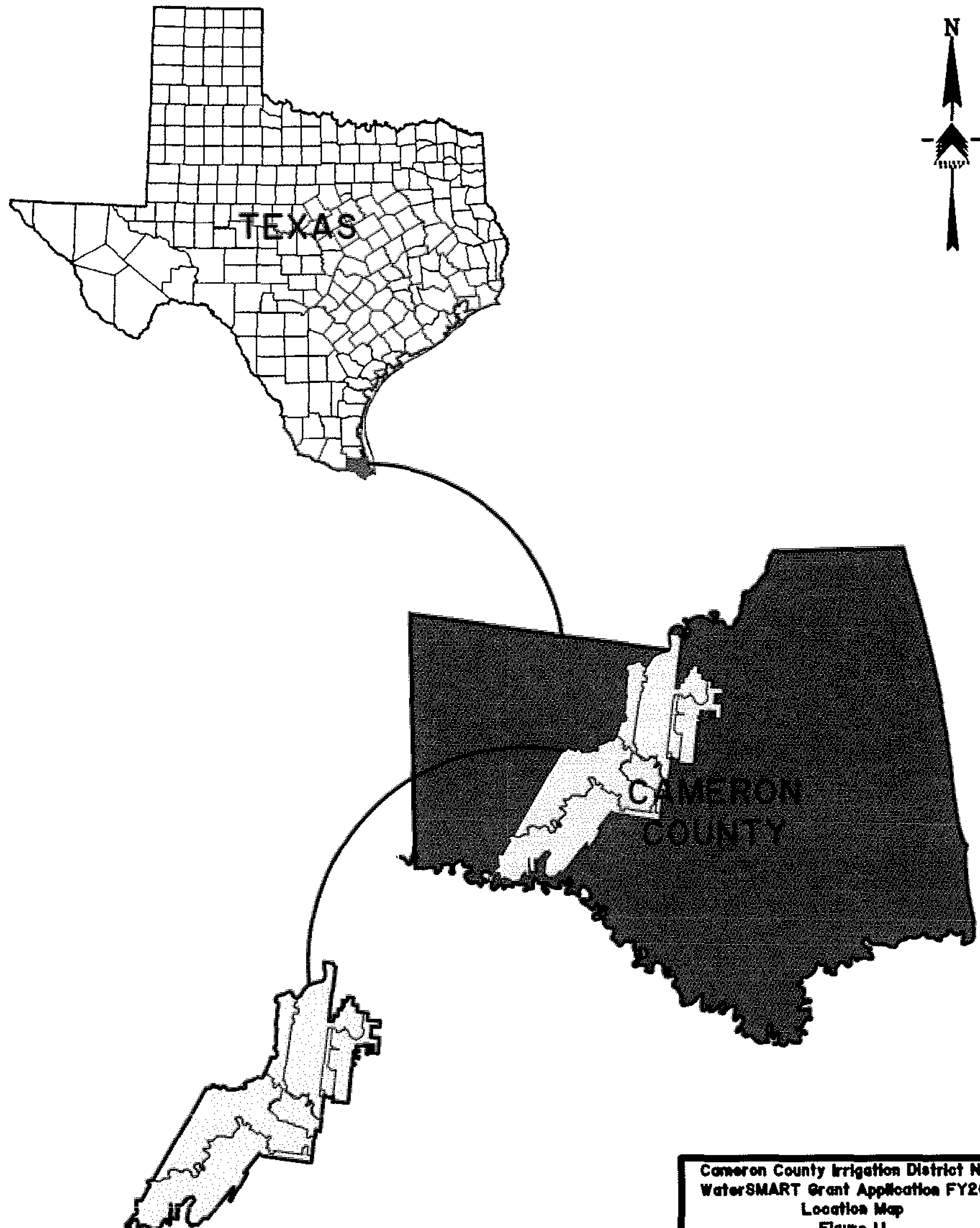

CAMERON COUNTY IRRIGATION DISTRICT No.2

Cameron County Irrigation District No.2
WaterSMART Grant Application FY2016
Location Map
Figure 1.1

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WaterSMART: Water and Energy Efficiency Grants for FY 2016 – Funding Group 1

Cameron County Irrigation District No. 2

Conversion of Lateral "J" from Open Canal to a Pipeline

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January, 2016

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IV.D.4 Technical Proposal

IV.D.4.1 Executive Summary

Date: January, 20, 2016
Applicant: Cameron County Irrigation District No. 2
26041 FM 510
San Benito, Texas 78586
Project Title: Conversion of Lateral "J" from Open Canal to a Pipeline

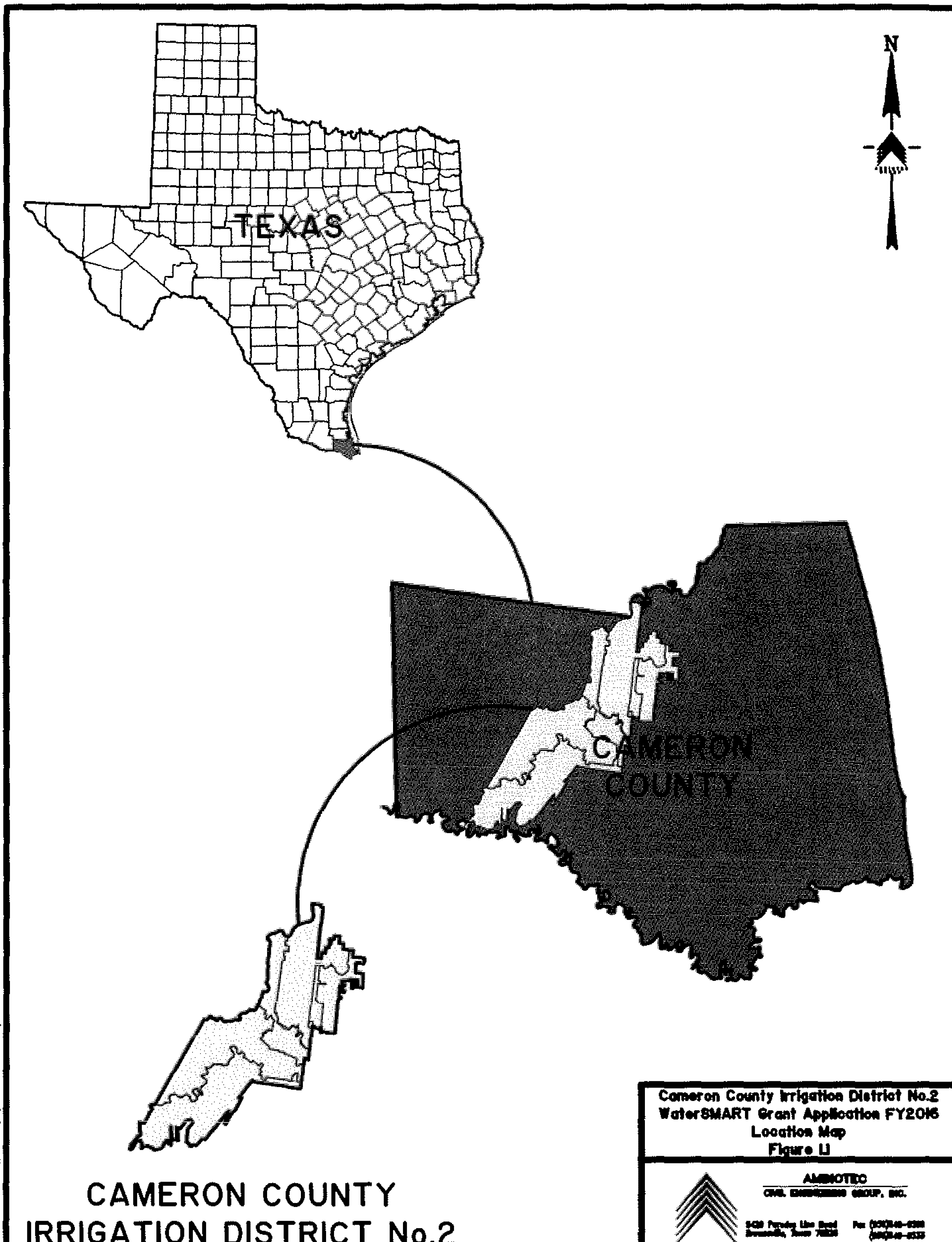
The Cameron County Irrigation District No. 2 (CCID2) is proposing to partner with the Bureau of Reclamation (Reclamation) with a Funding Group I Project to conserve water and energy. The proposed project consists of converting approximately 7,200 liner feet (lf) of the unlined open canal in a segment of the Lateral "J" to underground pipeline. These improvements are expected to improve water deliveries by conserving approximately 611.43 acre feet per year of water which accomplishes Task A. The reduced water pumping requirements resulting from water conservation measures will decrease the required pumping time thus increasing energy efficiency of water deliveries by an estimated 24,610 kilowatt hours per year to accomplish Task B. Due to the proximity to the Lower Rio Grande Valley Wildlife Refuge, this project could indirectly benefit the Ocelot and Jaguarundi endangered species addressing Task C. CCID2 is an active participant in the Lower Rio Grande Valley Watermaster System and the conserved water will allow CCID2 to explore marketing efforts satisfying Task D. All of the proposed improvements are to be constructed on CCID2 property (none of the improvements will be located on a Federal Facility) and this project should be completed within 24 months. The construction phase of this project is estimated at 6 months, not considering schedule adjustments to accommodate necessary irrigation demands. The project can begin immediately upon any grant agreement execution.

