supplies owned by coastal users; (4) calculate costs of potential exchange facilities, mentioned in item 3, including pipelines, pump stations, storage facilities, and well fields, as appropriate, (5) calculate O&M costs for facilities; and (6) identify potential cost savings to regions through cooperative implementation of desalt and freshwater exchange strategies, as opposed to implementation of the projects by each region within their respective regional plans.

IRC—4: Palmetto Bend Stage II: Palmetto Bend Stage II reservoir site is located in Jackson County (Region P), with an estimated firm yield of 28,000 acre-feet per year initially, and 23,000 acre-feet per year after 50 years of sediment accumulation. The Lavaca-Navidad River Authority holds a permit for the water rights and construction of the project. Region N has included the reservoir as a potential option to meet its needs beyond 2030.

The reservoir site is located in close proximity the Mary Rhodes Memorial Pipeline and to the pipelines of the Region L plan to obtain Lower Colorado River water. The project has potentials as an individual reservoir, as a channel diversion project to scalp Lavaca River flows into Lake Texana, and perhaps would have capacity for storage of diversions from the Lower Colorado River.

The objectives of evaluations of this water management strategy for potential inter-regional cooperation are to: (1) estimate the yield of Palmetto Bend Stage II when operated in conjunction with the Gulf Coast Aquifer in Refugio County; (2) estimate the combined yield of Lake Texana and Palmetto Bend Stage II when operated in conjunction with the Gulf Coast Aquifer in Refugio County; (3) estimate contributions to the yield of Lake Texana if the Palmetto Bend Stage II site is sized as a diversion facility, with scalping into Lake Texana, both with and without conjunctive use of groundwater; and (4) estimate the cost of facilities necessary for both the conjunctive use and scalping options.

IRC—5: Optimization of Nueces Basin Yield: Present surface water development in the Nueces River Basin includes Lake Corpus Christi and Choke Canyon Reservoir. These reservoirs, plus other surface water rights of the Basin, are the major water supply for a 7-County

area of the Coastal Bend region. However, the storage capacity of Choke Canyon Reservoir is presently underutilized, since runoff from the contributing watershed has been less than rates used in sizing the Project. Opportunities for additional development and management of the water resources of the Nueces Basin include: (a) a reservoir at a site near Cotulla, (b) diversion of floodwaters of the Nueces River to Choke Canyon Reservoir, (c) construction of a pipeline linking Choke Canyon Reservoir to Lake Corpus Christi, (d) construction of a pipeline from Lake Corpus Christi to Calallen Reservoir, and (e) diversions to Choke Canyon Reservoir from the San Antonio River near Falls City, and diversions to Lake Corpus Christi or to the Corpus Christi water treatment plant at Calallen from sources to the east, including the Gulf Coast Aquifer in Refugio, Goliad, and Bee Counties, the Lower Guadalupe River, and the Lower Colorado River. Concepts for a systematic evaluation of these elements are expressed for consideration as a cooperative water management strategy for Regions L, M, and N.

The objectives of evaluations of this water management strategy for potential inter-regional cooperation in the development of one or more of the yield enhancing potentials mentioned above are to: (1) estimate additional water supply yields in the Nueces River Basin, without and with Edwards Aquifer recharge enhancement, based upon 1989 levels of Return Flows, as used in Region L Plan; (2) compute costs for selected cases having favorable/feasible yields; and (3) assess environmental effects of cases having favorable/feasible yields and costs.

IRC—6: Inter-Regional Facilities: The Inter-Regional Facilities strategy includes 3 potential operational and management systems, as follows: (6A) South Texas collection and delivery system, with delivery systems for Bexar County of Region L, Corpus Christi area of Region N, and Lower Rio Grande Valley of Region M; and (6B) Nueces Basin Selected Yield Optimization Strategy as Base System, with South Texas collection and delivery system, and delivery system extensions to Bexar County of Region L and Lower Rio Grande Valley of Region M; and (6C) South Texas collection and delivery system, with delivery systems for Bexar County of Region L, Corpus Christi area of Region N, with Palmetto Bend Stage II as an added source of supply. The base plan for each of the 3 alternative South Texas collection and delivery systems is:

- Region L: Lower Guadalupe Diversion, with Gulf Coast Aquifer in Refugio and Goliad Counties, and Lower Colorado Diversion, and
- Region N: Garwood Diversion to the Mary Rhodes Memorial Pipeline, with Gulf Coast Aquifer in Refugio, Goliad, and Bee Counties.

Delivery System 6A would include elements to serve Regions L, N, K, M, and P, as follows: (a) Cotulla Reservoir Yield to Frio River and Choke Canyon Reservoir, (b) Nueces River Diversions to Choke Canyon Reservoir, (c) San Antonio River Diversions to Choke Canyon Reservoir, (d) Choke Canyon Reservoir Diversion to Bexar County, (e) Lower Guadalupe/Gulf Coast Aquifer, and/or Lower Colorado Surface Water, and/or Palmetto Bend Stage II, and/or Desalination Facility at Corpus Christi to Region N to replace Choke Canyon Diversion to Bexar County, and (f) Expand deliveries from sources listed in (e) to Regions N and M if quantities available.

Delivery System 6B would include elements to serve Regions L, N, and M, as follows: (a) Nueces River Diversions to Choke Canyon Reservoir, (b) San Antonio River Diversions to Choke Canyon Reservoir, (c) Choke Canyon Reservoir Diversion to Bexar County, (d) Cotulla Reservoir Yield, with Groundwater from Carrizo Aquifer in Dimmit and LaSalle Counties to Laredo, (e) Lower Guadalupe/Gulf Coast Aquifer, and/or Lower Colorado surface Water, and/or Palmetto Bend Stage II, and/or Desalination Facility at Corpus Christi to Region N to replace Choke Canyon Diversion to Bexar County, and (f) Expand deliveries from sources listed in (e) to Regions N and M if quantities available.

Delivery System 6C would include elements to serve Regions L and N, by Constructing Palmetto Bend Stage II, with diversions to Regions L and/or N.

The objectives of evaluations of the Inter-Regional Facilities strategy for potential inter-regional cooperation are to: (1) estimate yields of selected System configurations; (2) compute costs of System configurations selected; (3) assess environmental effects of System configurations selected; and (4) assess the potential for enhancement of water available for Instream Flows and Bay and Estuary Inflows, according to methods stated in the report.

The Draft Report, dated December 27, 2001 was issued to representatives of Regions K, L, M, N, and P for review and consideration. The consultants met with each Regional Water Planning Group in a regularly scheduled RWPG meeting, presented the report, and responded to questions. In a review letter dated February 13, 2002, the Texas Water Development Board expressed reservations as to eligibility of the proposed Inter-Regional Water Management Strategies for TWDB funding (See Appendix C).

The respective RWPGs considered the Water Management Strategies identified in the Draft Report for inclusion in their respective Scopes of Work of their grant applications to TWDB for Regional Water Plan updates and revisions for the 2006 Regional Water Plans. Region K included Consultant participation in the inter-regional cooperation effort in Task 10.

Region L included in its request for supplemental funding, an evaluation of Lower Colorado River (IRC-2), Desalination (IRC-3), Optimization of Nueces Basin Yield (IRC-5), Inter-Regional Facilities (IRC-6), and provisions for inter-regional coordination in Task 10. Region N included Optimization of Nueces Basin Yield (IRC-5), giving this Water Management Strategy its highest ranking for supplemental funding to evaluate water management strategies, with a requested budget of \$158,000. Regions M and P did not include any of the inter-regional strategies in their grant applications.

Section 1
***Inter-Regional Coordination for the Development of Consensus
On Water Management Strategies for South Texas***

1.1 *An Inter-Regional Water Planning Process for South Texas*

While Senate Bill 1 divided the state into regional water planning areas, it also encouraged inter-regional water planning, coordination and cooperation. In an effort to identify potential water management strategies benefiting water users throughout the entire South Texas area, from the Rio Grande to the Colorado River, five SB1 Regional Water Planning Groups resolved to sponsor an Inter-Regional Coordination (IRC) process. The five water planning regions involved in the process include: Lower Colorado River (Region K); South Central Texas (Region L); Rio Grande (Region M); Coastal Bend (Region N); and Lavaca (Region P). The Texas Water Development Board has provided financial assistance to enable the regions to undertake this Inter-Regional Coordination (IRC) program.

Through a process of facilitated meetings, the Inter-Regional Work Group (IRWG), consisting of representatives of the five participating regional water planning groups, has identified and described water management strategies of potential interest to 2 or more of Regions K, L, M, N and P for cooperative, inter-regional water planning efforts during the forthcoming round of regional water planning pursuant to 31 Texas Administrative Code, Chapters 355, 357, and 358, and TWDB Rules, effective March 11, 1998, as amended. The facilitated meetings were open to the public, and used information about water management strategies that were identified and evaluated in the regional water plans that were completed and filed with the Texas Water Development Board (TWDB) in January 2001, and other information that became available to the IRWG. The objective of the process was the specification of Inter-Regional Water Management Strategies (IRWMS) to be recommended for evaluation and consideration for inclusion in 2 or more of the forthcoming regional water plans of the cooperating regions in order to increase the effectiveness and efficiencies of water plans in the cooperating regions.

1.2 Project Management

The Nueces River Authority (NRA), Region N's Designated Political Subdivision, serves as the Project Manager acting on behalf of Regions K, L, M, N, and P. The IRWG obtained professional services for: (1) facilitation of IRWG deliberations, (2) public information, (3) preparation of technical information, and (4) preparation of reports. The Consultant Team includes representatives from the staffs of the consultants of each cooperating region, as follows: HDR Engineering, Inc., Open Forum, and Moorhouse Associates, Inc. (Region L), NRS Consulting Engineers (Region M), HDR Engineering, Inc. (Region N), and Turner, Collie, and Braden (Regions K and P). The Consultant Team provides Assistance to the Nueces River Authority (NRA), acting on behalf of Regions K, L, M, N, and P. HDR Engineering, Inc. is the Prime Contractor to NRA, with others working as subcontractors to HDR.

Staff of the Consultant Team participated in IRWG sessions at which Potential Inter-Regional Water Management Strategies were identified and discussed. From these discussions, and other written and/or verbal communications through NRA's project manager, HDR prepared this draft report for presentation to each cooperating region's Regional Water Planning Group (RWPG) for consideration and decisions. Estimated budgets for technical evaluation of each of the identified Inter-Regional Water Management Strategies described in Section 2 are summarized in Appendix A.

1.3 Criteria for Evaluating Potential Inter-Regional Water Management Strategies

The evaluations of the strategies listed below will be carried out in accordance with TWDB Rules for regional water planning, with the individual strategies being analyzed: (1) as of the immediate location of the strategy, and (2) included as components of one or more Inter-Regional Water Management Systems. Any strategies involving sharing of infrastructure to reduce costs, including sharing of the use of the Mary Rhodes Memorial Pipeline, sharing of other existing facilities, and sharing of conceptualized potential facilities will be evaluated in light of appropriate legal, physical, and financial conditions and commitments of the owners of the facilities. For example, evaluations of any strategy to integrate facilities into a Systems Operation will include recognition of owners' equities, with costs appropriately allocated to all who might cooperate, on the basis of proportionate use. However, the analyses will not imply that Owners will necessarily agree to such terms, leaving such agreements to be negotiated among those who will be involved.

Section 2

Potential Water Management Strategies for Consideration by Regions K, L, M, N, and P

2.1 Name of Strategy: IRC—1: Gulf Coast Aquifer—Bee, Goliad, and Refugio Counties

2.1.1 Background

The Gulf Coast Aquifer in Bee, Goliad, and Refugio Counties contains significant quantities of fresh water, which have not been developed (Figure-1). Local landowners have indicated an interest in selling water from the aquifer, and both Regions L and N have included water from this source as a potential option to meet projected needs. Information about quantities of water available is based upon a five-layer MODFLOW groundwater model developed for the recently completed regional water plans.¹ The Texas Water Development Board (TWDB) has initiated the development of new Groundwater Availability Models (GAMS) for the aquifer in these counties.

The Mary Rhodes Memorial Pipeline extends from Lake Texana to Corpus Christi and passes through the entire length of Refugio County along Hwy 77, and is very near to the water deposits of all three counties. The Region N water plan includes use of water from the Gulf Coast Aquifer via the Mary Rhodes Memorial Pipeline, as one of several potential options to meet needs after 2030.

The Region L water plan includes the Lower Guadalupe River Diversion to meet needs in the Bexar County area of Region L by 2010. This water management strategy includes diversions of water from the Guadalupe River upstream of the saltwater barrier under existing under-utilized water rights, with off-channel storage and well fields in Refugio County to firm up surface water supplies during times of drought. Mixing of the groundwater and surface water could potentially be accomplished in an off-channel storage reservoir.

2.1.2 Scope of Work

The objectives of evaluations of this water management strategy for potential inter-regional cooperation are to:

¹ Coastal Bend Regional Water Planning Group, "Coastal Bend Regional Water Plan, Volume I, Appendix C," Texas Water Development Board, Nueces River Authority, HDR Engineering, Inc., et al., January 2001.

- (1) Estimate the quantities of acceptable quality groundwater using the best available groundwater model taking into account relevant and appropriate regulatory policies (Local and State Rules and Policies) regarding aquifer drawdown.
- (2) Compute estimates of costs of water from this source, including purchase costs of water and/or water rights, costs of well fields, costs of pumping, and costs to collect the water into one or more systems that are centrally located within the area.
- (3) Evaluate effects of various levels of pumping upon water levels, potentials for saltwater intrusion, and potential effects upon local aquifer users.
- (4) Review and evaluate aquifer storage and recovery potentials to enhance long-term yields of the aquifer.
- (5) Evaluate potential environmental effects of use of this source of water, identify mitigation needs, and estimate mitigation costs.
- (6) Identify possibilities for cooperation of Regions K, L, M, N, and P to engage in conjunctive development and use of water from this potential source of supply together with other surface water sources.

