

ECONOMIC IMPLICATIONS OF REHABILITATION OF IRRIGATION DISTRICTS' INFRASTRUCTURE: TEXAS RIO GRANDE BASIN

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The joint effects of drought, urban growth, and limited water supplies arising from Mexico's default on the 1944 Water Treaty prompted an investigation of alternative means of identifying new sources of water and making more efficient use of existing water supplies. Recognizing the seriousness of the water crisis in South Texas, Congress enacted Public Law 106-576, entitled "The Lower Rio Grande Valley Water Resources Conservation and Improvement Act of 2000 (Act)." In that Act, Congress authorized water conservation projects for irrigation districts relying on the Rio Grande River for supply of agricultural irrigation, and municipal and industrial water. Several phases of project planning, development, evaluation, prioritization, financing, and fund appropriation are necessary, however, before these projects may be constructed. The Bureau of Reclamation is the agency tasked with administering the Act and it has issued a set of guidelines for preparing and reviewing such proposed capital renovation projects.

South Texas irrigation districts have an extensive system of engineered networks, including 24 major pumping stations, 800 miles of large water mains and canals, 1,700 miles of pipelines, and 700 miles of laterals that deliver water to agricultural fields and urban areas (Fipps). Yet, many of these key components are more than 100 years old, outdated, and in need of repair or replacement. Texas Agricultural Experiment Station and Texas Cooperative Extension economists and engineers are collaborating with Rio Grande Basin irrigation district managers, their consulting engineers, the Bureau of Reclamation, and the Texas Water Development Board to perform economic and energy evaluations of the proposed capital improvement projects.

Proposed projects include, among others, (a) meters for monitoring in-system flows and improving management of system operations; (b) lining for open-delivery canals and pipelines to reduce leaks, improve flow rates, and increase head at diversion points; and (c) pumping plant replacement, among others. Numerous differences exist across such projects, including initial investment costs, anticipated changes in operating and maintenance costs, lengths of the construction periods, lengths of expected useful lives, and types and amounts of water and energy savings.

A spreadsheet model, Rio Grande Irrigation District Economics (RGIDECON[®]), has been developed to facilitate economic and financial analyses accounting for the noted features and differences among proposed projects. That is, the spreadsheet's calculations are attuned to economic and financial principles consistent with capital budgeting procedures — enabling a comparison of projects with different economic lives, among other important considerations. As a result, RGIDECON[®] is capable of providing valuable information for prioritizing projects in the event of funding limitations. The methods assure recognition of the social time value of

money (and other resources), account for differences in assets' useful lives, and integrate analyses of individual project components into one comprehensive project assessment. Cost projections are adjusted annually to account for nominal increases in prices. Discount rates include terms for both social time value and increases in relative nominal input prices, but ignore risk. Potential performances of proposed projects and their respective component(s) are measured in terms of costs of water and energy savings. Rister et al (2002a) provides documentation of the methods incorporated into RGIDECON®.

Results of the cost analyses could be compared with economic values of water to conduct cost-benefit analyses, but such evaluations are not presently being conducted in explicit fashion. Methodology is also included in the spreadsheet for appraising the economic costs associated with energy savings. There are energy savings from pumping and/or relifting less water forthcoming from reducing seepage and from improving the efficiency of pumping/relifting operations. The Bureau of Reclamation, in a letter dated July 24, 2002 (Walkoviak), indicated that RGIDECON® satisfies the legislative criteria for authorizing projects and that the Bureau will use the results for economic and energy evaluation.

The economic water and energy savings analyses provide estimates of the economic costs per acre-foot of water savings and per BTU (and kwh) of energy savings associated with one proposed capital improvement activity (referred to as a component). An aggregate assessment is also supplied when two or more activities (i.e., components) comprise a proposed capital improvement project for a single irrigation district. The RGIDECON® model also accommodates "what if" analyses for irrigation districts interested in evaluating additional, non-Act authorized capital improvement investments in their water-delivery infrastructure.

The initial three application results of RGIDECON® are reported in Rister et al. (2002b, 2002c, and 2003). Table 1 provides a summary of the types of water and energy conservation projects associated with those evaluations and the costs per unit of water conserved; costs per unit of energy savings are not reported due to space limitations. The results indicate that costs per unit of water conserved range from \$13.20 to \$119.41 per ac-ft of water. Such costs are expressed on an annual basis, representing, in effect, the lease cost for using an ac-ft of water one time, in one year, rather than the purchase cost of a recurring water right. The finance aspect of the 'annuity equivalent' calculation as it is used in the RGIDECON® analyses is such that it represents an annual cost savings associated with one unit of water (or energy) each year extended indefinitely into the future. Zero salvage values and continual replacement of the respective water conservation technologies with similar capital items as their useful life ends are assumed. These estimates include the investment, estimated change in repair and maintenance and variable costs compared to the current system.

While the individual components of the three respective projects have widely varying cost estimates for the associated water savings, the aggregate measures for the three projects are much less varying, ranging from a low of \$29.87/ac-ft to a high of \$41.26/ac-ft. These results, when compared to recent cost estimates of freshwater forthcoming from desalination plants of more than \$1,200/ac-ft (Taylor), are indicative of the relative value of water conservation measures and suggest a need for careful deliberation when planning the authorization, appropriation, and distribution of public (and private) funds toward future water projects.