IV.D.4.2 Background Data

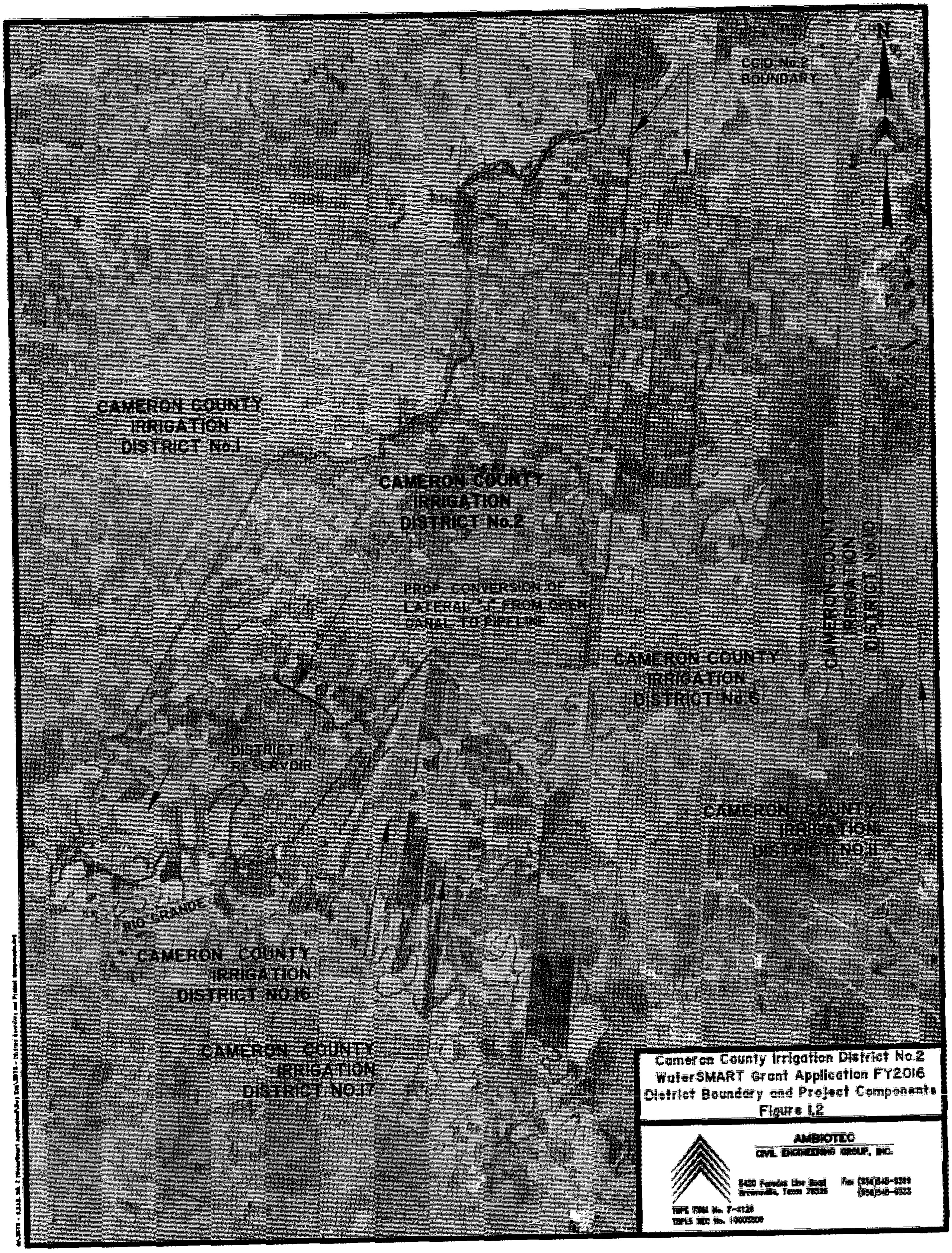
Cameron County Irrigation District No. 2 (CCID2) is located in the Lower Rio Grande Valley Region with its main office located in San Benito, Texas (See Figure 1.1). CCID2 boundary encompasses 64,459 acres and currently serves 55,151 acres of irrigated farmland where farmers grow citrus, vegetables, sugar cane, sorghum, corn and hay (See Figure 1.2).

CCID2 receives its water from the District's San Benito River Pump Station located in Los Indios, Texas on the eastern side of the Rio Grande. Pumped water from the Rio Grande is transported via two main earthen canals that deliver the entire district's agricultural and domestic demand. The district's distribution system consists of 241 miles of canals and pipelines including: 120 miles of unlined canals, 17 miles of lined canals, 104 miles of pipeline, and 15 miles of resaca. Of the 241 miles of canals, 137 miles are considered to be main canals and 104 miles are classified as lateral canals. In addition to the above list of open canals and pipelines, CCID2 has a storage reservoir with a capacity of 7,925 acre feet near the San Benito River Pump Station. Due to the large lengths of inefficient open unlined canals, CCID2's overall distribution conveyance efficiency is an estimated 60 percent.

All water right holders along the Rio Grande below Amistad Dam are part of the Lower Rio Grande Valley Watermaster System. The system is currently over allocated and during the past few decades the semi-arid watershed has experienced several long term droughts. In addition, the supply is further compromised by 1944 US-Mexico Treaty which allows Mexico to detain upstream flows and defer water deliveries up to five years in the amount 350,000 acre feet per year. The result is a system vulnerable to extreme drought and other inconsistent weather patterns.



Cameron County Irrigation District No.2
WaterSMART Grant Application FY2016
Location Map
Figure 1.1



Cameron County Irrigation District No.2
WaterSMART Grant Application FY2016
District Boundary and Project Components
Figure I.2

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CIVIL ENGINEERING GROUP, INC.

The Lower Rio Grande Valley Watermaster System provides water to irrigation water right holders after municipal and industrial water right holders have been accounted for. The US share of storage in the Amistad-Falcon System is currently at 65.6% of its 3,390,000 acre feet conservation capacity. This is up from 47.54 percent of normal conservation a year ago at this time. This recent significant increase is a result of unseasonable record rainfall in the watershed. However, inconsistent weather patterns can't be relied upon as a constant water source plus the area's population continues to grow, so water conservation improvements are imperative to long term water resource management.

Currently, CCID2's irrigation water right is a total of 147,824 acre feet per year. In addition to their irrigation water rights, the CCID2 holds municipal/domestic water rights of 5,518 acre feet per year, municipal water rights of 6,390 acre feet per year, and industrial water rights 192 acre feet per year. The average annual water diverted by the CCID2 from 2011 through 2015 for all users was roughly 71,400 acre feet per year. The CCID2's primary municipal customers include the East Rio Hondo Water Supply Corporation (6,685 acre feet per year), City of San Benito (5,500 acre feet per year) and the City of Rio Hondo (890 acre feet per year). The CCID2 is the sole source of water for these municipalities, which together include a total population of nearly 50,000 residents.

The CCID2 obtains its water from the Rio Grande at the CCID2 San Benito River Pump Station. This pump station, constructed in 2005, includes eight pumps (2 – 150Hp, 50 cfs pumps and 6 – 300Hp, 100cfs pumps) and is powered by both electricity and natural gas.

The CCID2 has completed several projects with Bureau of Reclamation in the past, including:

1. Pumping Plant Rehabilitation (03-FC-60-1799)
2. Canal Rehabilitation (04-FC-60-1871)
3. Water 2025 Challenge Grant- Gate Replacement (05-FC-60-2017)
4. Water 2025 Challenge Grant- Canal Piping (07FC602235)
5. Water 2025 Challenge Grant- Canal Flow Measurement & Control Improvements (08-FC-60-2330)
6. CCID2 is also a member of the Rio Grande Regional Water Authority that participated in the "Lower Rio Grande Basin Study", prepared by the Bureau of Reclamation in 2013.

Through CCID2's financial partnership with the Bureau of Reclamation, the above projects are conserving approximately 42,485 acre feet of water per year.

IV.D.4.3 Technical Project General Description

The project consists of water and energy conservation and other components that meet the goals of the 2016 WaterSMART Funding Opportunity Announcement No. R16-FOA-DO-004. The proposed project includes converting approximately 7,200 lf of the open unlined canal, Lateral "J", to underground PVC pipe. The location of Lateral "J" irrigation canal is shown in Figure 1.3. The conversion of Lateral "J" will conserve an estimated 611.43 acre-feet of water per year and energy conservation of 24,610 kilowatt hours per year. The current unlined canal experiences water losses from seepage into the ground, evaporation from the surface, plant transpiration from canal bank and floating vegetation, and canal bank failures. Figures 1.4 and 1.5 shows the existing cross sections of the Lateral "J" and Figures 1.6 through 1.9 show pictures of the existing conditions of irrigation canal. Replacing this open unlined canal with a pipe will require clearing and grubbing of the vegetation and canal debris, connecting the proposed piping to an existing control canal gate at the Right High Line Main Canal, installing of 7,200 linear feet of PVC piping and associated tees and valves, and replacing several individual service laterals. The proposed piping will connect to existing roadway culverts at FM 2520, or better known as Sam Houston Blvd. (TxDOT) and Gamble Road (Cameron County). Construction will not require work within the right-of-ways at either of these road crossings.

Cameron County Irrigation District No. 2
Proposed Conversion of Lateral "J" from
Canal to Pipeline
Figure I.3

Cameron County Irrigation District No. 2
Cross Sections Overview Map
Lateral "J" Open Canal
Figure I.4

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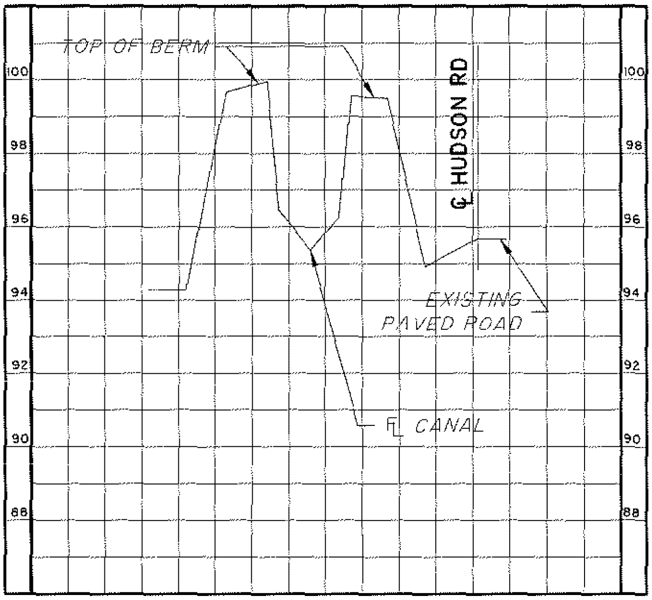

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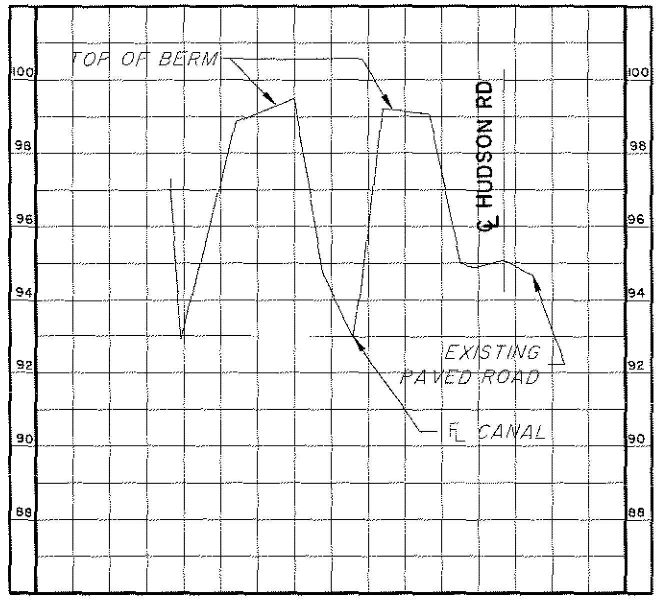