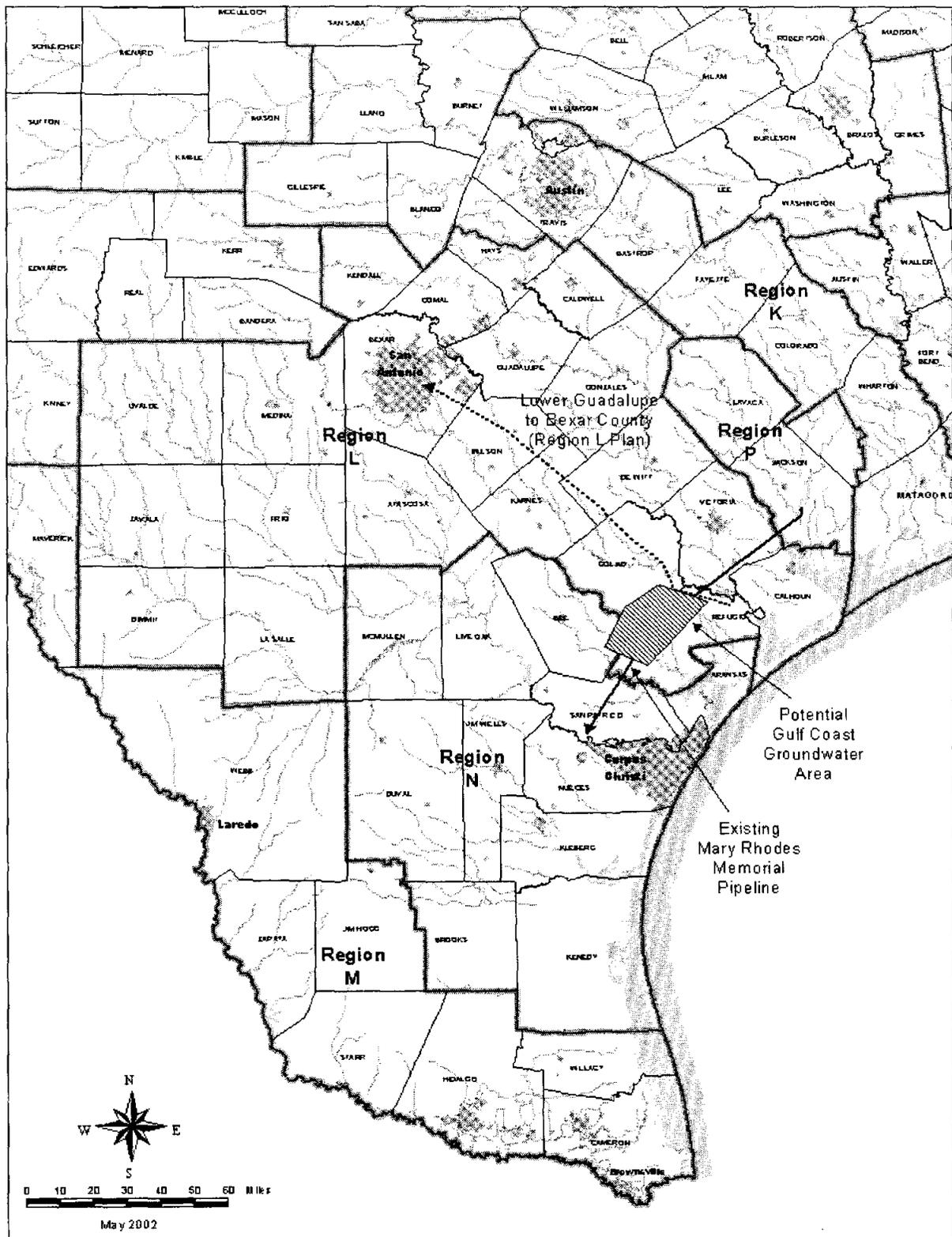


Figure 1. IRC-1: Gulf Coast Aquifer (Bee, Goliad, and Refugio Counties)

2.2 Name of Strategy: IRC—2: Lower Colorado River

2.2.1 Background

The Lower Colorado River in Colorado, Wharton, and Matagorda Counties is the location of surface water sources that have been included in the water plans of Regions K, L, and N (Figure-2). Region K has large irrigated acreages in each of the counties that are supplied surface water from run-of-river water rights, with this source of supply being included in the Region K water plan. However, the Region K plan has projected irrigation water shortages in the latter decades of the 50-year planning period.

Corpus Christi, of Region N, owns 35,000 acre-feet of run-of-river water rights with the diversion point located along the West Bank of the Colorado River at either the present Garwood Irrigation diversion point in Colorado County, or at a point on the West Bank of the Colorado River located in the reach specified by a point 5 miles downstream of the Garwood Irrigation diversion to Bay City. This supply is included in the Region N water plan as a potential option to meet needs in Region N after 2030. Corpus Christi's Mary Rhodes Memorial Pipeline from Lake Texana in Jackson County in Region P to Corpus Christi in Region N is available to convey water from this source once a new 40-mile connecting pipeline from the Lower Colorado River is constructed.

The Region L water plan includes water supplies from the Lower Colorado River, with proposed diversions at Bay City to meet projected needs in Bexar County of 66,000 acre-feet per year, beginning in 2020, and increasing to 132,000 acre-feet per year in 2050. The water management strategy included in the Region L plan includes water supplies to meet needs in Region L and has provisions to assist in meeting projected irrigation shortages in Region K of approximately 180,000 acre-feet per year. The strategy includes river diversion works, off-channel storage of surface water near the diversion points, well fields within the irrigated areas, and water conservation measures and programs to meet a part of the irrigation shortages in Region K. The Region L water management strategy includes pipelines from the off-channel reservoirs to convey the water to the Bexar County area and water treatment facilities in or near Bexar County. The well fields within the irrigated areas in Region K would supply water to the farmers of Region K via existing canals. In addition, the strategy provides for increased

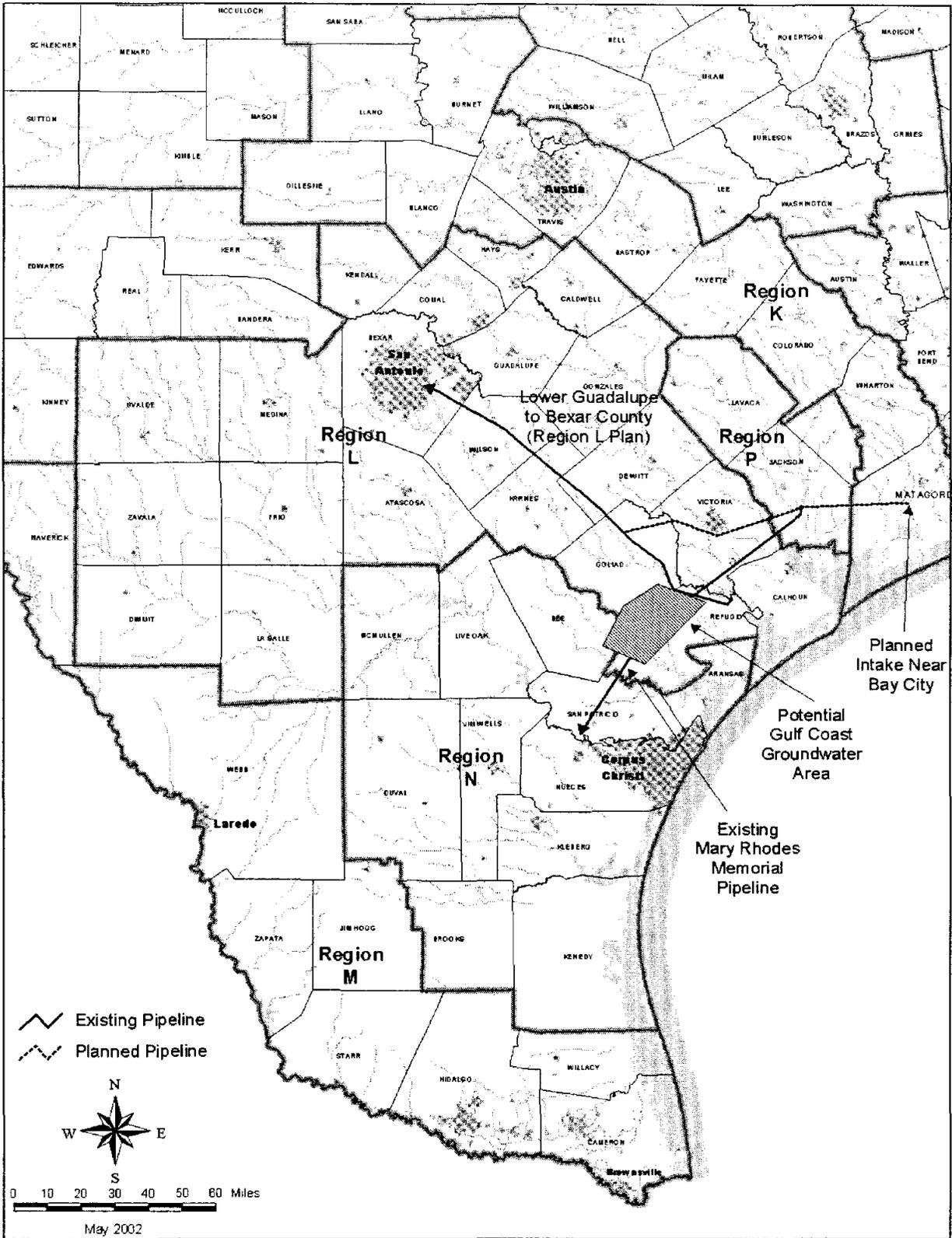


Figure 2. IRC-2: Lower Colorado River

irrigation water conservation through lining of canals, laser leveling, and other techniques. The irrigation conservation elements of this water management strategy account for about 120,000 acre-feet per year of the 180,000 acre-feet per year of irrigation water needed to meet the Region K irrigation shortage.

The San Antonio Water System (SAWS) located in Region L and The Lower Colorado River Authority (LCRA) located in Region K have entered into a Memorandum Contract effective February 7, 2001. The Memorandum Contract states in its recitals, among other things, that: "LCRA desires to sell and SAWS desires to purchase surface water to be made available from demand reduction and new firm yield to be developed from the Colorado River consistent with the regional water plans for Region K and Region L ("Project") if feasible and if legislation (the "Legislation") is enacted by the 77th Texas Legislature during its Regular Session to allow the purchase and sale of water on terms consistent with this Memorandum Contract." The Memorandum Contract includes the following specific provisions:

- (1) A maximum of 150,000 acre-feet per year sale of surface water; and
- (2) A 7 year study period to determine if water can be made available cost-effectively while addressing potential environmental impacts.

The Legislation mentioned in the Memorandum Contract was enacted by the 77th Texas Legislature, Regular Session, as HB 1629, and became effective May 3, 2001. The "Legislation" is entitled, "AN ACT relating to the provision of water by the Lower Colorado River Authority to a municipality outside the Colorado River Basin." HB 1629 includes the following specific provisions:

- (1) Contractual sale of no more than 150,000 acre-feet per year of water;
- (2) Provisions for instream flows no less protective than those in the LCRA Water Management Plan approved by TNRCC; and
- (3) Consistency with Regional Water Plans filed with TWDB on or before January 5, 2001.

In addition, HB1629:

- (1) Sets a base period for contracts of 50 years, with an option to renew for no more than an additional 30 years, with requirements that, if contracts are renewed, the municipality progressively reduces the quantity of water used during the last 10 years of the renewal term;
- (2) Provides for a surcharge to enable the LCRA to develop and manage water resources for the mutual benefit of the LCRA's service area and the municipality;

- (3) Ensures that the municipality will prepare a drought contingency plan, and has developed and implemented a water conservation plan that will result in the highest practicable levels of water conservation and efficiency achievable within its jurisdiction;
- (4) Provides for a broad public and scientific review process to ensure that all information that can be practicably developed is considered in establishing beneficial inflow and instream flow provisions; and
- (5) Provides that the contract must benefit stored water levels in the LCRA's existing reservoirs.

SAWS and LCRA are in the process of carrying out a 7-year evaluation of the strategy, including extensive environmental studies.

2.2.2 Scope of Work

The objectives of evaluations of this water management strategy for potential inter-regional cooperation are to:

- (1) Estimate the quantities of acceptable quality groundwater for use by irrigation farmers of Region K, using the most appropriate models taking into account relevant and appropriate regulatory policies (Local and State Rules and Policies) of aquifer drawdown.
- (2) Based on system operations with surface water sources, evaluate effects of various levels of groundwater pumping upon water levels, potential for saltwater intrusion, and potential effects upon local users of the aquifer.
- (3) Compute and/or update estimates of costs of water from the river (with and without groundwater), including costs of potentially shared facilities such as river diversion works, off-channel storage, pipelines and pump stations, and well fields.
- (4) Identify possibilities for cooperation of Regions K, L, M, N, and P to engage in cooperative development and use of water from this potential source of supply.
- (5) Identify cost savings to each region through construction of shared facilities.

2.3 Name of Strategy: IRC—3: Desalination

2.3.1 Background

Desalination potentials for Regions K, L, M, N, and P include desalination of seawater, brackish groundwater, and blended seawater and brackish groundwater (Figure-3).

In 2000, in support of the SB 1 regional water planning process, the Texas Water Development Board funded a study that reviewed membrane technologies and costs for water desalination, and performed an analysis of siting factors for seawater desalination along the Texas coast.² The review showed that reverse osmosis and electrodialysis reversal systems are the primary membrane treatment options to desalt brackish water, with reverse osmosis being the only viable membrane treatment option to desalt seawater.

The survey of operating desalination plants in Texas, Florida, and California, showed that the majority of membrane desalination plants are reverse osmosis systems treating brackish groundwater. However, both reverse osmosis and electrodialysis reversal systems are currently being used to treat inland brackish surface water in Texas. Total treated water costs for groundwater ranged from \$1.50/1,000 gal to \$2.75/1,000 gal, while treated surface water costs ranged from \$1.00/1,000 gal to \$1.20/1,000 gal. Operation and maintenance cost data showed significant economies of scale. The survey also showed that few seawater desalination facilities are currently operating in the U.S.

Cost and siting information for a seawater desalination facility were obtained from plans for a project currently being developed by Tampa Bay Water, Tampa Bay, Florida.³ Tampa Bay Water has a unique situation for these facilities, with an existing power plant providing sufficient raw water without drawing additional water from the bay, and a cooling water flow rate of 1,350 MGD to dilute the discharged concentrate. Also, several studies by Tampa Bay Water and

² Black, Bryan, and Mark Graves, "Desalination for Texas Water Supply," prepared for Texas Water Development Board, Nueces River Authority, Central Power & Light Company, City of Corpus Christi, and San Patricio Municipal Water District, Austin, Texas, August, 2000.

³ The Tampa Regional Water Supply project in Florida was described in detail, and siting and other information about the Tampa project were used in an assessment of the potentials for desalination along the Texas Coast.