References:

Bureau of Reclamation. *Guidelines for Preparing and Reviewing Proposals for Water Conservation and Improvement Projects Under Public Law 106-576 – Lower Rio Grande Valley Water Resources Conservation and Improvement Act of 2000*. United States Department of Interior. June 2001.

Fipps, Guy. “Potential Water Savings in Irrigated Agriculture for the Rio Grande Planning Region (Region M), Final Report.” Department of Biological & Agricultural Engineering, Texas A&M University, College Station, TX. December 22, 2000. In Regional Water Supply Plan for the Rio Grande Regional Water Planning Area (Region M), Volume II, Technical Appendix, Technical Memorandum.

Rister, M.E., R.D. Lacewell, J.R.C. Robinson, J.R. Ellis. and A.W. Sturdivant, *Economic Methodology for South Texas Irrigation Projects - RGIDECON*®. Texas Water Resources Institute. College Station, TX. TR-203, October 2002a.

Rister, M.E., R.D. Lacewell, A.W. Sturdivant., J.R.C. Robinson, M.C. Popp., and J.R. Ellis. *Economic and Conservation Evaluation of Capital Renovation Projects: Harlingen Irrigation District Cameron County No. 1 - Canal Meters and Telemetry Equipment, Impervious-Lining of Delivery Canals, Pipelines Replacing Delivery Canals, and On-Farm Delivery-Site Meters*. Texas Water Resources Institute, Texas A&M University. TR-202, October 2002b.

Rister, M.E., R.D. Lacewell, A.W. Sturdivant., J.R.C. Robinson, M.C. Popp., and J.R. Ellis. *Economic and Conservation Evaluation of Capital Renovation Projects: Edinburg Irrigation District Hidalgo County No. 1 - 72' Pipeline Replacing Delivery Canal and Multi-Size Pipeline Replacing Delivery Canal*. Texas Water Resources Institute, Texas A&M University. TR-205, November 2002c.

Rister, M.E., R.D. Lacewell, A.W. Sturdivant., J.R.C. Robinson, M.C. Popp., and J.R. Ellis. *Economic and Conservation Evaluation of Capital Renovation Projects: Cameron County Irrigation District No. 2 (San Benito) – Interconnect Between Canals 39 and 13-A1 and Replacement of Rio Grande Diversion Pumping Plant*. Texas Water Resources Institute, Texas A&M University. TR-212, March 2003.

Taylor, Steve. “Desalination Gets a Boost.” *Valley Morning Star*. December 12, 2002. http://www.rioweb.org/Archive/year2002/december02/vms_desalinationgets121202.html

United States Public Law 106-576. “Lower Rio Grande Valley Water Resources Conservation and Improvement Act of 2000.” Enacted December, 28, 2000. Located on web site <http://idea.tamu.edu/USPL106.doc>, July 4, 2002.

Walkoviak, Larry. Area Manager, United States of the Interior, Bureau of Reclamation, Great Plains Region, Oklahoma - Texas Area Office, Austin, TX. Personal correspondence, July 24, 2002.

Table 1. Illustrative results indicating characteristics and estimated costs for various capital renovation water conservation projects in selected irrigation districts in the Texas Rio Grande Valley.

<i>DISTRICT*</i> and Project Component	Description	Initial Investment Cost (\$)	Expected Useful Life (years)	Net Changes in O&M (\$)	Annuity Equivalent of Net Cost Stream - Water Savings (\$/yr)	Annuity Equivalent of Water Savings (ac-ft)	Calculated Cost of Water Savings (\$/ac-ft)
<i>HARLINGEN</i>							
Canal Meters & Telemetry	105 meters at 70 locations	\$757,538	15	\$114,675	\$188,987	2,157	\$87.60
Canal Lining	3.26 miles from Concrete to Impervious Lined	\$696,565	20	\$(3,912)	\$45,961	1,576	\$29.17
Pipeline	5.66 miles of 24" RG/RC** Pipe	\$1,106,080	49	\$(7,924)	\$42,626	3,230	\$13.20
On-farm Meters	400 turnout meters	\$649,816	10	\$76,000	\$133,063	6,129	\$21.71
Aggregate		\$3,209,999	n/a	\$188,839	\$410,637	13,092	\$31.37
<i>EDINBURG</i>							
Curry Main	5,900 feet of 72" RG/RC Pipe	\$1,264,299	49	\$(13,003)	\$58,556	1,366	\$42.87
N. Branch / E. Main	28,600 feet of 60", 54", 48" RG/RC Pipe	\$3,748,425	49	\$(70,431)	\$79,574	3,259	\$24.42
Aggregate		\$5,012,724	n/a	\$(83,434)	\$138,130	4,625	\$29.87
<i>SAN BENITO</i>							
Interconnect	12,600 feet Unlined Canal to Lined Canal	\$3,585,300	49	\$1,704	\$207,017	9,129	\$22.68
Pumping Plant	Facility Replacement	\$9,715,000	48	\$(433,842)	\$259,266	2,171	\$119.41
Aggregate		\$13,300,300	n/a	\$(432,138)	\$466,283	11,300	\$41.26

* Note Districts' local and commonly-referred-to names are used, with formal/complete names being, respectively, Cameron County Irrigation District No. 1, Hidalgo County Irrigation District No. 1, and Cameron County Irrigation District No. 2.

** "RG/RC" is an abbreviation for "rubber-gasket, reinforced concrete."