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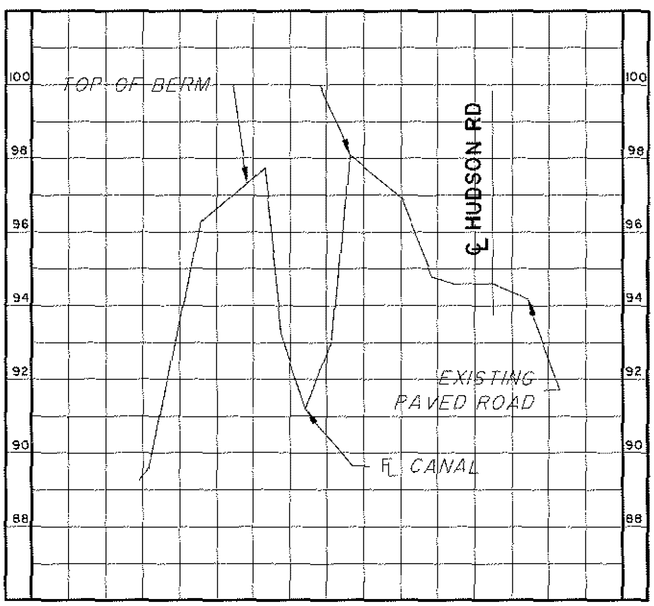

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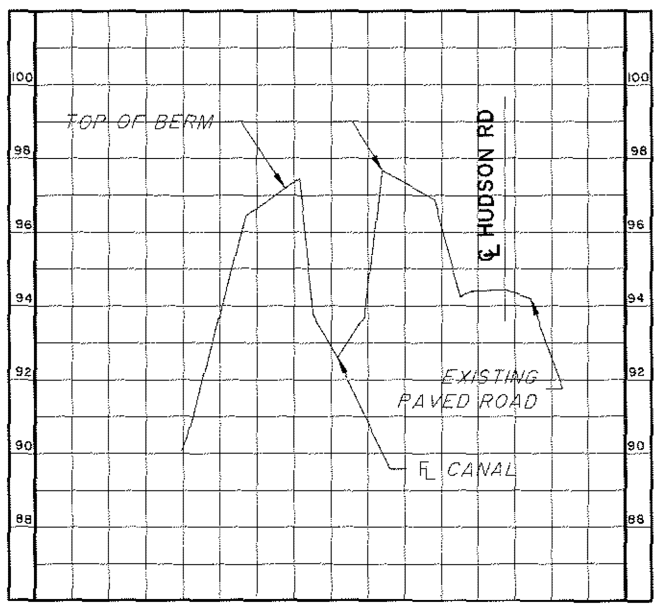

SECTION D-D
SCALE=1"=50'

Cameron County
Irrigation District No. 2
Cross Sections Existing Lateral
"J" Open Canal **Figure 1.5**

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CAMERON COUNTY IRRIGATION DISTRICT No.2

Figure I.6

Figure I.7

Figure I.8

Figure I.9

Cameron County Irrigation District No.2
Existing Conditions

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TBPLS REG No. [illegible]

IV.D.4.4 Evaluation Criteria

V.A.1 Evaluation Criterion A: Water Conservation

Subcriterion No. A.1 - Quantifiable Water Savings

Lateral "J" will be replaced with 36-inch and 42-inch diameter PVC pipe (See Appendix A for products brochures). The proposed PVC pipe will have no measureable loses in comparison to the unlined open canal.

From Texas A&M Department of Agricultural Engineering's, "Irrigation District Efficiencies and Potential Water Savings in the Lower Rio Grande Valley of Texas",[1] (See Appendix B); seepage rates were based on typical canal soils as shown in the USDA Soil Survey for Cameron County (See Appendix C). Typical soils encountered in this project area soil are Laredo Silty Clay Loam. According to "Irrigation District Efficiencies and Potential Water Savings in the Lower Rio Grande Valley of Texas", the seepage rate for silty clay loam is 2.24 gallons per square foot per day. Evaporation was estimated utilizing the "Report 316 Evaluation of Ground-Water Resources in the Lower Rio Grande Valley",[2] (See Appendix B). Using the above reference guidelines, the proposed pipe improvements will conserve approximately 611.43 acre feet per year for an annual transit loss reduction of 448.38 acre-feet per mile. The water conservation estimate is shown in Table 1 below.

Table 1 Water Conservation Estimate		
Lateral "J" Surface Area	3.40	Acres
Lateral "J" Cross Sectional Area	83.35	Feet
Lateral "J" Canal Volume	14.16	Acre Feet
Wetted Perimeter	32.00	Feet
Average Depth	5.00	Feet
Seepage Rate for Silty Clay Loam Soils	2.24	Gallons per Square Foot per of Wetted Perimeter per Day
Estimated Seepage	**594.16**	Acre Feet per Year
Evaporation Rate for Cameron County	61	Inches per Year
Estimated Evaporation	**17.27**	Acre Feet per Year
TOTAL WATER CONSERVATION ESTIMATED	**611.43**	Acre Feet per Year

Water is currently diverted into the Lateral "J" distribution system from the Right High Line Main Canal. The proposed improvements will better manage the water delivered to the 300.19 acres immediately served

[1] "Irrigation District Efficiencies and Potential Water Savings in the Lower Rio Grande Valley of Texas", Guy Fipps, and Craig Pope
[2] "Report 316 Evaluation of Ground-Water Resources in the Lower Rio Grande Valley", Wesley McCoy, Geologist, Texas Water Development Board, 1990

by the currently unlined open canal segment of Lateral "J" plus an additional 329.86 acres downstream of the proposed improvements. Figure 1.10 shows the existing canal cross section with the proposed irrigation pipe cross section.

The Lateral "J" distribution system provides water to approximately 630.05 acres and the estimated annual average demand for this system lateral is 861.3 acre feet. Adding the estimated 611.43 acre feet lost to seepage and evaporation, this results in 1,472.73 acre feet will be more efficiently managed as a result of the project.

Subcriterion No. A.2 – Percent of Total Supply

The CCID2 has pumped an average of 71,400 acre feet annually in recent years. Since majority of the district's distribution system relies on unlined and open earthen canals as delivery, the water losses in the distribution system are estimated at nearly 40 percent, or delivery of only 42,033.6 acre feet per year. When comparing the water savings for the proposed improvements for Lateral "J", 611.43 acre feet, the annual water savings expressed as a percentage of the district's supply is 1.45%. When considering only the water delivered through Lateral "J", 861.3 acre feet mentioned in Section 1.4.1.1 above, the annual water savings percentage for Lateral "J" is 71.00%.

V.A.2 Evaluation Criterion B: Energy-Water Nexus

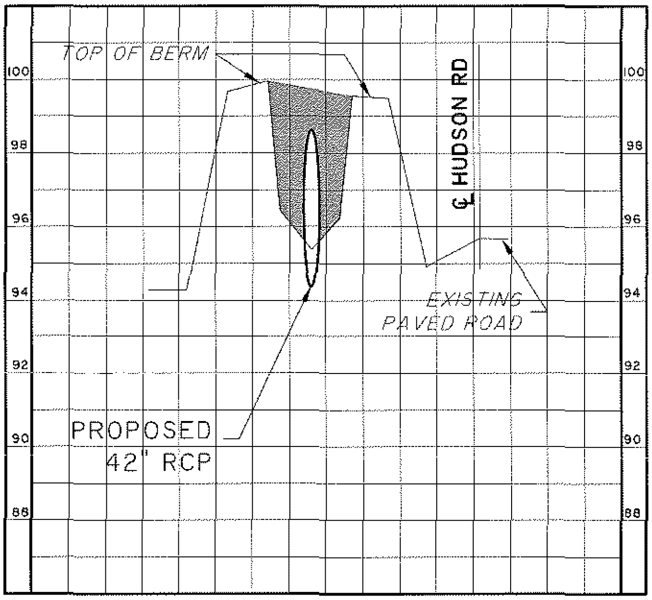
Subcriterion No. B.1 - Implementation of Renewable Energy Projects

The project does not include a renewable energy component related to water management and delivery.

Subcriterion No. B.2 – Increasing Energy Efficiency in Water Management

The project will result in energy conservation by pumping 611.43 acre feet less water from CCID2's San Benito River Pump Station. The San Benito River Pump Station includes eight pumps; 2 – 150Hp, 50 cfs pumps and 6 – 300Hp, 100cfs pumps. Table 2 below shows the calculated energy to be saved by pumping less water to a more efficient delivery system in Lateral "J".

Table 2 Energy Conservation Estimate			
Current Annual Energy Usage at San Benito Pump Station		2,873,494	Kwh
Total Water Pumped		71,400	Acre Feet
Average Energy per Acre Foot Pumped		40.25	Kwh/acre feet
Estimated Conserved Pumped Water		611.43	Acre Feet per Year
TOTAL ENERGY CONSERVATION ESTIMATED		**24,610**	Kwh/Year



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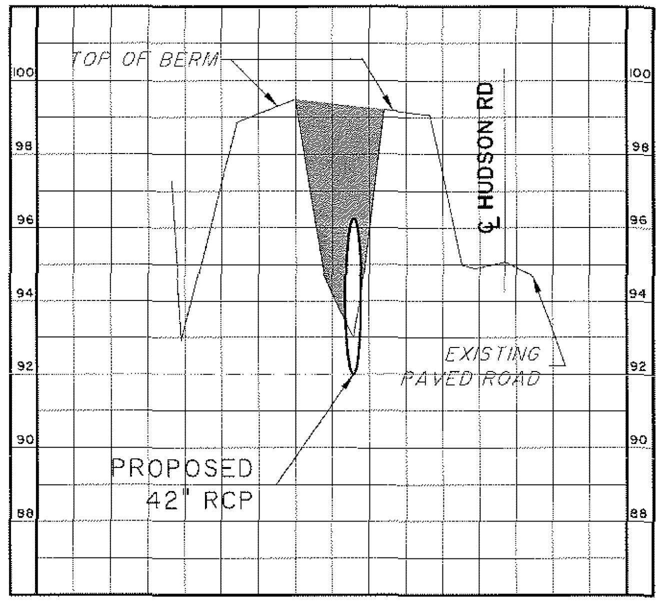