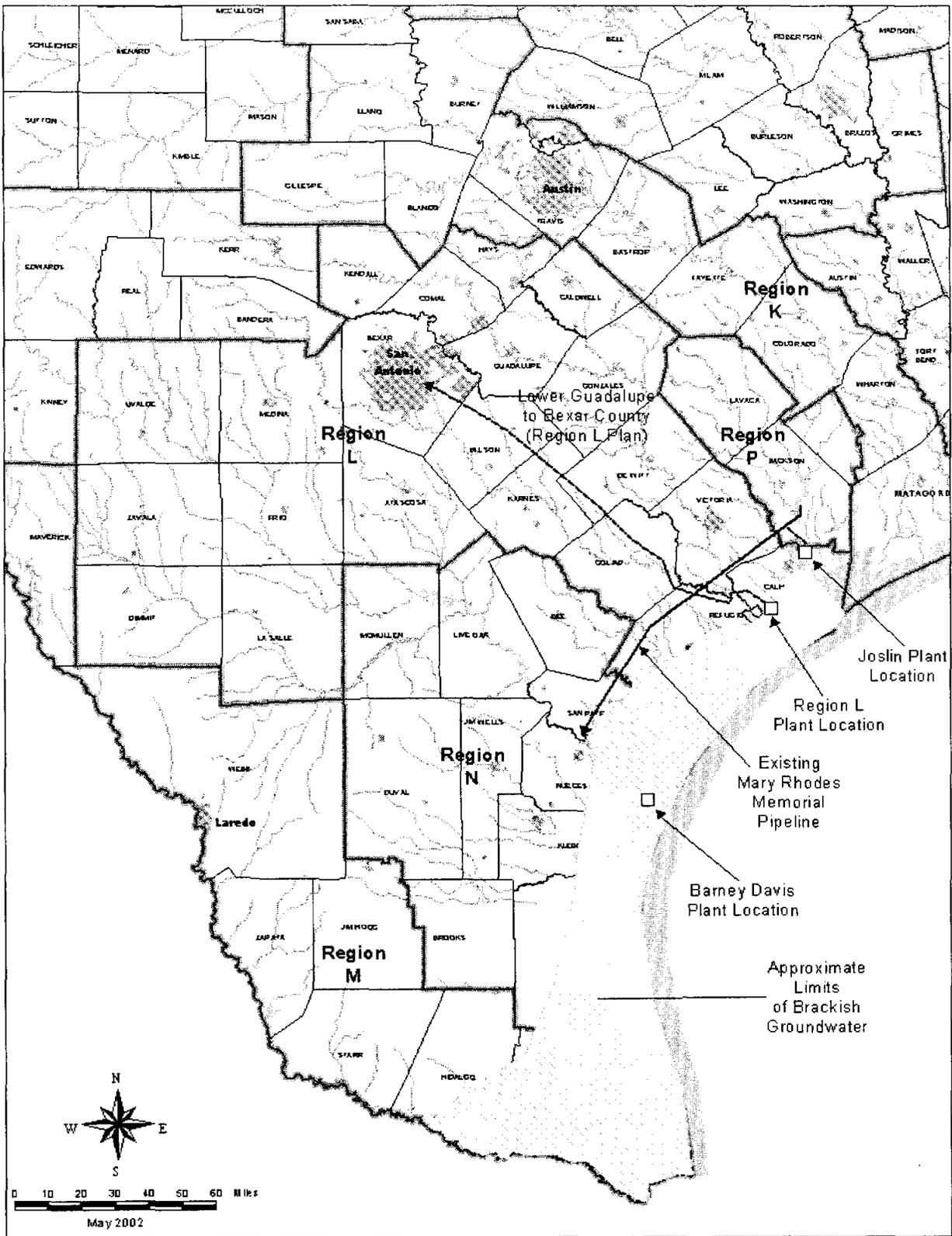


Figure 3. IRC-3: Desalination

Florida regulatory authorities indicate that the concentrate can be discharged through the existing power plant outfall without harmful environmental effects. These findings are largely dependent on the high degree of mixing and flushing observed in the discharge bay.

The costs and feasibility of providing water through seawater desalination were identified and reviewed with respect to their impact on seawater desalination for the Texas coast. The report describes the relation between Texas coastal geography, hydraulics and salinity and provides data on bay water flushing and salinity. The variability of water quality at different areas of the coast and over time was also evaluated, and a quantitative relation was developed to describe the impacts of source water salinity and other water quality parameters on capital and operation and maintenance costs. Estimates for the production of concentrate and finished water were provided using typical recovery rates over a range of conditions. In addition, issues regarding water rights permits required for diversion of state waters were addressed.

The report describes product water delivery issues and solutions, including post-treatment, water chemistry, and blending, the impacts of siting on the costs of intake and outfall structures, as well as the benefits of co-location with power stations. Flooding and storm surge issues were described as they impact potential sites and water production costs. Power supply, energy recovery, power costs, and probable trends were described including projections of the impact of electric utility deregulation on desalination power costs. Since concentrate disposal is a key issue for seawater desalination, the impact of concentrate disposal issues on site selection were evaluated and available literature on environmental impacts of concentrate discharges in coastal and marine waters, including toxicity, hydraulics, and mass balance models were reviewed.

The siting factors described above were incorporated into a general seawater desalination cost model that was used to evaluate several potential facility locations on the Texas coast. In addition, environmental considerations were addressed and prominent environmental features were illustrated on maps. Compliance with other local, state and federal regulations was also addressed, briefly.

The study shows that cost for a 25 MGD desalted water supply from a desalination plant operating at 100 percent utilization at two sites on the Texas coast are approximately \$2.85 per thousand gallons of product water. More realistic utilization rates (e.g., 85 percent) will cause the unit costs of water to be higher, with the estimated unit costs for the Texas coast being about

35 percent higher than the lowest proposal of \$2.08 received by Tampa Bay Water in 2000. The higher costs of these potential facilities along the Texas coast are primarily due to higher ambient salinity and added costs for concentrate disposal.

The authors of the report conclude that additional data need to be collected and additional evaluation will be needed in order to implement seawater desalination on a large scale. The report identifies data needs to reduce siting uncertainties and describes general planning measures for data acquisition. Topics addressed include source water quality, toxicity testing, receiving water hydraulics, and mass balance modeling for concentrate discharge.

The Texas Water Development Board also funded a study of desalination potential at the Joslin Steam-Electric Power Generating Plant located near Lavaca Bay in Region L. The study focused upon the potentials for desalination in association with use of screened and heated cooling water from the power plant, and the disposal of brine concentrate along with the discharge of power plant cooling water. The study considered the potentials to supply potable water to Regions L and N via the Mary Rhodes Memorial Pipeline, and pipelines of Region L water management strategies, including those to convey both surface and groundwater from the Lower Guadalupe and Lower Colorado Rivers and Gulf Coast Aquifer in the vicinity of the surface water sources. Region P completed the study in 2000, in cooperation with Regions L and N. In addition, Regions L, M, and N individually evaluated desalination water management strategies for their respective regions, and included desalination, as is stated below.

Regions L and N have included desalination of seawater as potential options in their respective water plans, with Region N including a seawater desalination plant near the Barney Davis Steam-Electric Power Plant on the Laguna Madre to supply water as needed beyond 2030. In separate action, the City of Corpus Christi has begun the planning of a 3 MGD to 5 MGD brackish groundwater desalination plant to be located on North Padre Island within the next 5 years.

The Region L plan includes a seawater desalination plant that would be located in Refugio County near the mouth of the Guadalupe River. This plant would obtain feed water from San Antonio Bay, and supply about 56,000 acre-feet per year to Bexar County in Region L in 2040, and 84,000 acre-feet per year in 2050.

The Region M plan includes desalination of brackish groundwater from aquifers in Cameron, Hidalgo, and Willacy Counties to meet local municipal and industrial needs, and

although the following projects are not in the Region M Plan, the Southmost Regional Water Authority (SRWA) in Cameron County is planning for the use of 17,000 acre-feet per year of brackish groundwater and the North Alamo Water Supply Corporation in Willacy County is planning for the use of 1,100 acre-feet per year of brackish groundwater. Each of these facilities is in the preliminary planning stages, with implementation tentatively scheduled within the next 5 years. Low-pressure reverse osmosis membrane technology is being considered as the treatment process. (SRWA is planning use of seawater desalination for additional water supply in the future.)

2.3.2 Scope of Work

The objectives of evaluations of this water management strategy for potential inter-regional cooperation are to:

- (1) Assemble, update, and/or adjust previously estimated desalt costs that were made by Regions L, M, and N for a range of sizes (50 MGD, 75 MGD, and 100 MGD) of desalination plants for locations at (a) Barney Davis Steam-Electric Plant, (b) Joslin Steam-Electric Plant, and (c) Region L's Calhoun County site.
- (2) Consider use of brackish groundwater obtained from well fields in coastal counties, as desalt plant source water to reduce costs, reduce potential saltwater intrusion into fresh groundwater well fields located inland, and reduce costs of brine disposal. Such brackish well fields would be located near the coast so as to intercept seawater that might intrude into freshwater well fields located inland, and the desalt process would be controlled to result in brine reject water at concentrations no greater than the salinity of the receiving estuaries.
- (3) Determine costs to inland water users (Bexar County) to supply de-salted water to coastal users (Corpus Christi) in exchange for inland freshwater supplies (Choke Canyon Reservoir) owned by coastal users. Cost out all potential exchange facilities, including pipelines, pump stations, storage facilities, and well fields, as appropriate. Cost out O&M for all facilities.
- (4) Monitor facilities currently underway to establish actual costs of treatment and utilize technology transfer among regions.
- (5) Identify potential cost savings to regions through implementation of strategy.

2.4 Name of Strategy: IRC—4: Palmetto Bend Stage II

2.4.1 Background

Palmetto Bend Stage II reservoir site is located on the Lavaca River in Jackson County (Region P) (Figure-4). The estimated firm yield of the project is 28,000 acre-feet per year initially, and is 23,000 acre-feet per year after 50 years of sediment accumulation. The Lavaca-Navidad River Authority holds a permit for the water rights and construction of the project, and the Region P plan has recommended the Palmetto Bend Stage II site as a unique reservoir site. Region N has included this reservoir as a potential option to meet its needs beyond 2030.

The reservoir site is located just west of Lake Texana, is upstream of and near to the Mary Rhodes Memorial Pipeline, and is in close proximity to the pipelines of the Region L plan strategy to obtain Lower Colorado River water. Palmetto Bend Stage II has potentials as an individual reservoir, as a channel diversion project to scalp Lavaca River flows into Lake Texana to increase Lake Texana yields, and perhaps as an individual project with some capacity for storage of diversions from the Lower Colorado River. Palmetto Bend Stage II needs to be evaluated as to its potential to enhance conjunctive management of surface and groundwater from the Lower Colorado and Lower Guadalupe Rivers and the Gulf Coast Aquifer.

2.4.2 Scope of Work

The objectives of evaluations of this water management strategy for potential inter-regional cooperation are to:

- (1) Estimate the combined yield of Palmetto Bend Stage II when operated in conjunction with the Gulf Coast Aquifer in Refugio County.
- (2) Estimate the combined yield of Lake Texana and Palmetto Bend Stage II when operated in conjunction with the Gulf Coast Aquifer in Refugio County.
- (3) Estimate contributions to the yield of Lake Texana if the Palmetto Bend Stage II site is sized as a diversion facility, with scalping into Lake Texana, both with and without conjunctive use of groundwater.
- (4) Estimate the cost of facilities necessary for both the conjunctive use and scalping options.

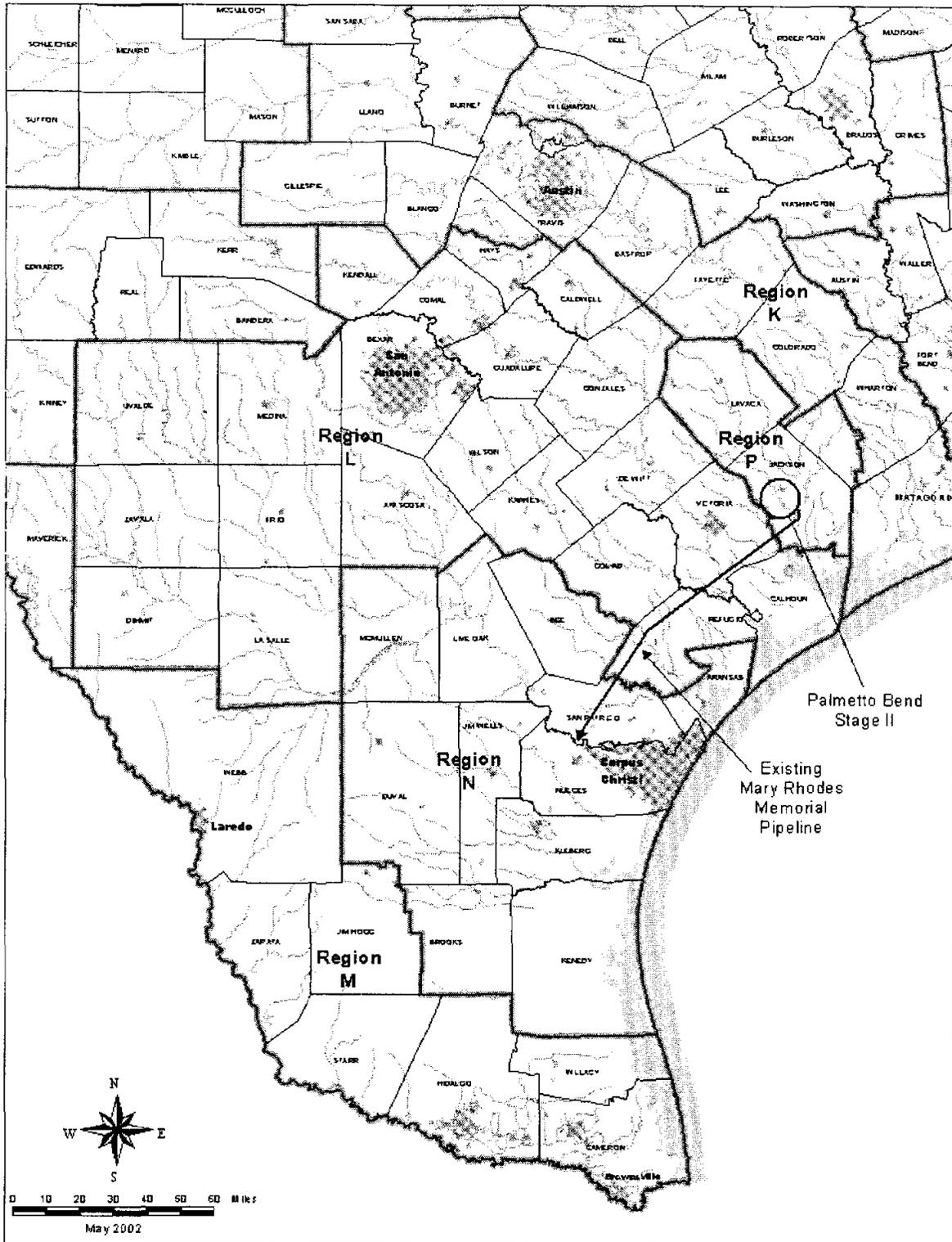


Figure 4. IRC-4: Palmetto Bend Stage II

2.5 Name of Strategy: IRC—5: Optimization of Nueces Basin Yield

2.5.1 Background

The Nueces River Basin has a drainage area of approximately 16,920 square miles in the semiarid area of Texas that extends northwesterly from the Gulf of Mexico at Corpus Christi to Rocksprings in Edwards County of the Edwards Plateau. The Nueces River empties into Nueces Bay, an arm of Corpus Christi Bay. Major streams include the Atascosa River, the Frio River and its tributaries (San Miguel Creek, Hondo Creek, Sabinal River, Dry Frio River, and Leona River), and the Nueces River. The Atascosa and Frio Rivers discharge into the Nueces River near the City of Three Rivers, upstream of Lake Corpus Christi.