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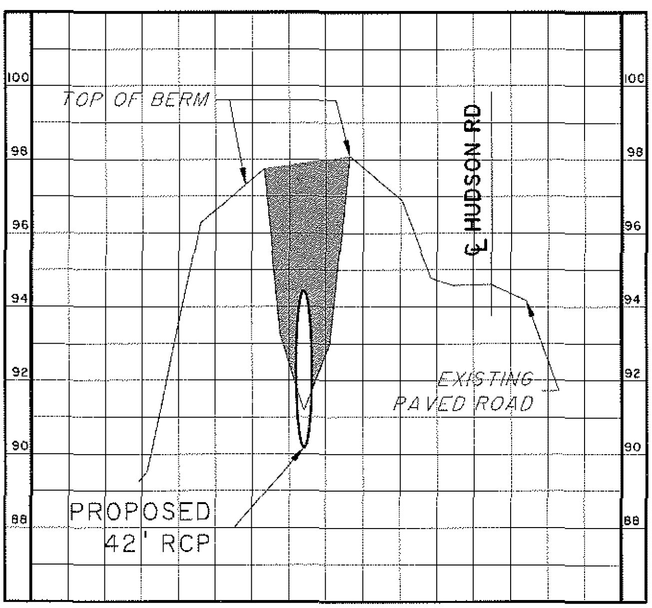

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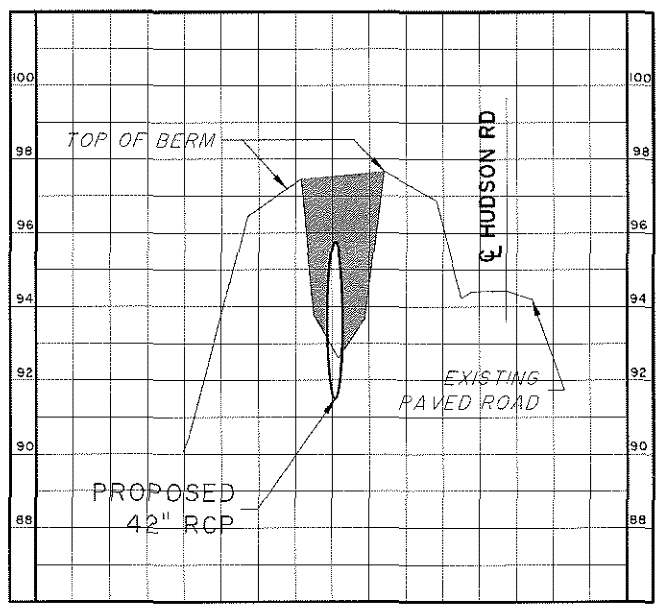

SECTION D-D
SCALE=1"=50'

Cameron County Irrigation District No. 2 Cross Sections Proposed Conversion Of Lateral "J" From Open Canal To Pipeline **Figure 1.10**

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The project is anticipated to reduce vehicle miles and resulting carbon emissions because of the reduction in required maintenance for the piped canal versus the current open unlined canal. Currently, Lateral "J" experiences bank failures on average of three times a year. Each failure requires heavy construction equipment approximately three to four days to repair. Using the carbon emission rates established in FEMA's Combustible Emissions Calculation Sheet (See Appendix D), Table 3 below shows the estimated carbon emissions saved by providing a more reliable conveyance system.

Table 3			
Estimate for Carbon Emissions for Canal Maintenance and Repairs			
Number of Bank Repairs		3	Failures/Year
Repair Equipment	**Estimated Hours/Repair**	**CO_2 Emission (tons/hr)**	**CO_2 Emission (tons/repair)**
Bull Dozer	48	0.1773	8.5104
Dump Truck	16	0.1772	2.8352
Excavator	16	0.1773	2.8368
Total CO_2 Emissions per Repair		14.18	tons/repair
Annual CO_2 Emissions for Lateral "J" Repairs		**42.55**	**Tons/Year**

V.A.3 Evaluation Criterion C: Benefits to Endangered Species

The proposed project will include a service lateral to supply water to Resaca del Rancho Viejo (Resaca) to maintain the current water level and maintain the surrounding habitat. This Resaca parallels the existing Lateral "J" open canal and is approximately 12 feet lower that the existing canal. Currently, a large portion of the water within the Resaca is from seepage of Lateral "J". Storm water is a limiting source of water and is not sufficient to maintain the surrounding habitat. By converting the Lateral "J" open unlined canal into a pipeline, access to majority of the Resaca's source of water will be removed. The service lateral will provide an access to irrigation water to fill the Resaca on an as-needed basis as requested by the adjacent landowners. By providing access to water in order to maintain the water levels in the adjacent Resaca, the riparian habitat can be preserved for the diverse array of birds and wildlife that live near and within the Resaca environment. In addition, the Lower Rio Grande Valley National Wildlife Refuge is only 4.3 downstream on Resaca del Rancho Viejo (2.5 miles direct route). This Refuge provides habitat for 19 threatened and endangered species including two federally listed endangered species; the Ocelot and Jaguarundi. As stated on the "Gulf Coast Jaguarundi Recovery Plan, First Revision," U.S Fish and Wildlife Service; December, 2013, the Jaguarundi's main diet consist of riparian birds, small mammals and reptiles that are part of the resacas habitat (See the referenced document's coversheet and USFWS List of Endangered Species in Texas have been included in Appendix E). The resacas, while they may not be the most prevailing habitat of these two federally listed endangered species, they do function as wildlife corridors to avoid going thru urbanized areas and provide them with a vast variety of food resources. The construction of a service lateral will allow the Resaca del Rancho Viejo maintain its riparian environment, in turn nurturing a more diverse and lively environment to support the restoration of the population of these endangered cat species.

V.A.4 Evaluation Criterion D: Water Marketing

The Texas Water Development Board's Rio Grande Regional Water Planning Group (Region M) estimates population in the eight county region is expected to grow from 1.7 million in 2010 to nearly 4 million in 2060. Based on these population projections, the water supply shortage is estimated to be nearly 600,000 acre feet per year by 2060 or 35 percent over the estimated water demands. With the continual growth of the region and the increase in water demand, the market for water will continue to increase. Recent droughts and water supply shortages have only increased the demand for water to the region's water rights holders.

CCID2 actively participates in the regional water marketing through the Rio Grande Watermaster Operations. The Watermaster serves as the administrator of all 53 member entity water rights holders within the Lower Rio Grande Valley jurisdiction and manages all contracts made between users which transfer any surface water allocation between user's accounts. The 611.43 acre feet of water per year expected to be saved by this project can be marketed to other non-CCID2 agricultural or municipal users in the region if determined to be a surplus by CCID2. In addition to the conserved additional water, CCID2 diverts "No Charge" diversions or excess flows in the Rio Grande that would otherwise flow to the Gulf of Mexico. The excess flow diversions are stored in CCID2's reservoirs and made available to other users in the system by the contract sale of allocation to the other users in the Rio Grande Watermaster System.

V.A.5 Evaluation Criterion E: Other Contributions to Water Supply Sustainability

Subcriterion No. E.1 – Addressing Adaptation Strategies in a WaterSMART Basin Study

The Bureau of Reclamation completed the "Lower Rio Grande Basin Study" in 2013 for the Rio Grande Regional Water Authority (RGRWA) of which CCID2 is an active member. The Basin Study makes numerous references to the Water Management Strategies developed in the 2010 Region M Rio Grande Plan. One strategy, which is referenced in both plans, is the improvement of irrigation conveyance system conservation. This strategy, along with On-Farm Water Conservation (which will be discussed below in Section V.A.5 E.2), have the most impact on the overall conservation of water for the district and region as a whole. The replacement of Lateral "J" from open unlined canal to underground pipeline is an Irrigation Conveyance System Conservation Project which will conserve 611.43 acre feet per year. The estimated and actual water and energy conservation data will be shared for future studies and future benefits with other Basin Study Partners in the Lower Rio Grande Valley Watermaster System.

Subcriterion No. E.2 – Expediting Future On-Farm Irrigation Improvements

On-Farm Improvements are controlled by the individual land owners. However, the placement of Lateral "J" into a pipeline will increase water pressures and allow Lateral "J" landowners to install more efficient drip irrigation or lay flat irrigation poly pipe.

Subcriterion No. E.3 – Other Water Supply Sustainability Benefits

All water right holders along the Rio Grande below Amistad Dam are part of the Lower Rio Grande Valley Watermaster System. During the past several years the system has far exceeded the available water supply and the recent severe droughts have only worsened the water supply levels. In addition, the system has become more reliant on Mexico release of water from their watershed as agreed upon in the February, 1944 "Treaty between the United States of America and Mexico, Utilization of Waters of the Colorado and Tijuana Rivers and of the Rio Grande". This treaty allows Mexico to detain upstream flows and defer water releases for up to five years in the amount 350,000 acre feet per year. That results in a total impoundment of 1.75 million acre-feet of water for the five year period, or 55.1% of the total Amistad/Falcon Dam impoundment. This combined with the fact that the majority of the watershed is a semi-arid region, leads the Lower Rio Grande Valley Watermaster System very susceptible to irregular weather patterns.

The recent droughts have significantly impacted the local economy. Reports have estimated the loss of irrigation would result in an estimated loss of $394.9 million and 4,840 jobs[3] (See Appendix F). The economic effects from the reduction or loss of irrigation water directly impact the economic activity in the agricultural economy and in other non-agricultural economic areas.

All the partners in the Lower Rio Grande Valley Watermaster System know the importance of water conservation. Any water conservation benefit from this project provides direct and indirect economic benefits for CCID2 and others in the region. The 611.43 acre feet of water per year expected to be saved by this project can be marketed to other non-CCID2 agricultural or municipal users in the region. The conserved water, along with the energy savings from the reduced pumping requirements, provides an added commodity for CCID2.

V.A.6. Evaluation Criterion F: Implementation and Results

Subcriterion No. F.1 – Project Planning

1. Preliminary Planning - The Conversion of Lateral "J" from open unlined canal to a pipeline project has been identified and prioritized in past District planning efforts. CCID2 has completed several of these types of projects over the past several years to improve the overall water conveyance efficiency of the district's distribution system. CCID2's staff and operators have first-hand knowledge of the delivery inefficiencies and the structural conditions of the conveyance system. CCID2 identifies this type of project and ranks them based on the most cost effectiveness in regards to water and energy conservation to the district. Preliminary design work, including project cost estimates and preliminary water and energy savings, have already been prepared for this grant application.

2. CCID2 Planning Documents - The CCID2 has adopted a Water Conservation Plan and a Drought Contingency Plan (included in Appendix G) to ensure that water is used efficiently within the operations of the district during normal operations and during drought conditions. These plans are developed to address several strategies to decrease the overall water consumption, reducing system water conveyance losses, and improving efficiency of water use.