Present surface water development in the Nueces River Basin includes Lake Corpus Christi impounded by Wesley Seale Dam on the main stem, located near Mathis, and Choke Canyon Reservoir near the mouth of the Frio River, upstream of the City of Three Rivers. The Choke Canyon Reservoir/Lake Corpus Christi System (CCR/LCC System) and associated water rights, plus other surface water rights of the Nueces Basin are owned by the City of Corpus Christi and The Nueces River Authority, and are the major water supply for a 7-County area of the Coastal Bend region. The storage capacity of Choke Canyon Reservoir is presently underutilized, since runoff from the Frio watershed has been less than rates used in sizing the Project. In addition, there are possibilities for diversions of flood flows from the Nueces River into Choke Canyon Reservoir which may increase the yield of the CCR/LCC System at comparatively attractive costs in comparison to other alternatives. Studies of the rivers in this watershed indicate that channel losses are some of the highest in Texas, and with management and new facilities, it may be possible to reduce these losses and provide additional water supply

Opportunities for additional development and management of the water resources of the Nueces Basin include a reservoir at a site near Cotulla, diversion of floodwaters of the Nueces River to Choke Canyon Reservoir, construction of a pipeline linking Choke Canyon Reservoir to Lake Corpus Christi, construction of a pipeline from Lake Corpus Christi to Calallen Reservoir, diversions to Choke Canyon Reservoir from the San Antonio River near Falls City, and diversions to Lake Corpus Christi or to the Corpus Christi water treatment plant at Calallen from sources to the east, including the Gulf Coast Aquifer in Refugio, Goliad, and Bee Counties, the Lower Guadalupe River, and the Lower Colorado River. Information developed by Regions L and N during the first regional planning cycle, completed in January 2001, about the Cotulla

Reservoir, Nueces River Diversions to Choke Canyon and pipelines to convey water from the reservoirs to points of use are described below. In addition, concepts for a systematic evaluation of these elements are expressed for consideration as a cooperative water management strategy for Regions L, M, and N.

Cotulla Reservoir: The Cotulla Reservoir site is located in Dimmit and LaSalle Counties, west of the town of Cotulla, and, as evaluated in the Region L plan, has an estimated firm yield of 57,000 acre-feet per year, with a 10,000 acre-feet per year reduction in the yield of the downstream CCR/LCC System. The site would involve the use of 31,000 acres of land.

Although Regions L and M considered the Cotulla Reservoir, it was not included in either plan, nor was it included in any of the other regional plans. The Cotulla site has potentials as a stand alone project, with mitigation of downstream effects upon the CCR/LCC System and environmental flows, or as a channel diversion from which water could be diverted and piped across the Nueces-Frio watershed divide, then discharged into the Frio River, and allowed to flow into Choke Canyon Reservoir for use in the CCR/LCC System. The Cotulla Reservoir, operated in conjunction with groundwater sources, may also be of interest to meet projected needs in the Laredo area (Region M).

Nueces River Diversions to Choke Canyon Reservoir: After the completion of Choke Canyon Reservoir in 1982, the concept of diversions into Choke Canyon Reservoir from the Nueces River below Three Rivers downstream of the confluence of the Frio and Atascosa Rivers, and from the Nueces River near Simmons, Texas upstream of its confluence with the Frio River, were identified. The distance from the proposed Simmons diversion point to Choke Canyon reservoir is less than 5 miles. Estimates developed prior to the 1990's drought showed that potential yield increases to the CCR/LCC System could be as much as 14,000 acre-feet per year. Recent estimates considering part of the 1990's drought show the potential yield increase is minimal. Estimates of the yield potentials from diversions at Three Rivers downstream of the confluence of the Frio and the Nueces, so as to pick up any available flow from the Atascosa were approximately 900 acre-feet per year.

Pipeline from Choke Canyon Reservoir to Lake Corpus Christi: Studies have shown that as much as 30 percent of the water released from Choke Canyon Reservoir for water supply purposes is lost in the Nueces River channel before reaching Lake Corpus Christi (HDR Engineering, Inc., 1991). In the recent Region N Water Plan, the yield potentials of a 35-mile,

90-inch diameter pipeline between Choke Canyon Reservoir and Lake Corpus Christi were estimated to be approximately 30,900 acre-feet per year (HDR Engineering, Inc., 2001). The estimates took into account the Choke Canyon Reservoir water rights permit conditions of minimum releases for in-stream flow maintenance, as well as the TNRCC Agreed Order for Bay and Estuary Inflows (Agreed Order) in existence at the time. However, the Agreed Order has been amended since the estimates were made, necessitating that yields would have to be revised based upon the present Agreed Order.

Pipeline from Lake Corpus Christi to Calallen Dam: Studies have shown that about 7 percent of water released from Lake Corpus Christi is lost in the Nueces River channel between Lake Corpus Christi and the Calallen Dam (TWDB and USGS data). In 1995, the increased yield potentials of a 23-mile, 66-inch diameter pipeline between Lake Corpus Christi and the Calallen Dam were estimated to be about 6,000 acre-feet per year (HDR Engineering, Inc., 1995). The estimates took into account the Agreed Order in existence at the time. As in the case of the pipeline from Choke Canyon Reservoir to Lake Corpus Christi, yields would have to be revised based upon the present Agreed Order.

Use of Available Choke Canyon Storage Capacity: As one of the five "Alternative Regional Water Plans" considered during the development of the Region L Water Plan completed in 2001, Region L looked at a potential "Inter-Regional Cooperation Alternative Regional Water Plan" based on the cooperative development of water supplies by Regions L, N, P, and K. This conceptual plan would have provided significant additional water supply to Regions L and N through increased use of the storage capacity of Choke Canyon Reservoir. A principal feature of the conceptual plan was the purchase and delivery of unappropriated streamflow and treated wastewater return flows to Choke Canyon Reservoir from the San Antonio River near Falls City. Diversion and delivery of this enhanced water supply in the CCR/LCC System would be from Choke Canyon Reservoir in Region N to Bexar County of Region L. The plan would have enhanced the water supply for Corpus Christi by purchase and delivery of water to Corpus Christi from the Guadalupe River at the Saltwater Barrier under existing water rights and by the delivery of groundwater from the Gulf Coast Aquifer near Refugio. The presently under-utilized storage in Choke Canyon Reservoir has potential to increase supplies to Regions L, N, and perhaps other regions through the diversion of streamflows from the San Antonio River into Choke Canyon for use by Region L when needed,

with supplemental diversions from the Guadalupe, Lavaca, and Lower Colorado for conveyance to Region N via the Mary Rhodes and connecting pipelines.

Nueces Basin Yield Optimization Strategy: The present conditions of the CCR/LCC System include the fact that the Nueces River Basin is now in a critical period that has exceeded the length of the critical period of the 1960's, which was used to compute the yield at the time of system construction. Thus, the yield of the CCR/LCC System is now less than that which was computed at the time of development of Choke Canyon Reservoir. Therefore, Choke Canyon Reservoir storage capacity is greater than that needed for the hydrology of the site. In addition, Lake Corpus Christi yield is suffering from the effects of siltation. These factors have created an interest in evaluating the potential for increasing, or optimizing, the yield of water resources within the Nueces River Basin. The following Water Management Strategy has been identified for consideration (Figure-5).

Facilities to take advantage of storage capabilities of Choke Canyon Reservoir and restore the yield of the CCR/LCC System -- evaluate as individual strategies and in combination:

- (1) Construction of Cotulla Reservoir in Dimmit and LaSalle Counties for use in one or more of the following ways:
 - (a) Potential overdrafting of yield, with diversions into Choke Canyon Reservoir via a pipeline and the Frio River to reduce channel losses that would be incurred if releases were made via the braided reach of the Nueces River downstream to Lake Corpus Christi.
 - (b) Diversion of all or a portion of yield to meet projected needs in the City of Laredo in Region M, or for use to enhance the yield of the CCR/LCC System for Region N.
 - (c) Reservoir yield plus development of groundwater from the Carrizo Aquifer in LaSalle and/or Dimmit Counties with diversion of the combined yield to meet all or a part of projected needs in the City of Laredo in Region M, or for use to enhance the yield of the CCR/LCC System for Region N.
- (2) Construction of Diversions from the Nueces River at Three Rivers and the Nueces River near Simmons in Live Oak County, into Choke Canyon Reservoir.
- (3) Construction of facilities to divert water from rivers and/or aquifers to the east into Choke Canyon Reservoir, with purchase and delivery of water from eastern sources to Lake Corpus Christi or directly to the Corpus Christi water treatment plant at Calallen.
- (4) Consider avoided cost of a pipeline between Choke Canyon Reservoir and Lake Corpus Christi.

(Evaluate CCR/LCC System yield with 1, 2, and 3, as individual strategies, and in combinations of 1 & 2, 1 & 3, and 3 & 4, with and without Edwards Aquifer Recharge, as included in Region L Plan (See Water Management Strategy IRC—6).

2.5.2 Scope of Work

The objectives of evaluations of this water management strategy for potential inter-regional cooperation are to:

- (1) Estimate additional water supply yields potentially available in the Nueces River Basin, based upon 1989 levels of Return Flows, as used in Region L Plan:
 - (a) Without Edwards Aquifer recharge enhancement, and
 - (b) With Edwards Aquifer recharge enhancement, as included in Region L Plan.
- (2) Compute costs for selected cases having favorable/feasible yields.
- (3) Assess environmental effects of cases having favorable/feasible yields and costs, as selected from results of Numbers (1) and (2) above.

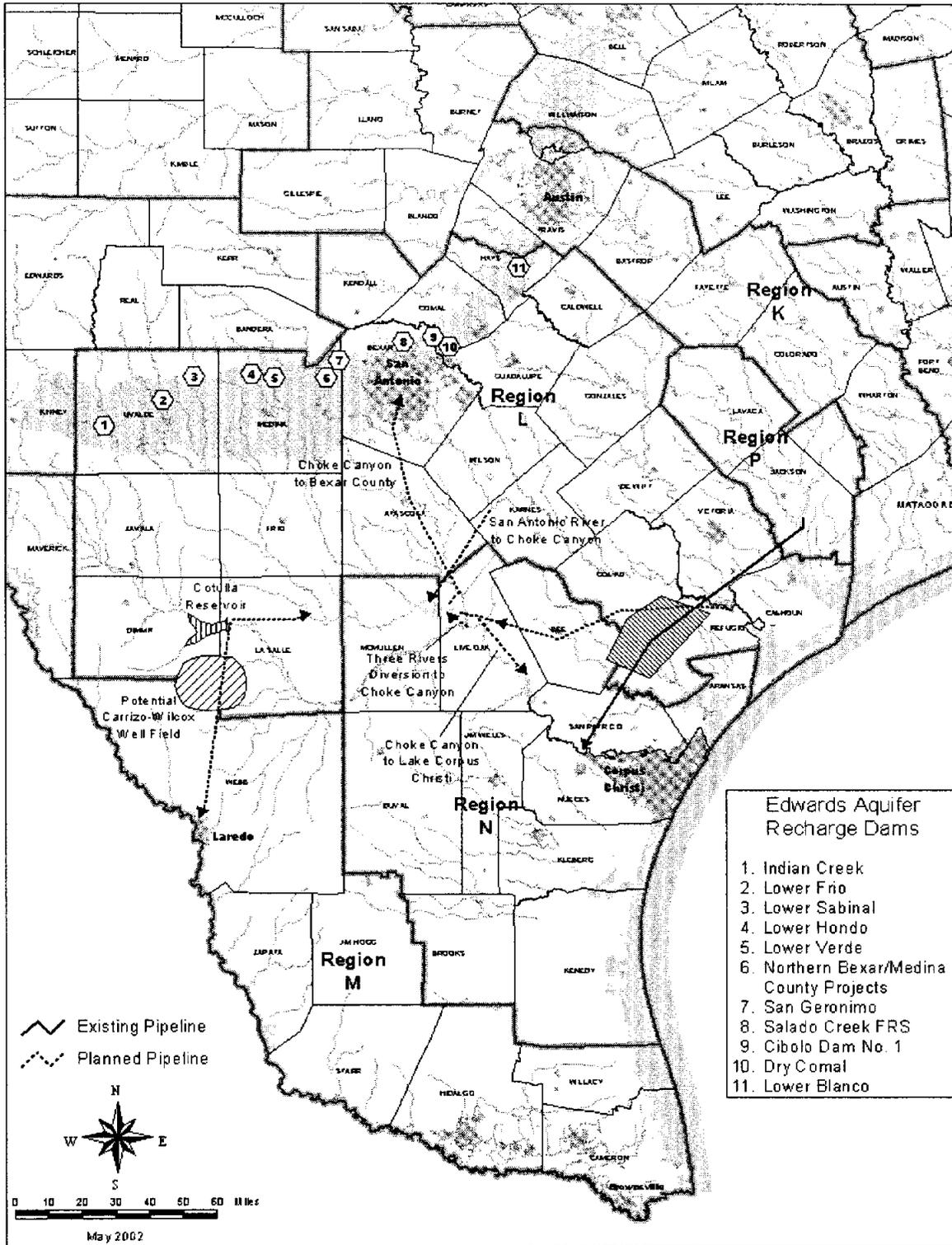


Figure 5. IRC-5. Optimization of Nueces Basin Yield

2.6 Name of Strategy: IRC—6: Inter-Regional Facilities

2.6.1 Background

Inter-Regional Cooperation Strategies 1 through 5 are individual strategies evaluated as to their respective quantity, cost, and environmental information, which is expressed in terms as of their respective locations. This last Inter-Regional Cooperation Strategy, “Inter-Regional Facilities,” is for the purpose of organizing and/or integrating one or more of the individual strategies into one or more operational and management systems for delivery of water to entities in Regions K, L, M, N, and P, as appropriate.