3. CCID2's Role in Planning Efforts – CCID2's Management plays an active role in regional and statewide planning efforts. The participation in these efforts provides the district the ability to gain knowledge from other providers with new conveyance methods, management policies, and innovative technology to improve the district's overall effectiveness and efficiency. CCID2 conforms to the goals set forth by the Rio Grande Regional Water Planning Group and the Texas Water Development Board in regards to drought response and conservation goals. All of these state and regional planning efforts recognize that pipeline conversion projects are the most cost effective method to conserve large volumes of water lost by irrigation districts in their conveyance systems.

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[3] Luis A. Ribera and Dena McCorkle, "Economic Impact Estimate of Irrigation Water shortage on the Lower Rio Grande Valley Agriculture", Texas A&M University AgriLife Extension, June, 2013

Subcriterion No. F.2 – Readiness to Proceed

The consultant will work with CCID2 to finalize the design necessary for the proposed project improvements. Preliminary design is completed and final design can be finalized within 90 days of notice of grant award. Since the proposed improvements are to be constructed within the previously disturbed areas and within the boundaries of CCID2's right-of-way, environmental compliance will be easily achieved and no project delays are expected. CCID2 and its consultant will work with private and governmental regulatory agencies during the design phase to address any environmental concerns which may arise.

Table 4 below provides the conceptual project schedule.

Table 4
Project Schedule

TASKS		MONTHS
1.0	**Design Phase (6 Months)**	
1.1	Collect Field Surveying Data	1 - 2
1.2	Finalize Design	2 - 5
1.3	Material Procurement	5 - 6
2.0	**Construction Phase (6 Months)**	
2.1	Site Clearing and Grubbing	7
2.2	Pipeline Installation	8 - 11
2.3	Tie-Ins and Misc. Improvements	11 - 12
2.4	Final Clean Up and Start Up	12
3.0	**Project Management and Reporting (12 Months)**	
3.1	Post Project Reporting and Performance	12 - 23
3.2	Final Report	24

The construction of the proposed improvements will be conducted by CCID2 Staff. The construction phase of the project will be limited to the months whereby the irrigation demand is reduced. This is not anticipated to affect the completion schedule. In reference to the above schedule, preliminary clearing and final clean up tasks can be conducted before and after the pipeline is placed into service thus reducing the time that irrigation will be interrupted.

Subcriterion No. F.3 – Performance Measures

Upon completion of the proposed improvements, CCID2 will install temporary flow metering devices at Lateral "J" influent canal gate structure and at individual customer's outlet structures. Water losses will be determined by subtracting the influent measurements with the delivered water and pipe volumes. Energy conservation measurements will be calculated by using the same "Average Energy per Acre Foot Pumped" factor shown in Table 2 in comparison to the measured water volume savings determine the flow monitoring for the Lateral "J". CCID2 and the consultant will prepare a final report, for submittal to the Bureau of Reclamation, on the findings of the water conservation measures resulting from the proposed improvements included in this project.

Subcriterion No. F.4 – Reasonableness of Costs

Assuming a design life of 50 years, typical for PVC pipelines, the Reasonableness of Costs is the project construction costs divided by the savings of 611.43 acre feet per year and the design life of 50 years equals a cost of $18.88 per acre feet/year. Adding in the present value of the costs savings associated with the reduction in pump electrical usage, $3,692 per year, considering a rate return of 2%, reduces the capital cost to $461,218 resulting in reasonableness of cost of $15.09/acre feet/year. Table 5 shows the calculation of the Reasonableness of Cost.

Table 5 Reasonableness of Costs		
Overall Project Costs	$577,303	
Project Design Life	50	Years
Total Volume Conserved	611.43	Acre Feet/Year
Reasonableness of Costs	$18.88	Acre Feet/Year
Annual Energy Conserved	24,610	Kwh/Year
Energy Unit Costs	$0.15	Kwh
Annual Cost Savings	$3,692	per Year
Present Worth of Energy Conserved		
(2% for 50 Years)	$116,085	
Energy Costs Savings (Present Worth)	$3.80	
TOTAL REASONABLENESS OF COST (LESS ENERGY SAVINGS)	**$15.09**	**Acre Feet/Year**

V.A.7 Evaluation Criterion G: Additional Non-Federal Funding

CCID2 is seeking federal grant funds of $288,652 and the remaining funds for the project will be provided by CCID2. With a total project cost of $577,303, the Non-Federal funding percentage is 50.0 percent.

V.A.8 Evaluation Criterion H: Connection to Reclamation Project Activities

The Bureau of Reclamation has funded numerous projects in the Lower Rio Grande Valley for several irrigation and municipal entities. All the projects directly and indirectly affect water conservation for the entire basin which transfers to benefits to all users in the Lower Rio Grande Valley Watermaster System. CCID2 experience with previously funded Bureau of Reclamation projects is listed in Section IV.D.4.2 of this report.

The Lower Rio Grande Basin Study was completed by the Bureau of Reclamation in December, 2013. The report was completed in partnership with the Rio Grande Regional Water Authority, including its 53 entities committee, the TCEQ Region M Planning Group, the Texas Commission on Environmental Quality, the Texas Water Development Board, and the International Boundary and Water Commission. The study evaluated future water demands, future water supply, weather inconsistencies and other factors impacting the supply and demand for water in the Lower Rio Grande Basin. The Rio Grande Regional Water Authority is made up of eight counties including Hidalgo, Willacy and Cameron Counties. CCID2 is an active member of the Rio Grande Regional Water Authority.

IV.D.5 Performance Measures

From section V.A.1 of this report, as per the Texas A&M Department of Agricultural Engineering, "Irrigation District Efficiencies and Potential Water Savings in the Lower Rio Grande Valley of Texas", Guy Fipps, and Craig Pope; seepage rates were based on typical canal soils as shown in the USDA Soil Survey for Cameron County. Typical soils encountered in this project area soil are Laredo Silty Clay Loam with an estimated seepage rate of 2.24 gallons per square foot per day. Evaporation was estimated utilizing the "Report 316 Evaluation of Ground-Water Resources in the Lower Rio Grande Valley", by the Texas Water Development Board, 1990. Using the above reference guidelines, the proposed pipe improvements will conserve approximately 611.43 acre feet per year. At the beginning of the project, these figures will be compared to field measurements to determine the accuracy of the estimated water conserved.

Upon completion of the proposed improvements, CCID2 will install temporary flow metering devices at Lateral "J" influent canal gate structure and at individual customer's outlet structures. Water seepage and evaporation losses will be determine by subtracting the influent measurements with the delivered water and pipe volumes. CCID2 and the consultant will prepare a final report, for submittal to the Bureau of Reclamation, on the findings of the water conservation measures resulting from the proposed improvements included in this project.

IV.D.6 Environmental and Cultural Resources Compliance

The proposed project will be constructed by CCID2 staff. Staff will be instructed to minimize impacts to local environmental sensitive areas and adjacent landowners. All proposed improvements are to be constructed with in the CCID2 existing right-of-way (ROW) which has been previously disturbed. To protect against any environmental damages, CCID2 will coordinate with Federal, State and Local regulatory agencies to ensure all required environmental regulations are followed.

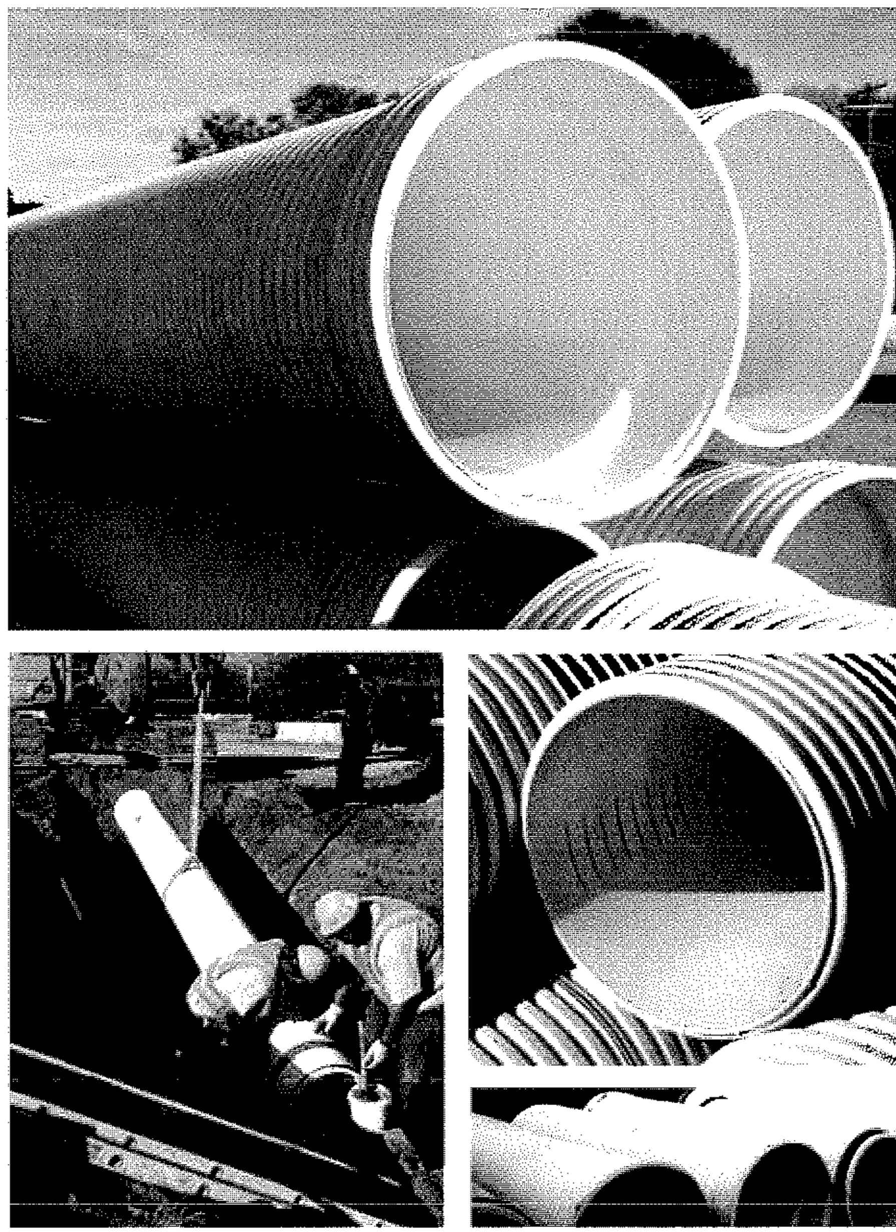
1. Since the project will include soil excavation, the creation of dust is a strong possibility. CCID2 crews will sprinkle water to control dust creation during construction.
2. The current irrigation canal is routinely maintained by CCID2 maintenance crews and doesn't provide sufficient habitat for endangered species. The area is not designated as a protected habitat by the US Fish and Wildlife Service. In any case, CCID2 will work with all Federal, State and Local regulatory agencies to ensure the project follows any required federal environmental regulations.
3. The project area is not designated as a protected wetland by the US Army Corps of Engineers. The Corps of Engineers does not regulate irrigation canals and drainage ditches.
4. Portions of the CCID2 water conveyance system was constructed 1903.
5. The project proposes to connect to an existing influent control structure and service laterals to adjacent farm land. These features were constructed, modified and improved on an as-needed basis over the last 60 years.
6. CCID2 doesn't own any structures that may qualify for the National Register of Historic Places. The Environmental Compliance Report will coordinate with the Texas State Historical Preservation Office for approval prior to the commencement of the construction work.