- (1) South Texas collection and delivery system, with delivery systems for Bexar County of Region L, Corpus Christi area of Region N, and Lower Rio Grande Valley of Region M.
- (2) Nueces Basin Selected Yield Optimization Strategy as Base System, with South Texas collection and delivery system, delivery system extensions to Bexar County of Region L and Lower Rio Grande Valley of Region M. For example, the sources of water to supplement the yield of the Nueces Basin could be from the Guadalupe River at the saltwater barrier, and/or the Lower Colorado River at Bay City, and/or Palmetto Bend Stage II, and/or the Gulf Coast Aquifer in Refugio, Goliad, and Bee Counties, or a combination of these sources, with diversion from Choke Canyon Reservoir as a way to meet a part of projected needs in Region L, and deliveries to Lake Corpus Christi or the Corpus Christi water treatment plant to replace the increment of Choke Canyon Reservoir yield diverted to Region L. In addition, these sources could assist in meeting projected increases in needs of the Coastal Bend area of Region N, and with increased quantities and extensions of pipelines from a point near Kingsville to Region M, could assist in meeting projected needs in Region M.

(See Figures 6-A, 6-B, and 6-C for Potential South Texas Delivery Systems 6A, 6B, and 6C listed after Scope Item (4) Below.)

2.6.2 Scope of Work

The objectives of evaluations of this water management strategy for potential inter-regional cooperation are to:

- (1) Estimate yields of selected System configurations.
- (2) Compute costs of System configurations selected.
- (3) Assess environmental effects of System configurations selected.
- (4) Assess the potential for enhancement of water available for Instream Flows and Bay and Estuary Inflows, according to the following methods:

- (a) Instream Flows: Using appropriate hydrologic model(s) and period of record:
- 1) Evaluate the magnitude of streamflows for existing conditions at select principal points in the rivers and streams of the Water Management Strategies included in IRC—6 (i.e. ‘baseline hydrology,’ which is full use of authorized water rights and 1989 levels of effluent discharge).
 - 2) Assess the effects of implementation of Water Management Strategy IRC—6 including, changes in stream flows at principal points in the rivers and streams, changes in spring flows or changes in the discharge/recharge relationship between streams and aquifers.
 - 3) Compare the results of a and b in terms of levels and frequencies of stream flows at principal points in the rivers and streams, and display differences for the with and without implementation of Water Management Strategy IRC—6 scenarios.
- (b) Bay and Estuary Freshwater Inflow Needs: Using appropriate hydrologic model(s) and period of record,
- 1) Evaluate the magnitude of freshwater inflows for existing conditions to the bays and estuaries of the Water Management Strategies included in IRC—6 (i.e. ‘baseline hydrology,’ which is full use of authorized water rights and 1989 levels of effluent discharge).
 - 2) Assess the effects of implementation of Water Management Strategy IRC—6 including, quantification of the degree and frequency at which freshwater inflows meet established annual and seasonal benchmark levels MinQsal, MinQ, and MaxH in each affected estuary.
 - 3) Compare the results of a and b in terms of levels and frequencies to which freshwater inflows meet established annual and seasonal benchmark levels MinQsal, MinQ, and MaxH in each affected estuary for the with and without implementation of Water Management Strategy IRC—6 scenarios.
- (c) Identify and evaluate operational methods and/or adjustments to IRC—6 which might enhance in-stream flow and/or bay and estuary inflow amounts and sources of water for facilities associated with that strategy;
- 1) Identify underutilized water rights that could potentially be temporarily or permanently reallocated for the purpose of enhancing quantities of water available to the environment.
 - 2) Identify water rights that could potentially be purchased, in whole or in part, for the purpose of enhancing quantities of water available to the environment.
 - 3) Identify return flows to be dedicated for the purpose of enhancing quantities of water available to the environment.
 - 4) Identify potential water trades that could be undertaken to ameliorate environmental water deficits on an intra- or inter-regional basis.
 - 5) Identify water savings through conservation and/or systems operations efficiencies that could be dedicated to enhancing quantities of water available to the environment.

- 6) Identify potential special conditions that could be placed on new or amended water rights to protect quantities of water available to the environment.
- 7) Identify mechanisms for ensuring unappropriated waters are available to meet environmental water needs.
- 8) Identify opportunities for development of infrastructure to deliver water to locations where it may provide environmental benefits. Such infrastructure would be incorporated into IRC—6.
 - a. Estimate quantities of water involved.
 - b. Estimate size and cost of facilities.
 - c. Compute cost shares among cooperating regions.

2.6.3 IRC— Potential South Texas Delivery System 6A

2.6.3.1 Base Plan

- Region L: Lower Guadalupe Diversion, with Gulf Coast Aquifer in Refugio and Goliad Counties, and Lower Colorado Diversion.
- Region N: Garwood Diversion to the Mary Rhodes Memorial Pipeline, with Gulf Coast Aquifer in Refugio, Goliad, and Bee Counties.

2.6.3.2 Cooperative Additions: Regions L, N, K, M, and P

- Cotulla Reservoir Yield to Frio River and Choke Canyon Reservoir (Region N).
- Nueces River Diversions to Choke Canyon Reservoir (Region N).
- San Antonio River Diversions to Choke Canyon Reservoir (Region N).
- Choke Canyon Reservoir Diversion (Region N) to Bexar County (Region L). (Note: Pipeline between Choke Canyon Reservoir and Lake Corpus Christi not needed, if Choke Canyon yield diverted to Bexar County.)
- Lower Guadalupe/Gulf Coast Aquifer (Bee, Goliad, and Refugio Counties), and/or Lower Colorado Surface Water (Region K)/Gulf Coast Aquifer (Bee, Goliad, and Refugio Counties), and/or Palmetto Bend Stage II (Region P), and/or Desalination Facility at Corpus Christi to Region N to replace yield of Choke Canyon Diversion to Bexar County upon CCR/LCC System.
- Expand Deliveries from sources listed in bullet number 5 immediately above to Regions N and M, if quantities available.

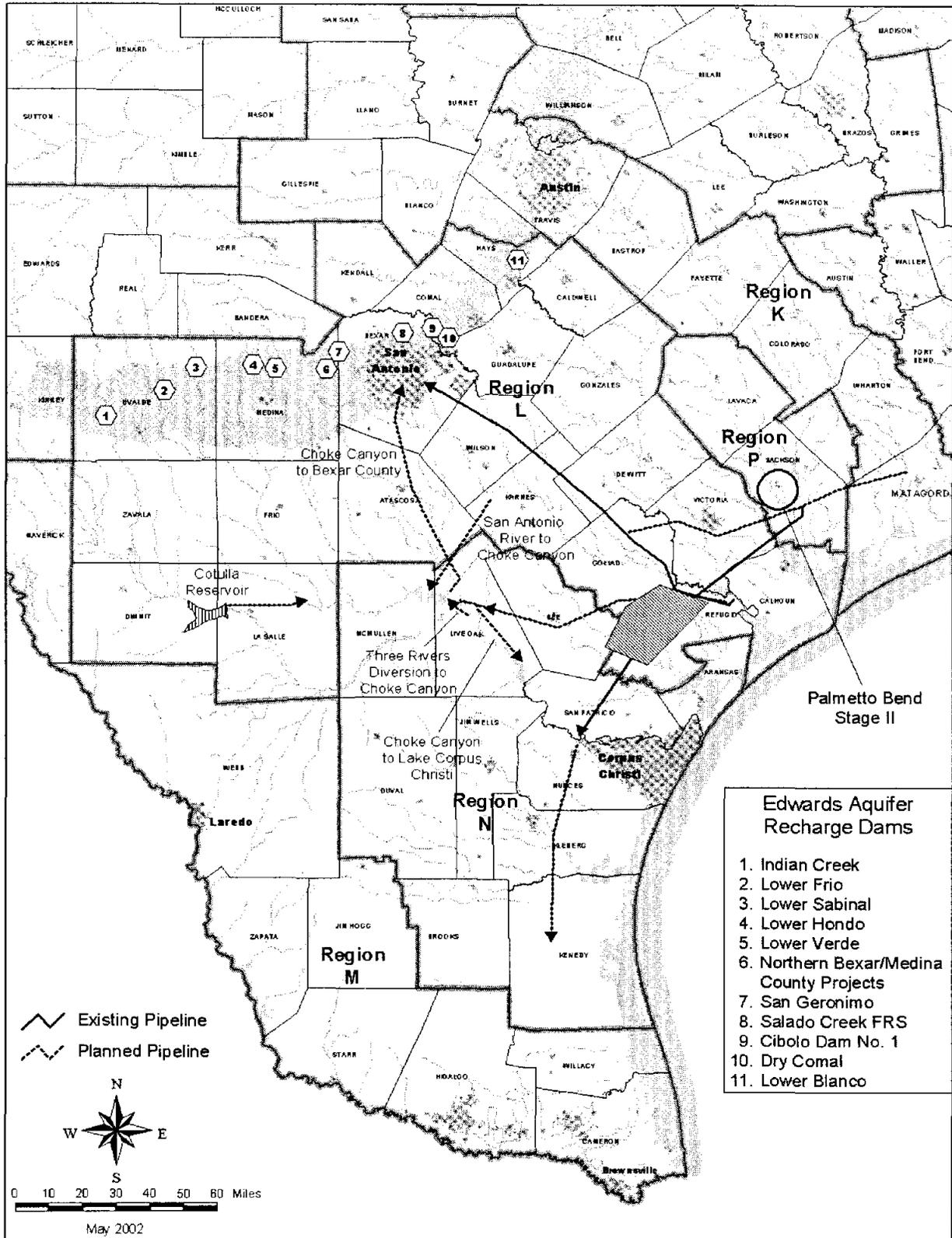


Figure 6A. IRC-6A: Potential South Texas Delivery System

2.6.4 IRC—Potential South Texas Delivery System 6B

2.6.4.1 Base Plan:

- Region L: Lower Guadalupe Diversion, with Gulf Coast Aquifer in Refugio and Goliad Counties, and Lower Colorado Diversion.
- Region N: Garwood Diversion to the Mary Rhodes Memorial Pipeline, with Gulf Coast Aquifer in Refugio, Goliad, and Bee Counties.

2.6.4.2 Cooperative Additions: Regions L, N, and M;

- Nueces River Diversions to Choke Canyon Reservoir (Region N).
- San Antonio River Diversions to Choke Canyon Reservoir (Region N).
- Choke Canyon Reservoir Diversion (Region N) to Bexar County (Region L). (Note: Pipeline between Choke Canyon Reservoir and Lake Corpus Christi not needed, if Choke Canyon yield diverted to Bexar County.)
- Cotulla Reservoir Yield, with Groundwater from Carrizo Aquifer in Dimmit and LaSalle Counties to Laredo (Region M).
- Lower Guadalupe/Gulf Coast Aquifer (Bee, Goliad, and Refugio Counties), and/or Lower Colorado Surface Water (Region K)/Gulf Coast Aquifer (Bee, Goliad, and Refugio Counties), and/or Palmetto Bend Stage II (Region P), and/or Desalination Facility at Corpus Christi to Region N to replace yield of Choke Canyon Reservoir and Cotulla Reservoir upon CCR/LCC System.
- Expand Deliveries from sources in bullet number 5 immediately above to Regions N and M, if Quantities available.

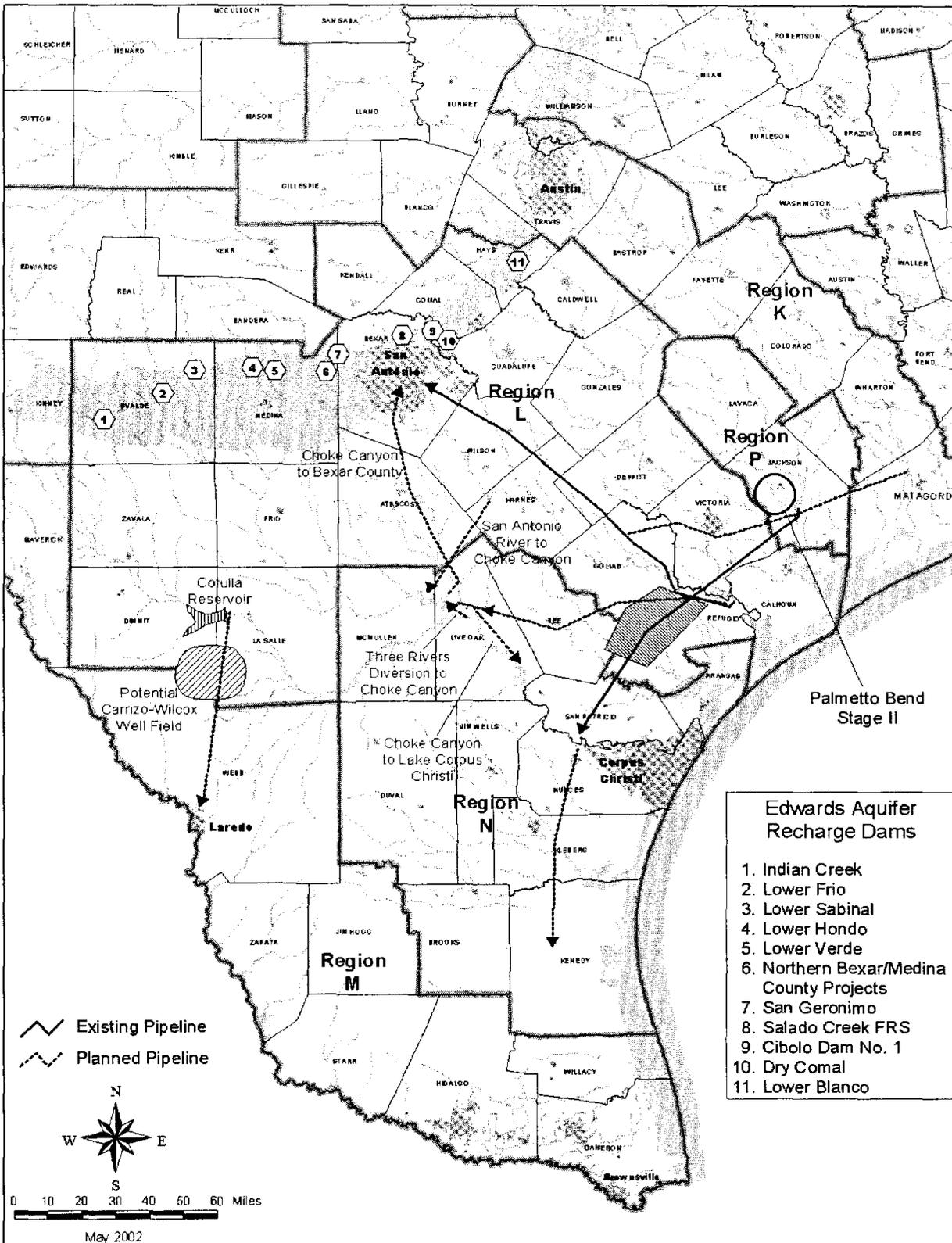


Figure 6B. IRC-6B: Potential South Texas Delivery System

2.6.5 IRC—Potential South Texas Delivery System 6C

2.6.5.1 Base Plan:

- Region L: Lower Guadalupe Diversion, with Gulf Coast Aquifer in Refugio and Goliad Counties, and Lower Colorado Diversion.
- Region N: Garwood Diversion to the Mary Rhodes Memorial Pipeline, with Gulf Coast Aquifer in Refugio, Goliad, and Bee Counties.

2.6.5.2 Cooperative Additions: Regions L, N, and P;

- Construct Palmetto Bend Stage II (Region P), with Diversions to Region L and/or Region N.

Section 3
Water Management Strategies Included in
2006 Regional Water Plan Scopes of Work
by Regions K, L, M, N, and P

The Draft Report, Sections 1 and 2, and Appendix A, “ Water Management Strategies for Potential Inter-Regional Cooperation,” dated December 27, 2001 was issued to representatives of Regions K, L, M, N, and P for their review and consideration.

The consultants met with each Regional Water Planning Group in a regularly scheduled RWPG meeting, presented the report, and responded to questions. The respective RWPGs considered the Water Management Strategies identified in the Draft Report for inclusion in their respective Scopes of Work of their grant applications to TWDB for Regional Water Plan updates and revisions for the 2006 Regional Water Plans. The RWPG meetings were held on the dates, and at the locations listed in Table 3-1.

Table 3-1. Dates and Locations of Prior RWPG Meetings

<i>Date</i>	<i>Time</i>	<i>Meeting</i>	<i>Location/City</i>
01/08/02	6:30 PM	Lavaca RWPG <i>Region P</i>	Harry Hafernack Center, 891 Brackenridge Parkway, Edna
01/10/02	10:00 AM	South Central Texas RWPG <i>Region L</i>	SARA Board Room, 100 E Guenther Street, San Antonio
01/17/02	1:30 PM	Coastal Bend RWPG <i>Region N</i>	TX A&M Research & Extension Center, 10345 Agnes Street, Corpus Christi
01/31/02	10:30 AM	Rio Grande RWPG <i>Region M</i>	East Conference Room McAllen Int. Airport, 2500 South Bicentennial
02/13/02	10:00 AM	Lower Colorado RWPG <i>Region K</i>	LCRA's McKinney Roughs, Highway 71, 10 miles W of Bastrop

In a review letter dated February 13, 2002, the Texas Water Development Board expressed reservations as to eligibility of the proposed Inter-Regional Water Management Strategies for TWDB funding. On March 12, 2002, in an Inter-Regional Cooperation Project Telephone Conference Call, representatives of each region summarized the status of each region’s Scope of Work, as of that date, insofar as inclusion of elements of the “Water

May 2002

Management Strategies for Potential Inter-Regional Cooperation” identified and described in the Inter-Regional Workgroup Draft Report, was concerned. After discussion, the telephone conferees decided that the IRWG meeting scheduled for March 15, 2002 should be re-scheduled for a date after the regions had finalized their respective scopes, and that the Consultant team led by HDR Engineering, Inc., should make corrections and changes identified by the RWPGs and add a section to the Report which lists the Water Management Strategies of the December 27, 2001 Draft Report that were included in each participating region’s Scope of Work for Regional Water Plan update and revision. The Water Management Strategies of the Inter-Regional Cooperation Draft Report that are included in each participating region’s Scope of Work for Regional Water Plan update and revision are presented below.

3.1 Region K (Lower Colorado Region)

In Task 10, Public Participation and Education/Input — Adoption of the Plan, Region K included Subtask d (one of 7 Subtasks of Task 10) Consultant participation in the inter-regional cooperation effort. However, the application does not list budgeted amounts for the subtasks of Task 10.

3.2 Region L (South Central Texas Region)

In Task 4, Identification, Evaluation, and Selection of Water Management Strategies, Region L included Water Management Strategies (Task 4b). The following subtasks of Task 4b are identified by the SCTRWPG as water management strategies for which supplemental funding is requested on a priority basis.

- Perform and document technical evaluations of water management strategies selected from among those identified in the 2001 Regional Water Plan as requiring further study regarding quantity, cost, and/or feasibility, including brush management, weather modification, growth management, and unmet irrigation needs; and
- Perform and document technical evaluations of the following water management strategies for potential inter-regional cooperation and, at SCTRWPG discretion, integrate selected strategies into the 2006 Regional Water Plan. These strategies are very specific elements of more comprehensive strategies developed through the efforts of an Inter-Regional Water Planning Group involving Regions K, L, M, N, and P (Section 2 above):
 1. Lower Colorado River (IRC-2) — Compare the costs of independent versus shared facilities for planned transmission of new water supplies from the Colorado River near Bay City (Region K) to Corpus Christi (Region N) and Bexar County (Region L) considering segments extending

- from Bay City to the Mary Rhodes Pipeline and from Tivoli to Bexar County.
2. Desalination (IRC-3) — Compare the costs of planned desalination facility drawing water from the Guadalupe Estuary for treatment and delivery to Bexar County to the development of a desalination facility in Corpus Christi in exchange for use of Choke Canyon Reservoir as a firm water supply source for Bexar County.
 3. Optimization of Nueces Basin Yield (IRC-5) — Coordinate with and provide technical information regarding Region L water management strategies such as Edwards Aquifer Recharge Projects to Region N.
 4. Inter-Regional Facilities (IRC-6) — Participate in the continuing refinement of water management strategies for potential inter-regional cooperation.

In addition, Region L included provisions for inter-regional coordination in Task 10, Plan Adoption and Other Items. The budget request by Region L for evaluation of inter-regional cooperation water management strategies is \$64,000.

3.3 Region M (Rio Grande Region)

Region M did not include any of the inter-regional cooperation water management strategies in its application for regional plan revision and update.

3.4 Region N (Coastal Bend Region)

Region N included “Evaluation of combined water management strategies to optimize yield of Nueces River Basin considering New Drought of Record, New Channel Loss Data, use of periodically available water and overdrafting of reservoirs in combination with ASR and concepts from public comments,” (IRC-5: Optimization of Nueces Basin Yield) in its application for Regional Planning funds. This Water Management Strategy was given the highest ranking by Region N for supplemental funding to evaluate water management strategies, and was budgeted at \$158,000.

3.5 Region P (Lavaca Region)

Region P did not include any of the inter-regional cooperation water management strategies in its application for regional plan revision and update. However, Region P expressed disappointment that the Inter-Regional Group had not given further consideration to evaluations of Palmetto Bend Stage II in conjunction with the use water from the Gulf Coast to meet needs in neighboring regions.

Appendix A
Preliminary Budget Estimate for Technical Evaluation of
Inter-Regional Water Management Strategy

Water Management Strategies	Budget
IRC-1 Gulf Coast Aquifer	\$68,000
IRC-2 Lower Colorado River	\$48,000
IRC-3 Desalination	\$51,000
IRC-4 Palmetto Bend Stage II	\$45,000
IRC-5 Nueces Basin Yield Optimization	\$143,000
IRC-6 Inter-Regional Facilities	\$180,000
Total	\$535,000

Appendix B

Regional Water Planning Group Comments

Prepared for

Inter-Regional Work Group

**South Central Texas Region (L)
Rio Grande Region (M)
Coastal Bend Region (N)
Lavaca Region (P)
Lower Colorado Region (K)
Nueces River Authority
Texas Water Development Board**

Consultants:

**HDR Engineering, Inc.
Moorhouse Associates, Inc.
Open Forum
NRS Consulting Engineers
Turner, Collie & Braden**

February 15, 2002

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1 Inter-Regional Coordination for the Development of Consensus On Water Management Strategies for South Texas

1.1 Introduction

This report contains comments recorded during Regional Water Planning Group Meetings as planning group members considered the Draft Report of Water Management Strategies for Potential Inter-Regional Cooperation, dated December 27, 2001. The five planning groups participating in the Inter-Regional Work Group (IRWG) reviewed the draft report as an agenda item during their regularly scheduled Regional Water Planning Group Meetings according to the following schedule:

Date	Time	Meeting	Location/City
01/08/02	6:30 PM	Lavaca RWPG Region P	Harry Hafernack Center, 891 Brackenridge Parkway, Edna
01/10/02	10:00 AM	South Central Texas RWPG Region L	SARA Board Room, 100 E Guenther Street, San Antonio
01/17/02	1:30 PM	Coastal Bend RWPG Region N	TX A&M Research & Extension Center, 10345 Agnes Street, Corpus Christi
01/31/02	10:30 AM	Rio Grande RWPG Region M	East Conference Room McAllen Int. Airport, 2500 South Bicentennial
02/13/02	10:00 AM	Lower Colorado RWPG Region K	LCRA's McKinney Roughs, Highway 71, 10 miles W of Bastrop

1.2 Process for Revising Draft Report of Water Management Strategies for Potential Inter-Regional Cooperation

This report of Regional Water Planning Group comments was presented to the IRWG at a meeting on February 15, 2002 at 10:00 AM at Three Rivers City Hall. The IRWG has revised the Water Management Strategy report to reflect the input provided from participating Regional Water Planning Groups.

2 Potential Water Management Strategies for Consideration by Regions K, L, M, N, and P

2.1 IRC-1: Gulf Coast Aquifer – Bee, Goliad and Refugio Counties

Tuesday, January 8, 2002 Lavaca RWPG – Region P

- You said there is no local resistance to groundwater pumping and potentially drying up their wells. Is this true?
- Do the locals there have a ground water conservation district? Yes, this is to enable groundwater sales.
- James Dodson explained that most wells in the area are mainly agriculture use. The wells are shallow (in the Chico) and the proposed pumping is in the deeper aquifer zones.
- Maggie Moorhouse noted that there is some concern on the part of locals, but the presence of the groundwater management district should help provide the mechanism to address concerns.

Thursday, January 10, 2002 South Central Texas RWPG – Region L

- Is the idea here to have one well field that would serve both regions?
- If no one else takes interest in this do we still go ahead with the groundwater in the lower Guadalupe diversion option?
- Is this the same water?
- The idea here is to look at ways to cooperate on using the water.
- Is there any notion to go outside those three counties for groundwater? Not in this option.

Thursday, January 17, 2002 Coastal Bend RWPG – Region N

- There was no discussion specific to this strategy. See general comments.

Thursday, January 31, 2002 Rio Grande RWPG – Region M

- There was no discussion specific to this strategy.

Wednesday, February 13, 2002 Lower Colorado RWPG—Region K

- I don't see the term "sustainability" or the concept of that ever mentioned. What will be the yardstick against which you will measure? How do you hold this concept in mind? (That will have to be addressed by each region in their philosophies and policies.)
- Region L is *well aware* of Region K's policy on sustainability.
- You said saltwater intrusion would be evaluated. What about subsidence?

2.2 IRC-2: Lower Colorado River

Tuesday, January 8, 2002 Lavaca RWPG – Region P

- There is no irrigation district in Jackson County. The map shading is incorrect. Colorado, Wharton and Matagorda County is where the pumping is predicted to be in this strategy.
- Ground water can not be exported from the region under the currently proposed agreement with SAWS.
 - Only under drought conditions
 - Only surface water can be transferred out of the basin.
- While the groundwater can not be transferred it can be used for local irrigation needs and effectively traded for rights that can be transferred out.
- The concern is the idea of unlimited pumping to San Antonio.
- The Region L policy is to honor groundwater management district rules.
- Wharton County now has a district. Lavaca does not. What does that mean for Lavaca County? They are exposed to potential pumping and exporting of groundwater.
- Is this suggested pumping in an area that already has a shortage?
- It will be very important to include groundwater management districts in future regional water planning processes.

Thursday, January 10, 2002 South Central Texas RWPG – Region L

- The map has been corrected here to reflect the corrections recommended from region P. Region P is interested in sustainability and was concerned that the prior representation did not honor that.
- This option has a possibility to bring the Garwood water over to the Mary Rhodes pipeline. That water can not be put into Lake Texana because of the restrictions on that facility.
- The Gulf Coast aquifer goes all along the coast, right? Couldn't we develop a well field all along that entire coastal area?
- James Dodson explained that in the regional planning groundwater model information indicates we are already reaching sustainable yield in the corpus Christi area but to the north there is some available water. Then even further north, near P, they are also at sustainable yield.
- How did you calculate sustainability?
- What are the demons to too much drawdown?
- There is no match to recharge and I did not hear you mention subsidence as a consideration?
- James explained that recharge was included in the model. The real focus was on the Goliad or Evangeline section of the aquifer.
- How does this factor into the interaction of the regional model? Where is the cooperation? I.e.: pipelines and holding facilities
- The cooperation will come in sizing the facilities for total use, rather than just meeting current needs. There are a number of questions as far as scheduling and optimizing of the system.

Thursday, January 17, 2002 Coastal Bend RWPG – Region N

- There was no discussion specific to this strategy.

Thursday, January 31, 2002 Rio Grande RWPG – Region M

- It must be nice to have surplus water.

Wednesday, February 13, 2002 Lower Colorado RWPG—Region K

- At the risk of being redundant... Is it desirable for us to be involved in the IWRG discussion? If the recommendations of the IWRG impinge on or conflict with our needs, then there is concern that they will be given interest to the detriment of our interests. On this option, sustainability is not mentioned, and that is our major issue.
- This is looking at synergies that can be realized through the advantages of looking at four basins in cooperation. For example, we don't always have floods at the same time. Potential improvements would be pumping less groundwater by reducing San Antonio's need in the aggregate. That would be an advantage to our area, especially in conjunction with other downstream options. Or perhaps the LCRA pipeline would help move the Corpus Christi Garwood water to the Mary Rhodes pipeline, so long as they mitigate the loss of our water. That's just a conceptual idea.
- Is there a potential problem in the future with the transportation of water from the intake pipeline at Bay City when the SAWS contract expires?
- Clarify the sustainability issues. We need to be clear that the interregional study must not be inconsistent with what Region K wants to do.
- Lots of opportunities for sharing, but be clear that groundwater will stay in it's own area.
- There are two new groundwater districts down there that have not begun to collect data to help them manage their resource.
- I would feel much better if the scope addressed the sustainability issue, as well as the effect on bays and estuaries. That is important to Region K, too. That sensitivity needs to be expressed. If that is expressed sufficiently in the Option 6 description, then I'd like to see a cross-reference.
- We need to be very clear about the complexity of this option. This has two pipelines coming out of Bay City. The possibility of cheap groundwater joining into all that is a real concern. The contract expressly states that groundwater must remain there for the farmers. That has a direct relationship to the amount of water being taken out for San Antonio and Corpus Christi.
- One issue we don't want to lose sight of is this: Even if we stay within the sustainable yield of an aquifer, we can still experience significant drawdown. These farmers rely almost completely on groundwater. Will we be putting those folks out of business who don't have access to surface water?
- Subsidence comment also applies. As Quentin said, flooding occurs in different places at different times. We should make sure those pipelines flow both ways.
- Planning horizon for large type facilities and pipelines... on such a large scale, the timelines are equating to 80-year horizons on the SAWS project. The 50-year SB1 timeline seems short considering the scope of some of these projects. Demand vs. supply

quantitative analysis hasn't been done, and the City of Austin expressed that concern to LCRA earlier.