List of Appendices

Appendix A
Contech Engineering Solutions A-2000 PVC and Diamond Plastics Pro-21 PVC

CONTECH®
ENGINEERED SOLUTIONS

A-2000™ PVC Pipe for Storm Sewers and Drainage



Selecting Performance Storm Sewers and Drainage Systems

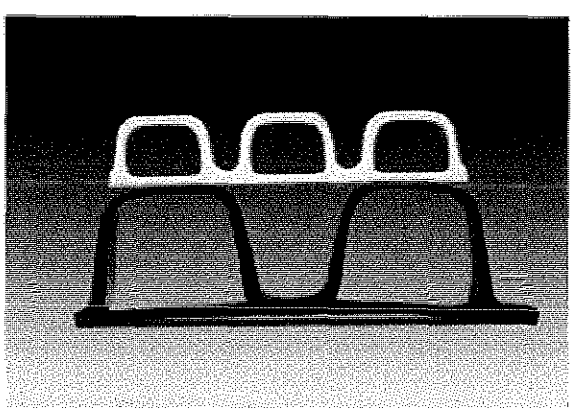
Drainage systems are required to meet multiple criteria. The choice of a particular material depends upon a number of factors; however, the best choice is the one that yields the best performance over the project life cycle.

Thermoplastic Storm Sewer and Drainage Pipe

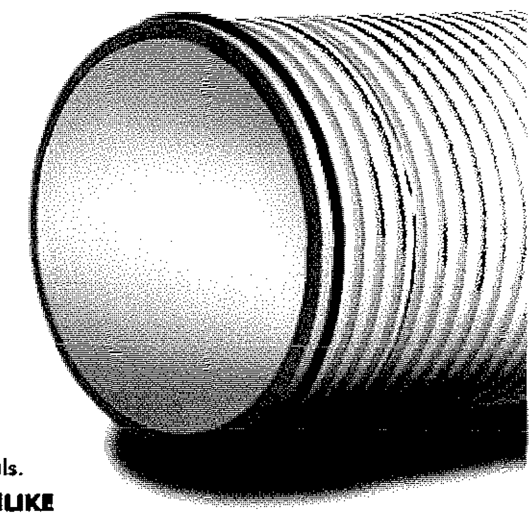
In recent years, the use of thermoplastic pipe for stormwater drainage systems has gained wide acceptance—based upon performance and economic advantages when contrasted with more conventional drainage pipe materials. **However, when it comes to performance, not all thermoplastic storm sewer pipes are equal.** There are distinct differences between A-2000 Polyvinyl Chloride (PVC) drainage pipe and other drainage pipes that can affect overall pipe system performance.

Contech® A-2000 PVC Drainage Pipe: Available in Diameters 4"-36" and 14' or 22' lengths.

Originally developed in the early 1980's, A-2000 has built an outstanding performance history that's setting the standard for gravity flow, sanitary sewer applications. The material advantages offered by PVC—plus the innovative, double wall design with the unique, patented gasketed joint system—makes A-2000 the ideal choice for stormwater drainage systems. Now you can have all of the advantages without the limitations of HDPE or reinforced concrete pipe.



Compact A-2000 PVC profile is stable and not subject to local buckling like HDPE.



Strength

A-2000's PVC compound provides **6 times** greater long-term material stiffness as compared to HDPE drainage pipe materials. And A-2000 pipe, **UNLIKE** HDPE drainage pipe, has a minimum 46 pipe stiffness for **ALL** diameters.

Minimum Specified Pipe Stiffness (73°)*

Pipe Diameter	PVC ASTM F949	HDPE AASHTO M294
12	46	50
15	46	42
18	46	40
24	46	34
30	46	28
36	46	22

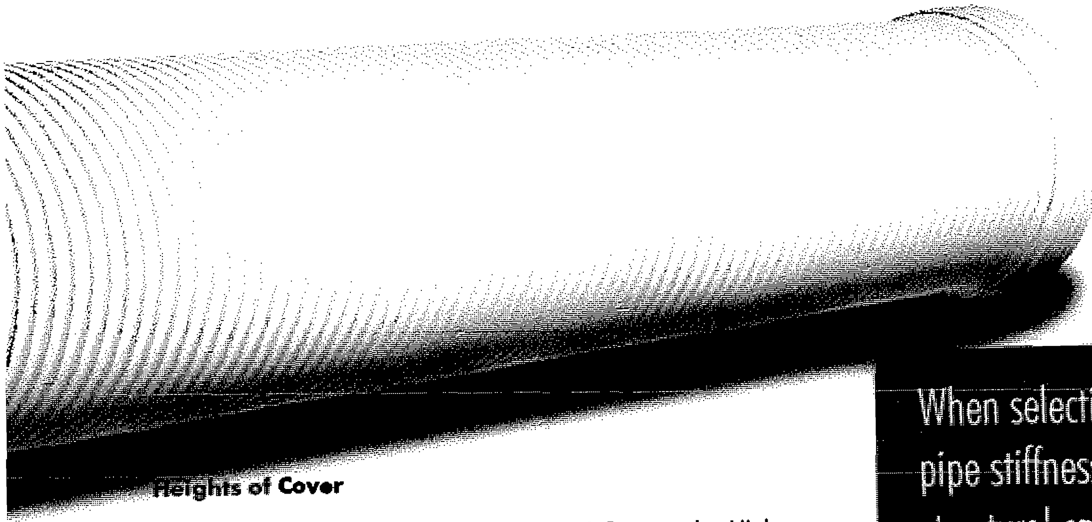
**Actual A-2000 pipe stiffness values are 50 psi*

Better deflection control

When compared to other thermoplastic pipes on the market, A-2000 stands up to the test. In fact, it comes out on top.

When installed in accordance with ASTM D2321, A-2000 provides excellent shape control (performance).

The difference between effective pipe stiffness of A-2000 and HDPE drainage pipe during construction on a summer day can result in A-2000 being as much as **3 TIMES STIFFER.** This significant stiffness advantage, combined with PVC's lower strain sensitivity and temperature sensitivity, means A-2000 can be installed with conventional flexible pipe practice and not experience excessive shape distortions.

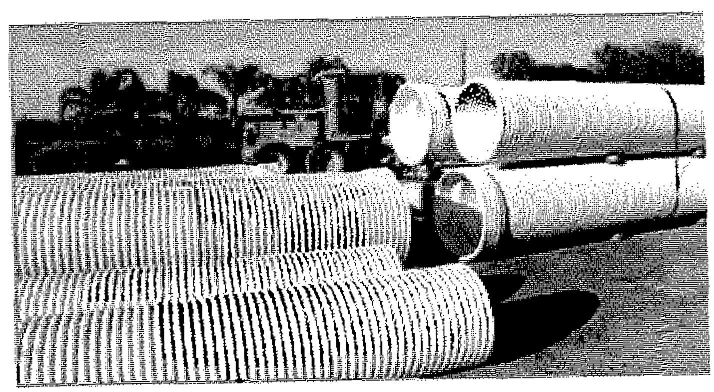


Heights of Cover

Based on research done under the National Cooperative Highway Research Program, AASHTO has revised its plastic pipe design methods. AASHTO designs now include wall profile stability, soil arching and deflection as design considerations. Unstable wall profiles fail by local buckling rather than by ring compression or ring buckling. This research demonstrates that the A-2000 profile is stable while others, like those used for HDPE M294 pipe, are not.

A-2000 PVC pipe can be used with 1 foot of cover under highway loading. Current AASHTO LRFD Design Methodology has required all thermoplastic pipes to have a minimum height of cover of 2 feet under pavement. This requirement was derived from a Minnesota DOT Research Report (2005) that studied HDPE pipe performance under highway loading. The report indicates significant thermal expansion of HDPE pipe under shallow fills. PVC pipe was not incorporated in this study, and it should be noted that HDPE experiences four times more thermal expansion than PVC.

When selecting a system based on pipe stiffness, material strength and structural capability, A-2000 PVC far exceeds the performance characteristics of HDPE drainage pipe.



A comparison of cover heights using AASHTO design methodology and H20 live loading for A-2000 and a major manufacturer's M294 HDPE pipe are summarized below.

A-2000 vs. M294 HDPE (AASHTO Heights of Cover)

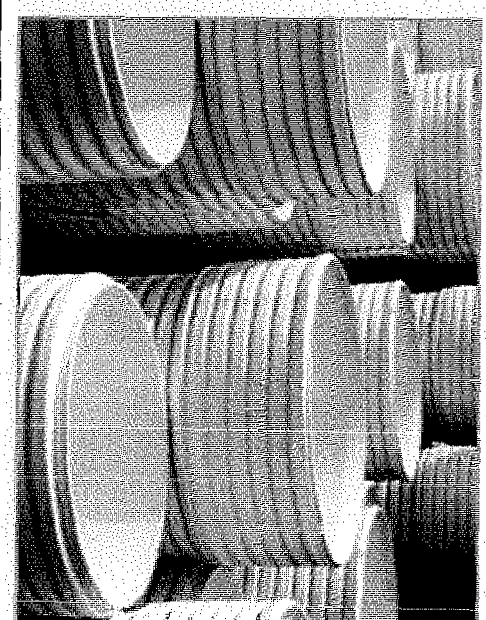
Pipe Type/Specification	Allowable Height of Cover	Allowable Structural Backfill	Min. Compaction	Min. Trench
PVC A-2000 - ASTM F949	2'-20'	A-1-a, A-1-b, A-3, A-2-4, A-2-5	90%	1.5 X O.D. + 12"
	21'-35'	A-1-a, A-1-b, A-3	95%	1.5 X O.D. + 12"
Corrugated HDPE - AASHTO M294	2'-10'	A1-a, A1-b, A-3	95%	O.D. + 36"
	11'-20'	A-1-a	95%	2.0 x O.D.
	21'-35'	Not Allowed		

Durability, Service Life

PVC materials used in the manufacture of gravity flow pipe offer excellent resistance to conventional corrosion and abrasion. In fact, profile wall PVC pipe has been shown to have better abrasion resistance than reinforced concrete pipe in side-by-side laboratory testing at California State University.