- We have two parallel scopings going on here...this and the LCRA/SAWS deal. I thought the groundwater issues would be studied in the SAWS 7-year study. We shouldn't tell LCRA/SAWS how they should scope it. (James: We will be discussing this issue on Friday...if there is something already going on, can we take something out of this work and let them take care of it?)
- New groundwater districts should be totally involved in the scoping of any groundwater studies that would affect them.

2.3 IRC-3: Desalination

Tuesday, January 8, 2002 Lavaca RWPG – Region P

- Page 2 – 10 numbers need to be checked. The \$2.85 number is at full utilization. A more realistic utilization amount is 85%. The realistic cost for Texas water desalination is \$3.10 per thousand gallons. Let's include that number in the discussion.
- Are these numbers going to come down with improved technology?
- The Tampa Bay numbers are very aggressive and are not for a working or operational plant. We don't project values to be much lower by 2030.
- Also remember Desalination and pipelines to carry the water have a lot of energy needs. There are firm costs associated with the energy that is not related to technology.
- I think Corpus Christi is already interested in Barney Davis.
- Joslin does not seem to be on the radar screen because it is so far away from the needs.
- That is why Barney Davis may be of more interest to San Antonio because they could trade to Corpus Christi the water at the plant for upstream Corpus Christi rights more proximal to San Antonio.
- Corpus Christi already has an RFP available for desalination of brackish seawater at a site on North Padre Island. There is not currently one available for the Barney Davis site.

Thursday, January 10, 2002 South Central Texas RWPG – Region L

- Is there brackish groundwater all along the gulf coast? Yes
- And one of the brackish groundwater ideas is already in the works by Corpus Christi. Reference was given to the project currently in the works for Padre Island.
- Another thing to consider is that once the groundwater is pulled in, the potential exists for saltwater intrusion.
- It does seem foolish for all the regions to be working on this same idea. Is there any possibility for the TWDB to participate in a pilot plant to "test the waters" so to speak?
- Where are the current plants in Texas? The one plant in Texas is in the Lake Granberry area. James Dodson can provide more information if that is of interest.

Thursday, January 17, 2002 Coastal Bend RWPG – Region N

- There was no discussion specific to this strategy.

Thursday, January 31, 2002 Rio Grande RWPG – Region M

- We are interested in benefiting from the technology transfer, but a plant in Corpus Christi will not be providing any water for us. See also General Comments.

Wednesday, February 13, 2002 Lower Colorado RWPG—Region K

- I think *this* creates new water. That's what Commissioner Henry was concerned about. I drafted a letter to James Dodson regarding this. I think from an interregional perspective, desalting brackish groundwater is a great opportunity, one of the better new targets—even better than seawater. (The Chair distributed copies of the letter to all in attendance.)
- (James: There are issues to be explored, including disposal of concentrate, environmental issues such as site cleanup standards that are more lenient in terms of disposal over brackish aquifers.)

2.4 IRC-4: Palmetto Bend Stage II**Tuesday, January 8, 2002 Lavaca RWPG – Region P**

- I think the conjunctive use of ground water violates the Region P plan.
- We believe we are currently near sustainable use in this region.
- We need to correct page 2 – 13. The idea of conjunctive use of Jackson County groundwater is not what our plan directs (P).
- Again – the Pearce Ranch groundwater is not available to be taken out of the local area.
- How we might use the aquifers for storage is a question we will be looking into.
- Our planning in Region P was based on sustainable yield. It is very important that these ideas are considered.

Thursday, January 10, 2002 South Central Texas RWPG – Region L

- There was no discussion of this strategy until the general discussion section at the end.

Thursday, January 17, 2002 Coastal Bend RWPG – Region N

- There was no discussion specific to this strategy. See General Comments.

Thursday, January 31, 2002 Rio Grande RWPG – Region M

- There was no discussion specific to this strategy.

Wednesday, February 13, 2002 Lower Colorado RWPG—Region K

- There was no discussion specific to this strategy.

2.5 IRC-5: Optimization of Nueces Basin Yield**Tuesday, January 8, 2002 Lavaca RWPG – Region P**

- Reminds me of a shell game.
- See further comments in General Discussion section.

Thursday, January 10, 2002 South Central Texas RWPG – Region L

- I just want to be sure to understand that these descriptions are just for study. They are not done deals. (Audience question, followed by response: “That is correct.”)

Thursday, January 17, 2002 Coastal Bend RWPG – Region N

- My thinking is that because we have available capacity in Choke. It would be wise to look at what is available in the basin before we start evaluating putting other sources into the reservoir.
- The city of CC has water rights along the Nueces. How would Cotulla impact those? What is the yield of the Cotulla small dam diversion?
- That is not the 10,000 acre feet mentioned? Yes, but that is not that type of analysis. That one did not honor water rights, it mitigated for impacts.
- Who would get the water? That is for the RWPGs to decide and work out once the study is done.
- Let’s figure out how to keep the water in the watershed. Like when Lake Corpus Christi is full and we have to watch the water go by. We lose it. Let us figure out how to keep it into the system for storage.
- Let us all study this together.
- Maybe let’s reserve the rights.
- I think this is all tied to recharge dams. I think some people want to do recharge dams, but they impact the downstream.
- I hope that in the long term you talk about the water releases. We are trying to capture more science and have more data that indicates how to manage the releases so they are at maximum effectiveness and allow us to leave the most water in the system.
- A more recent development is that the Corps of Engineers got funding of what is called a reconnaissance study of the Nueces River system. This may mean that some of these projects are available for federal funding. That could assist in executing some of this.
- Hey, they want to build recharge dams and we have a bucket that is half full all the time. Lets figure out how to do the dams and fill up the bucket while we work together.
- This is to evaluate and discover where win-win opportunities exist.
- It is important to remember that this area paid for the bucket and it is our bucket.
- It is a question of whose water is it? Does someone already have a claim to it? Let’s claim it. We have the bucket, the water and the pipeline. Corpus Christi has made some excellent decisions over the years and we are now in a good situation.
- We are working toward bringing more water from Lake Texana. We brought 44 hundred AF last year and are trying to get 7500 AF of interruptible. We currently use 66 hundred AF. So the more we use Texana the more we leave in the reservoirs. If we bring in more then we can put it in storage, we can then decide how we want to benefit.
- San Antonio had the opportunity to buy a portion of Texana to go 60/40 with us. But San Antonio decided to opt out.
- The pipeline has it’s own mechanical vulnerabilities.
- EPA called us up recently because they were doing screening for vulnerable areas. This was an area that depended on one source. But with the pipeline we have another source.
- How much channel loss is there in getting the water to Choke?

- You would have to do the physical reconnaissance to see what the actual losses might be. But you do not really need a reservoir at Cotulla; you just need a retention facility.
- There are many variations that we could look at.
- We are looking at spending \$3 billion in this area to develop water, but we have not looked at the systems operation on the development of these plans.
- What is the difference between the Cotulla diversion and some of these other diversion ideas?
- The pipeline between the two reservoirs is also very interesting.
- What is it going to do to the river if you put something at Cotulla?
- You might cut out some downstream flooding. It would be good to capture the water that flows over the dam.
- What will happen to the braided reach area if we divert upstream?

Thursday, January 31, 2002 Rio Grande RWPG – Region M

- We are interested in Cotulla if Laredo is interested in it. See general comments.

Wednesday, February 13, 2002 Lower Colorado RWPG—Region K

- Curious as to why the Lower Colorado was not included in this strategy.
- You have reservoirs in high evaporation site areas. Keep it in the pipelines or under the ground.

2.6 IRC-6: Interregional Facilities

2.6.1 IRC-Potential South Texas Delivery System 6A

Tuesday, January 8, 2002 Lavaca RWPG – Region P

- Note all pipelines go through the pumping station at Texana, but none of this water will be put into Lake Texana.

Thursday, January 10, 2002 South Central Texas RWPG – Region L

- There was no discussion of this strategy.

Thursday, January 17, 2002 Coastal Bend RWPG – Region N

- The joint pipeline from the Colorado certainly has appeal. Also looking at the Cotulla to Choke idea is worth looking at.
- One thing that concerns me is 6b where the water from Nueces goes to Laredo. Why would we give some of our water to them.
- Someone from that area would have had to participate in the Cotulla project of contributed water rights into the project.
- The Laredo area is currently looking at groundwater expansion to meet their needs.
- I would really like to know what it would do for our region if we share the cost of the Colorado pipeline.

Thursday, January 31, 2002 Rio Grande RWPG – Region M

- How do these ideas gel with Governor Perry’s new transportation plan?

Wednesday, February 13, 2002 Lower Colorado RWPG—Region K

- If you are going to do this you will have to evaluate all the various components and decide what you are going to do.
- Have you thought about the pipeline on the coast being one that can move water in either direction?
- In looking at these systems from the Region K point of view, the Lower Colorado option is temporary. How will the cessation of flow from that direction be factored in?

2.6.2 IRC-Potential South Texas Delivery System 6B**Tuesday, January 8, 2002 Lavaca RWPG – Region P**

- Is the assumption that the LRGV will not receive the water due them from Mexico? Basically, yes.
- The group that will really suffer is the agriculture sector in the Valley because they can not afford it.
- On the map, the pipeline dashed line to the Lower Rio Grande Valley is open for discussion.
- Down in the Valley – if you line the canals there will be great benefit.
- What is the water shortages/needs that are projected for the RGV? Can they meet their M & I demands by transferring irrigation water rights?
- Concern was expressed to support the Valley. Our economies are all interlaced.
- Also expressed concern that the Valley may be looking to other regions to meet long term needs, and we don’t have that kind of water.

Thursday, January 10, 2002 South Central Texas RWPG – Region L

- There was no discussion of this strategy.

Wednesday, February 13, 2002 Lower Colorado RWPG—Region K

- There was no discussion of this strategy.

2.6.3 IRC- Potential South Texas Delivery System 6C**Tuesday, January 8, 2002 Lavaca RWPG - Region P**

- There was no discussion specific to this option.

Thursday, January 10, 2002 South Central Texas RWPG – Region L

- How would these be used? Could you tie into the desalt plants?

- Yes these could transport desalt treated water. It would depend on the location of your treatment system. I do not know if you would want to mix desalt water in the pipelines or at the treatment plant.

Wednesday, February 13, 2002 Lower Colorado RWPG—Region K

- There was no discussion specific to this option.
- General Discussion

3 General Discussion (Strategies, Environmental, Budgets)

3.1 Tuesday, January 8, 2002 Lavaca RWPG - Region P

Water Management Strategies

- Did Region L ever evaluate an area for a reservoir site to the north of San Antonio?
- Herb Grubb (with HDR, Inc.) pointed to two sites available for analysis, one of which impacted the yield of Canyon so badly that it was not a candidate. The other did not have a high enough yield on its own.
- Every study discussed tonight involves a pipeline. The Colorado River is currently very high. It would be good if these pipelines could be used to move flood and excess water to a storage site. The water can then be used during droughts.
- Is there any way to store water as a scalping operation?
- Region L is evaluating terminal storage sites near San Antonio and several sites for reservoirs were considered during the last planning cycle. These reservoir sites were highly opposed by the public.
- At some point, we may need to swallow our pride and build one.
- The available storage capacity at Choke Canyon was discussed. The Nueces Optimization option should also include the potential storage of scalped waters.

Environmental Study and Environmental Group Coordination

- Bill Roberts (TWDB) indicated that the meeting to discuss the environmental studies is scheduled for Monday, January 14th.
- The current thinking is that Regional Water Planning Groups may do environmental baseline studies on a voluntary basis, but it will need to be done within the currently allocated funding amounts.

Budget

- Concerns were expressed of current allocations and finding money to do these types of studies.
- Will we need to lobby for additional money?
- Will the environmental groups pitch in?
- Is it possible that the IRWG ideas may be funded from the \$4M available?
- Bill Roberts (TWDB) explained that they are setting aside \$1M for unforeseen things. It will not be available. However, \$5M is available for all the regions to compete for. The regions will have to apply for these additional funds.

3.2 Thursday, January 10, 2002 South Central Texas RWPG – Region L

Water Management Strategies

- What are we to do with this from now?
- We are to discuss how and which strategies we want to cooperate with in the next round of planning.
- I think we need to look at the three pipelines currently in the Region L plan. It might be significant to evaluate keeping the desalt water on the coast to trade for water more proximal to San Antonio. I do not think we need a third pipeline bringing water up to San Antonio if we do not need to build one.
- Edwards Aquifer recharge does not seem to be mentioned very thoroughly in these analyses. Is there anything beyond the recharge dams currently in the plan and under negotiation? Are we discussing any other trade options for rights with Corpus Christi on any other water rights that Corpus Christi may have (in exchange for further recharge of the Edwards Aquifer)?
- Herb Grubb replied other specific ideas are not currently identified.
- The first five options are dealing with sources without specific details as to where the water might specifically get used. Option 6 is then to evaluate how to best move the supplies around.
- The idea of the recharge dams for the EA and the impacts to the Nueces basin, how was that included in the discussion? Herb Grubb indicated that the only discussion was in reference to the IRC 4 discussion of Nueces basin optimization. Do you want it with or without recharge?

Environmental Study Options

- What happened to the Environmental option?
- The environmental considerations are included in the analysis for each of the individual option analysis. How will that issue will be addressed in this process. We were interested in looking at including environmental questions in the process and the TWDB indicated that was not part of this process. The meeting on Monday will tell us more.