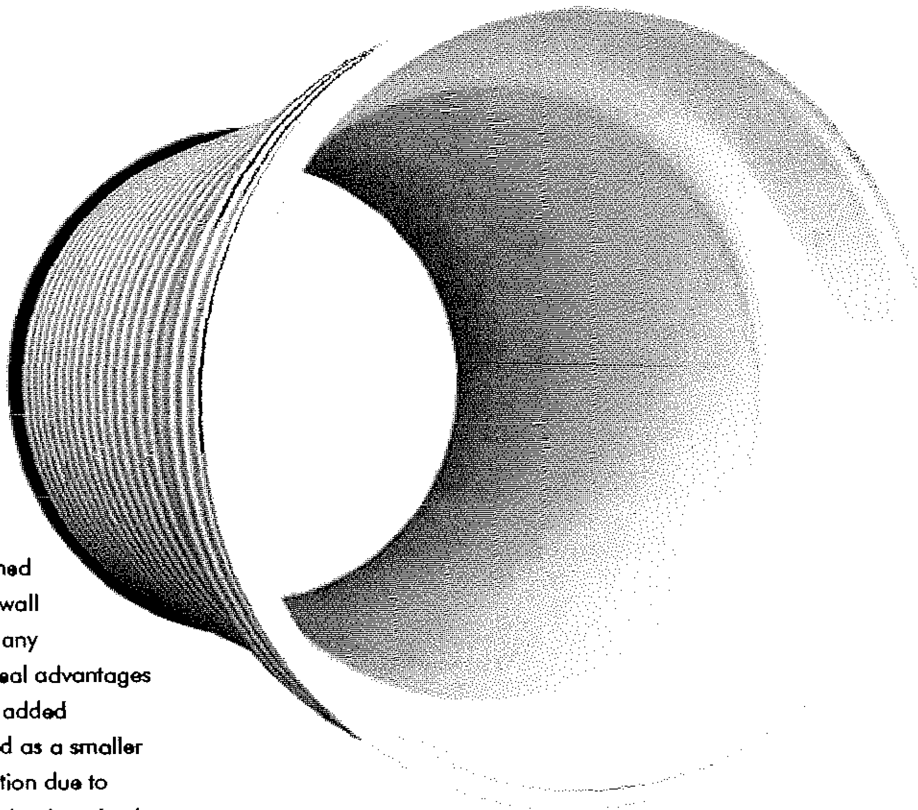
PVC and HDPE do **not** provide equal long-term durability performance. Under loading or localized tensile stress, some grades of HDPE are subject to environmental stress cracking—also known as slow crack growth. Exhibited as premature rupture, this phenomenon can occur when stressed HDPE plastics are attacked by a reagent (even storm runoff) that causes cracking or rupture at stress levels well below design performance expectations.

PVC pipe is not threatened by this type of cracking. When you consider durability and service life, A-2000 PVC far exceeds the performance characteristics of HDPE drainage pipe. (See the National Cooperative Highway Research Program study conducted by Drexel University, March, 1999: "HDPE Pipe: Recommended Material Specifications and Design Requirements".)



Contech A-2000 PVC far exceeds the durability and service life of HDPE drainage pipe.

Hydraulic Efficiency



A-2000 vs. Concrete Pipe

Thermoplastic pipes, with smoother interiors and fewer joints, reduce resistance to flow and are hydraulically more efficient than conventional (i.e., RCP) storm drainage pipe materials. Flow testing conducted in 2002 by the Utah Water Research Laboratory concluded

A-2000 PVC Pipe, with its inner wall formed over a polished mandrel, has the lowest wall friction factor (Manning's "n" = .009) of any thermoplastic pipe available and offers real advantages compared to RCP (n = .012- .013). This added efficiency means A-2000 can be designed as a smaller and less expensive pipe, with less excavation due to flatter pipe slopes and less manhole/junction box depth requirements.

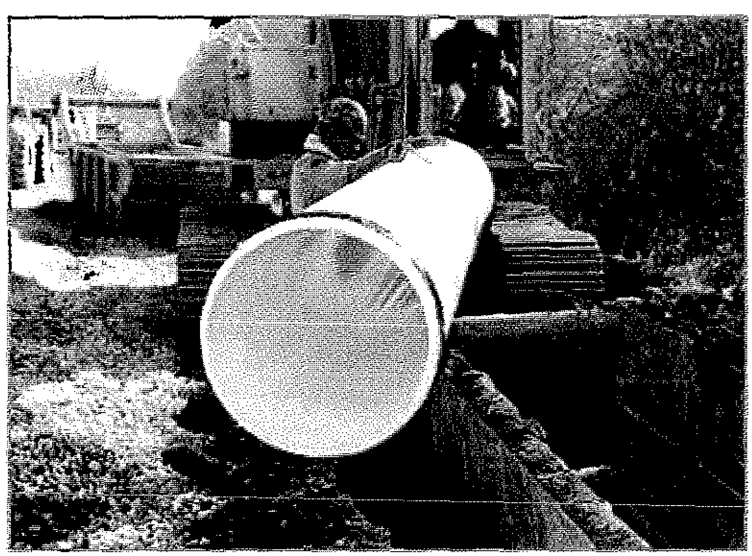
A-2000 vs. HDPE Pipe

Hydraulic tests performed at a major United States Water Research Laboratory led researchers to conclude that HDPE drainage pipe's "n" factor varied "depending upon the smoothness of the liners" and "the bonding of the liner to the corrugations made the pipe interior somewhat wavy." Once installed, HDPE pipe walls are subject to local buckling (NCHRP Report 438) and the measured waviness increases with load. Using the method derived to estimate the effective Manning's "n" factor, Manning's "n" values of 0.017-0.022 provide a more accurate representation of HDPE's hydraulic efficiency when in-service and under load.

A-2000 PVC pipe, with its engineered, stable profile, is designed to **NOT** buckle.

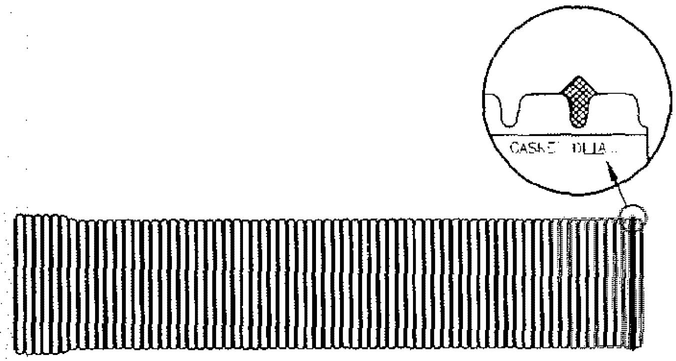
When you're selecting a system based on hydraulic efficiency, A-2000 PVC pipe far exceeds the performance limitations of HDPE and RCP drainage pipe.

A-2000 PVC has a smooth, glossy interior for uninterrupted flow.



The Need for Tight Joints

Storm sewers have always presented special needs for tight jointing systems. Because of their function, they are subject to rapidly changing flow levels. The sudden rise and fall of flow levels leaves storm sewers susceptible to backfill migration into the sewer unless tight joints are used. This loss of backfill reduces the soil support of the pipe and causes settlement at the surface. Where storm sewers are below the existing water table, water tight joints are needed to prevent infiltration and maintain storm sewer capacity.



A-2000's long, 22-feet lengths and soil/water tight joints clearly make it the preferred choice with regard to system tightness. In comparison, RCP has many joints—increasing the opportunity for soil infiltration and settlement. And with A-2000 you don't have to specify special jointing requirements. Watertight gasketed joints are standard with A-2000.

Handling and Installation

A-2000's easy handling weight and the availability of up to 22-feet lay lengths often result in reduced labor costs and more economical installation. Compared to heavy-weight and short-length RCP, A-2000 can be installed with greater ease and lower cost. And contrasted to HDPE, A-2000 has added beam strength—which means better line and grade control, increasing crew efficiency. Plus, A-2000 requires less trench width, lowering excavation costs and speeding installation.

The Performance Choice

With the increasing demands on our drainage and storm sewer systems, products designed and proven to provide the best performance over the project life cycle are needed. A-2000 PVC drainage pipe offers all of the initial cost advantages associated with thermoplastic pipe when compared with RCP but without the performance limitations of HDPE drainage pipe. There's no reason to compromise on performance—**Select A-2000 PVC: The Best Storm Sewer and Drainage Pipe on the Planet.**

Contech's A-2000 is lightweight and easy to handle.

Best Pipe on the Planet

Additional A-2000 Products and Applications

A-2000 for Roof Drainage Systems

Managing large volumes of stormwater runoff from roof areas of industrial, commercial and warehouse facilities is more demanding than for most gravity-fed sewer systems. Additionally, intense rainfalls, combined with added building height, can create hydrostatic pressures within the pipe as well as on the joints and other system components. To handle these requirements, you need the higher strength and joint tightness of A-2000 PVC drainage pipe. Contech's full line of readily-available adapters and fittings makes connecting downspouts and laterals simple. Because of the unique gasket and bell design, there is no field beveling required.

A2™ Liner Pipe for Trenchless Rehabilitation

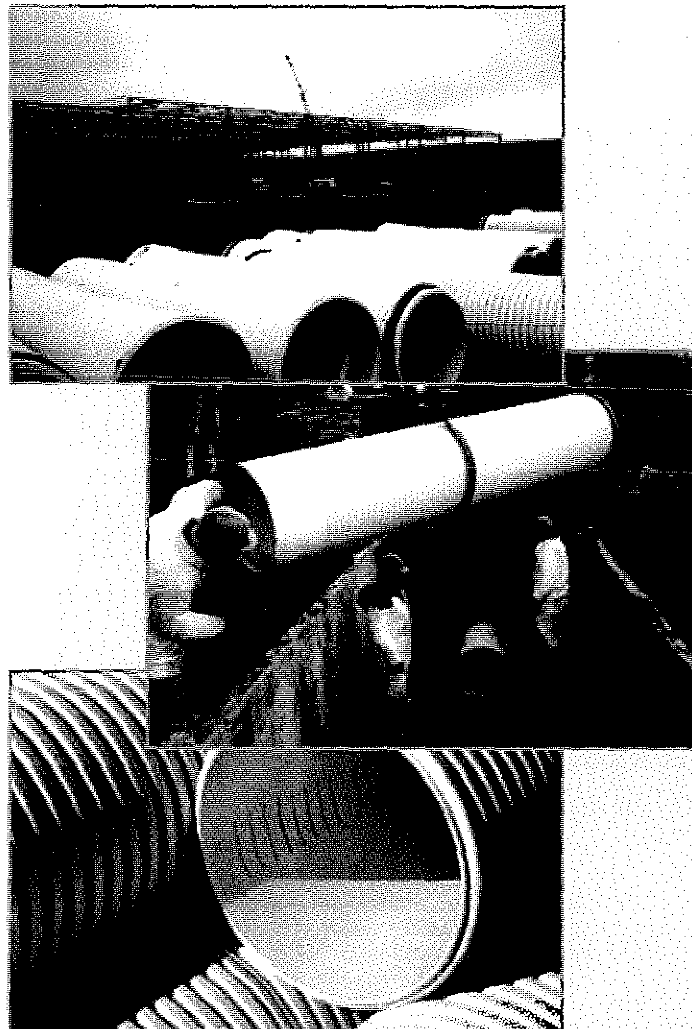
Renew the performance of your aging underground infrastructure with A2 Liner Pipe—the proven, trenchless solution to sliplining existing sewers and culverts. Using the double wall A-2000 design, Contech developed A2 Liner Pipe for sliplining deteriorating pipelines where open trenching is not practical or desirable. You can install A2 Liner Pipe in diameters ranging from 12"-36" and in lengths from 2.5' to 20'—speeding installation. And because of its light weight, you can use smaller, less expensive equipment for installation—reducing costs.