Budget

- We may decide that there are not enough funds to allocate from the currently recommended dollars allocated for each planning group. It may be that we will want to recommend these projects for some of the set-aside fund.
- Who is interested in these strategies in the next step? By which group and on what considerations will these strategies be pursued?
- The IRWG is making no recommendations on that idea; it is anticipated that the discussion on the 15th will include that topic.
- What if all the regions say that all should be studied, but there are limited funds? My preference is to see Option 6 evaluated.
- We have to have done some of the other supplies studies before we can do 6. So option 6 is not a stand-alone analysis.
- I am more interested in Option 5

- There is some risk that if you look at all the pieces together that you may miss the key pieces.
- Haven't we already done IRC-1? A lot of work has already been done on this one, but more work needs to be done.
- I think we are also very interested in doing IRC 1.
- When you look at the magnitude of investment for water over the next five years. I would like to see all six evaluated, but we may need to do a Chevrolet analysis at first rather than the Cadillac analysis. But I hate to send one of them aside and miss something valuable.
- Did you just offer to pay for the whole thing? (Laughter) No, I just feel these are all valuable ideas.
- I think we are also very interested in the first option also.
- We may want to say that we are interested in the report as it is written, but are not ready to sign off on a commitment today.
- It may be that we decide on the specific items that we want to tell the IRWG that we definitely want included in our scope.
- If there were one that we are not interested in, it would be the Palmetto project. We have passed on that one before.
- What was the discussion at the Region P meeting like? Did they offer any interest in taking on these options?
- In general they have expressed interest in desalination and Palmetto. They do not need either to meet their needs, but since they have a permit for the Palmetto site they think that it should be looked at.
- The general feeling is that we are not interested in performing further analysis of the Palmetto Bend II strategy (IRC – 4).
- I would like to make sure that recharge is highlighted in more detail in the next draft. The studies should include analysis that will include the information needed to negotiate trades' for recharge water kept in the Edwards aquifer rather than allowed to enter the Nueces system.

3.3 Thursday, January 17, 2002

Coastal Bend RWPG – Region N

Water Management Strategies

- Do you want to take any action or recommendations on these or just capture our comments and pass them on?
- My only comment is that the Gulf Coast Aquifer and Palmetto Bend Site have been studied thoroughly.
- The idea is to just try to adapt them to some of the other ideas.
- There is no problem with studying them as long as it does not come out of our allocation.

Budget

- How would we pay for these studies?
- The funding process was reviewed for the group by James Dodson. The possibility was discussed of agreeing to pool and apply for additional funds jointly as an interregional recommendation to do these studies. We will also be getting feedback on the recommendations from the TWDB to make sure these are eligible for funding.

- I think it would be hard to try and do these studies with the funds currently allocated by the formula.
- What will happen at the meeting on the 15th?
- That meeting will review the input from the RWPG, and revise and recommend the scope.
- We are really trying to come to some agreement on what should be studied. Region L also said they are concerned about the money, but also what would the mechanics be for a study. The real action is whether you want to incorporate any of these particular options into your immediate scope of work. And then the larger idea of looking for some of the money from the competitive pool.
- Are there any motions to take any actions on any of these items?
- No motions were made.
- The group is still interested in participating in the process and we will look it again during the next step. We will look at this again after the new formula for allocation comes out from the TWDB.
- Have Greg and Bernie been attending the meetings? Yes and Judge Miller, Mark Scott, and the city of CC have been participating.
- The consensus is that there are no objections to the studies and that we want to continue to participate in the process.

3.4 Thursday, January 31, 2002 Rio Grande RWPG – Region M

Water Management Strategies

- Our water needs are so critical right here, right now, I have a problem with competing for funds when our needs are so great. There is really nothing in these ideas for the south area right now.
- From a practical standpoint, the only Inter-regional option we need to focus on is the Cotulla idea.
- I was in Corpus Christi recently and they were talking about the cost of Cotulla water with a pipeline. But it does seem of interest to Laredo to investigate as a possibility. I would suggest that we look at Cotulla for Laredo's use.
- In the area of the Cotulla reservoir, is the permeability of the soil a concern? I think it was looked at in the past and it was a problem.
- Overall, we are interested in the desalination more so for the technology and lessons learned at this point.
- Cotulla is one idea that could help Laredo.
- We know from the public letters to the editors that they are asking: "Why do we not have a pipeline from east Texas to meet our needs?"
- What did the Corpus Christi pipeline cost? I think about \$750 to \$1000 per mile.
- I think our effort is well worth it because we can say we looked at it. It would make sense if the Federal Government would come and say they would fund a pipeline from the east. But that is a pie in the sky dream.
- The need for maximizing the current resources is obviously the first order of business. In the United Kingdom we are also trying to capture the flood-water when it is available. Urban designs include rainwater capture and groundwater infiltration systems.

- By doing recharge enhancement features the landowners benefit and do not lose their land (to reservoirs).
- Solar powered desalination technology is also a great place for you to look.
- We need to see how much interest Laredo has in participating in evaluating the Cotulla feature and pipeline. Communication with Laredo is important and their representative is not here today.
- As I recall Laredo was going to drill sample core wells to see if their Wilcox plans were feasible.

Budget

- One of the most critical things in my mind is that I don't see any major weather pattern changes in the near future. We need to get desalination as a regional solution. I would hope that the TWDB would concentrate some efforts to help us way down here. We are so isolated. I do not want to bad mouth any Inter-regional work, but we need water now.
- We are between a real rock and a hard place on funding priorities.
- A motion was made to acknowledge the report and to solicit input from the city of Laredo Water Utilities. The motion passed.
- Also we think it is important to solicit technical information in regards to desalination.

3.5 Tuesday, February 13, 2002 Lower Colorado RWPG – Region K

Resolution of Interregional Conflict

- What happens when there is interregional conflict in policies, such as our sustainability policy? In the final stages, there will be mediation, negotiation, and conflict resolution. Our main conflict with Region L is over Alcoa.
- What we want to be sure of is that these conflicting issues are addressed early.

Appendix C
Texas Water Development Board Review Letter
with Responses

February 13, 2002
Mr. James A. Dodson
Deputy Executive Director
Nueces River Authority
6300 Ocean Dr.
Corpus Christi, Texas 78412

Dear Mr. Dodson:

Your letter dated January 21, 2002 transmitted the Draft Report, Water Management Strategies for Potential Inter-Regional Cooperation. Per your request, Texas Water Development Board (TWDB) staff reviewed the Draft Report. The following review addresses the six water management strategies presented in the Draft Report. This preliminary review does not imply any commitment to future funding, rather, it is solely intended to indicate preliminary TWDB staff determinations of eligibility for funding.

IRC-1: Gulf Coast Aquifer — Bee, Goliad, and Refugio Counties

The Draft Report refers to significant quantities of fresh water in the Gulf Coast Aquifer in Bee, Goliad, and Refugio Counties and to the groundwater model that was completed as part of the regional water plan for the Coastal Bend Regional Water Planning Area. It also points out that the TWDB initiated the development of a Groundwater Availability Model (GAM) that covers the same portion of the Gulf Coast Aquifer. The GAM should be completed by the end of this calendar year and, thus, will be available as a base for certain elements of the analyses listed in the Draft Report, such as groundwater quality, potential effects of regulatory policies, various levels of pumping upon water levels, saltwater intrusion, and local aquifer users.

Task 4 is described as the review and evaluation of aquifer storage and recovery potentials. It would be helpful if the Draft Report described how this effort relates to the recently completed work on the conjunctive use of groundwater in Refugio County. TWDB staff consider Task 6, which is the identification of possibilities for cooperation of Regions K, L, M, N, and P to be of interest since the affected counties cover more than one regional water planning area and each has their own groundwater conservation district.

Response: The point in paragraph one about the GAM for the Gulf coast Aquifer being available by the end of 2002 is noted, and the model will be used, as appropriate. The recently developed groundwater model by Region N, of the Gulf Coast Aquifer for use in the development of the Region N water plan is proposed to be used in The work of Task 4, mentioned in paragraph 2 to evaluate aquifer storage and recovery potentials in the Gulf Coast Aquifer in Refugio County for a range of pumping levels, a range of quantities of surface water available for ASR, and various water supply quantities needed by the cooperating regions. Previous analyses have been done for individual regional plans, without consideration of the effects of one region's plan upon the others, nor, have the accumulated effects of all of the plans upon the

aquifer in Refugio County been taken into account in light of local groundwater district rules, and potentials for ASR. The evaluations proposed for IRC—1 would provide results for a range of development scenarios that would allow both the local interests, and the several regions that need water to proceed with plans to make use of the Gulf Coast Aquifer in the most efficient manner, without the regions being in competition or conflict with each other.

IRC-2: Lower Colorado River

The TWDB has followed the Lower Colorado River water management strategy basically from its inception. The cooperation between Regions K and L in jointly developing this strategy during the first round of regional water planning is a great win-win solution to two water supply problems in this vital region of the State. Passage of House Bill 1629 by the 77th Texas Legislature is an important step forward; however, a lot of work remains before this strategy can become a reality.

As with IRC-1 above, the GAM should be available for any technical analyses. However, the Draft Report should clarify that this groundwater source is intended strictly for uses within Region K, which is the way it was presented in the Region K Regional Water Plan. TWDB staff considers Task 4, which is the identification of possibilities for cooperation of Regions K, L, M, N, and P to engage in cooperative development and use of this supply to be the initial and perhaps the most important task to be undertaken for this strategy.

Response: The points made in both paragraphs above are well taken, and the text of IRC—2 has been modified to state, “The well fields within the irrigated areas of Region K would supply water to the farmers of Region K via existing canals.”

IRC-3: Desalination

The TWDB recognizes the interest in desalination by many of the Planning Groups and has funded several recent studies on this subject. Task 1 proposes updating costs for desalination plants at various locations. It seems that the costs for these plants were evaluated within the past few years. Due to the recent completion of these other research efforts, TWDB staff questions the need for additional analyses at this time.

Task 2 addresses several concerns such as the use of brackish groundwater, reducing salt water intrusion and brine disposal. Aspects of Task 2 appear duplicative of previous work prepared by the Planning Groups for Regions L, N, and P and the Draft Report should clearly show what is new work to be undertaken and how the new work relates to work already completed. Task 4, which is the monitoring of desalination facilities is an ongoing activity of the TWDB and is not viewed as an appropriate task for regional water planning.

Response: The proposed updating of costs includes that which will be required for this strategy should it be retained as a water management strategy in the 2006 regional plans, or considered for inclusion at different levels in the 2006 plans than was in the 2001 plans. With respect to the work proposed in Task 2, neither of the plans considered the use of brackish groundwater other than that which was estimated to be available in the aquifers prior to withdrawal of brackish water. The Task 2 proposed

work is to consider the potentials for saltwater intrusion into the Gulf Coast brackish aquifers when or after withdrawal of brackish groundwater from them, with specific attention being given to the potentials for a steady stream of this “intuded” water being available as feed-water to the desalination plant. If this phenomenon could be established, then the salt-water intrusion path to freshwater aquifers could perhaps be blocked. The benefits would include lower cost of desalination, and reduced threats to contamination of freshwater aquifers in coastal areas.

Task 4 to monitor desalination facilities is intended to provide the most up to date technology and desalination cost information for use in the evaluation of IRC—3, and is not intended to duplicate the TWDB’s monitoring efforts.

IRC-4: Palmetto Bend Stage II

The TWDB is not aware of any significant support for this option from the affected Planning Groups. The evaluations of combined yield with the Gulf Coast Aquifer would be dependant on the availability of information from GAM (see comments on IRC-1). There will need to be significant clarification of how IRC-4 differs from previous evaluations of Palmetto Bend II by the Planning Groups for Regions L, N, and P.

Response: As is the case with the other Inter-Regional Cooperation strategies that have been identified and described, work has been done by one or more of the regions regarding the Palmetto Bend Stage II project. However, as is the case with the other IRC strategies, the work proposed here would be based upon previous results, but would be updated and expanded and modified for use in one or more Inter –Regional Cooperation strategies. If previous work had been adequate for this purpose, the strategy would either have been rejected, or adopted, as opposed to having been proposed for evaluations for potential inter-regional cooperation.

IRC-5: Optimization of Nueces Basin Yield

Based on previous studies, minimal results are expected from a diversion near Simmons, as described on pg. 2-18 of the Draft Report, and there may be little benefit from this evaluation. There will need to be clarification of the sequencing of the analysis. Will the anticipated yield from potential sources within the Nueces River Basin be evaluated before considering outside sources? Please explain how the inter-regional strategy extends and builds on previous work such as the consideration of a pipeline between Choke Canyon Reservoir and Lake Corpus Christi in the Region N Regional water Plan and the evaluation of the Cotulla Reservoir and the Inter-Regional Cooperation Alternative Water Plan in the Region L Regional Water Plan.

Response: The proposed scope of work for IRC—5, as well as the other IRC strategies, was to describe the options and identify the work tasks to be done. The proposals do not include work plans, such as the sequencing of the analysis, as is referenced in the comment above. However, the analyses would be done for the sources within the Nueces Basin before considering sources from outside the basin. In addition, the proposed analysis would be comprehensive, including the various Edwards Aquifer recharge projects, together with the in-basin and out-of basin sources, as listed in the scope of work. Although, several of the in-basin sources have been evaluated, there

are no definitive results that can be used to answer questions as to how in-basin sources, together with Edwards Aquifer recharge, use of Choke Canyon storage capacity, and use of ground and/or surface water from coastal areas to the east of Corpus Christi can be used to the mutual benefit of Regions K, L, N, and P. Without a comprehensive analysis, such as is proposed in IRC—5 and IRC—6, the individual regions will be forced to proceed on their own, and can not know of the potential cost savings and environmental considerations of cooperative efforts, nor can they include some of the potential sources of water without encountering competition and perhaps irreconcilable conflicts.

IRC-6: Inter-Regional Facilities

The strategy as described appears to incorporate the other five water management strategies. It appears that little of the described, additional technical work will be needed. For example, TWDB will be doing the environmental work for the strategies as described in the Concept Paper on Method of Stream Flow Assessment to be Utilized During Current Regional and State Water Planning Efforts. Instead, additional effort might be directed toward identification of possibilities for cooperation of Regions K, L, M, N, and P.

Response: IRC--1 through IRC-- 5 are individual strategies to be evaluated as to their respective quantity, cost, and environmental information, with results expressed in terms as of their respective locations. IRC—6, “Inter-Regional Facilities,” is for the purpose of organizing and/or integrating one or more of the individual strategies into one or more operational and management systems for delivery of water to entities in Regions K, L, M, N, and P, as appropriate; e.g.; the individual strategies must be included in water supply systems that deliver water to those who need it. Thus, it is necessary to develop quantities, costs, and environmental effects of the specified systems. The proposed technical work is to present the quantitative information required in TWDB rules for each Inter-Regional Facility, including the proposed environmental analyses. As was alluded to in the response above, many pieces of the potential strategies have been evaluated, but the pieces have not been put together into something that is useful to the regions. They are still pieces without much purpose.

I hope that this review has been of some benefit. If you have any further questions, please do not hesitate to give me a call at (512) 936-0813.

Sincerely,

Bill Mullican
Director
Water Resources Planning