A-2000 Perforated Pipe for Subdrainage Systems

Contech A-2000 offers several critical features and benefits that make it the performance choice for subsurface drainage systems:

- 46 psi pipe stiffness for structural stability and improved deflection control.
- Glossy smooth interior for improved hydraulic capacity.
- PVC rigidity that provides essential beam strength for improved line and grade control during installation.
- Positive-gasketed jointing system.

Standard perforations for 4"-18" diameters are slots, while perforations for pipe sizes 21"-36" are circular $^{3}/_{8}$" diameter (.375") holes. Fully perforated A-2000 is also available for even greater open area.



Perforation Dimensions

Pipe Size (in)	Slot Dimension/Hole Size (in) (min)	Centers (in)	Perforation Open Area (in²/LF)
4	1.062L x 0.031W	[illegible]	1.98
6	1.375L x 0.031W	0.52	1.98
8	1.750L x 0.031W	[illegible]	1.98
10	2.187L x 0.031W	0.83	1.98
12	1.687L x 0.051W	1.05	2.20
15	1.250L x 0.051W	1.38	2.00
18	0.750L x 0.051W	1.38	2.00
21	0.375 Diameter	1.60	2.30
24	0.375 Diameter	1.90	2.30
30	0.375 Diameter	2.32	2.20
36	0.375 Diameter	[illegible]	[illegible]

Specifications

Constant Stiffness Thermoplastic Pipe

1.0 PIPE: Polyvinyl Chloride (PVC) storm sewer/drain pipe and fittings shall be manufactured and tested in accordance with ASTM F949.

2.0 MATERIAL AND DESIGN: The structural design of thermoplastic pipes shall be in accordance with AASHTO LRFD titled: "Buried Structures and Tunnel Liners." To ensure long-term design strength properties, PVC pipe shall be manufactured from 12454 cell class material per ASTM D1784. Pipe and fittings shall have a minimum pipe stiffness of 46 lbs./in./in., when tested in accordance with ASTM D2412.

3.0 JOINING SYSTEM: Joints shall be an integral bell-gasketed joint. When the joint is assembled, it shall prevent misalignment of adjacent pipes and form either a soil tight joint (2 psi hydrostatic test per AASHTO Standard Specification for Highway Bridges) or a watertight joint (10.8 psi test per ASTM D3212 titled: "Standard Specification for Joints for Drain and Sewer Plastic Pipes using Flexible Elastomeric Seals') as required.

4.0 HYDRAULICS CAPACITY: The PVC Pipe covered in this section shall provide a Manning's "n" value of .009.

5.0 INSTALLATION: Thermoplastic pipe and fittings shall be installed in strict accordance with AASHTO Thermoplastic Specifications.

A2000 Drainage PDF 10/13 MC

RECYCLED PAPER

CONTECH
ENGINEERED SOLUTIONS

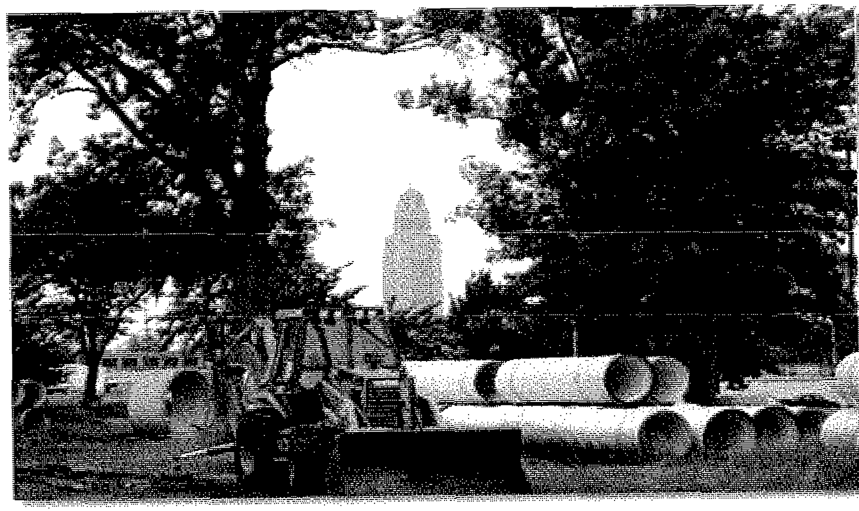
Pro-21™
SPECIFICATION DATA

PROFILE PIPE FOR THE 21st CENTURY

PRO-21™ SPECIFICATION DATA

Diamond "PRO-21" closed profile pipe is produced by extruding an "I-beam" type profile that is in turn wrapped onto a circular mandrel providing a continuous tube with a helical heat welded seam. The result is a pipe of solid wall appearance from the inside and outside which has the structural advantages of the "honeycomb or I-beam" construction internal to the pipe wall itself.
This results in a product which meets the performance requirements of a solid wall while providing the advantage of lighter weight. Diamond "PRO-21" meets all requirements of ASTM F1803.

Diamond's Closed Profile Pipe is made with PVC compounds that meet the requirements for cell class 12364 as described in ASTM D1784.
Integral bell sockets meet the requirements of ASTM D3212. Pipe gaskets meet the requirements of ASTM F477.



SHORT FORM **Specification for PVC Sewer Pipe**
Pro-21 PVC Gravity Sewer and Drain Pipe Sizes 30" - 60"
All sanitary sewer and storm drain pipe shall be Diamond Plastics Pro-21 PVC profile wall sewer pipe made of compounds meeting the minimum cell classification of 12364 as defined in ASTM D1784 and manufactured in accordance with ASTM F 1803. It shall have a smooth interior and exterior. It shall have a gasket with four sealing fins and a resilient wedge bevel. The joint shall meet all the requirements of ASTM D3212. The joint shall meet an allowable infiltration of 25 gallons per inch of internal diameter per mile per day or less. All PVC sewer pipe shall be installed in accordance with ASTM D2321, Uni-Bell's Uni-Pub 6 and the manufacturer's recommendations.

PRO-21 is supplied in 14 foot laying lengths.

PRO-21™ SPECIFICATION DATA

Nominal Pipe Size in. (mm)	Average Outside Diameter Inches	Bell Outside Diameter Inches	Minimum Inside Diameter Inches
Pipe Dimensions			
30" (750)	31.606	35"	29.410
33" (825)	35.036	38-1/2"	32.405
36" (900)	38.036	41-3/4"	35.395
42" (1050)	44.200	48-1/2"	41.375
48" (1200)	50.570	55"	47.360
54" (1350)	57.100	61-1/2"	53.350
60" (1500)	63.932	69-1/2"	59.340

Prices are subject to a firm policy of "Price in effect at time of shipment on regular purchases"

DIAMOND PLASTICS® CORPORATION

Corporate Headquarters • 1212 Johnstown Road • P.O.Box 1608 • Grand Island, NE 68802-1608

Appendix B

"Irrigation District Efficiencies and Potential Water Savings in the Lower Rio Grande Valley of Texas", Guy Fipps, and Craig Pope

"Report 316 Evaluation of Ground-Water Resources in the Lower Rio Grande Valley", by the Texas Water Development Board, 1990

Irrigation District Efficiencies and Potential Water Savings in the Lower Rio Grande Valley of Texas

*Guy Fipps and Craig Pope*1

Abstract

Agriculture holds about 90 percent of all the water rights in the Lower Rio Grande Valley. Rapidly growing municipalities and industries are focusing the need to free up water for transfer from agriculture. This paper will give the results of an analysis of the 28 irrigation districts including their current efficiencies and opportunities for water savings. The analysis is based on reported efficiencies of each district, GIS-based maps and databases of district infrastructure, measurement of canal seepage losses, accounting systems, etc. Preliminary analysis indicate a potential water savings of 54,000 to 223,000 ac-ft/yr could result from improvements in the conveyance efficiency of 28 districts through renovations such as canal lining and pipeline replacement. Implementing a combination of on-farm practices of metering, gated pipe water delivery, and improved water management and/or technology could result in a water savings of between 98,000 and 217,000 ac-ft/yr.

Background

The Lower Rio Grande Valley in Texas is located at the south most tip of the state at the end of the Rio Grande River. About 98% of all the water used in the Lower Rio Grande Valley, in both Texas and Mexico, is from the Rio Grande River. The region is undergoing rapid population and industrial growth. The Texas Water Development Board projects that by the year 2050, the population in the Valley will more than double, and municipal and industrial water demand will increase by 171% and 48%, respectively.

The lower Rio Grande River is over appropriated; that is, there are more water right permits than firm yield. Agriculture holds about 90% of the water rights and, depending on the year, accounts for about 80% of total withdrawals from the river. Thus, water to meet future demand will likely come from agriculture. The purpose of this study is to determine how much water could be "freed-up" by making improvement in the irrigation systems of the region.

In 1998, the area conducted an Integrated Water Resources Planning (IWRP) effort to identify water needs and sources over the 50 year period 2000 - 2050. This paper summarizes the protion of the project that examined potential water savings in irrigation districts and on-farm irrigation.

Description of the Irrigation Districts

This study examines 28 water districts in Hidalgo, Cameron and Willacy Counties. These districts hold authorized agricultural water rights totaling 1,468,314 ac-ft (Table 1). Based on water rights holdings, the districts vary greatly in size, with the smallest district having 625 ac-ft of water rights and the largest district 174,776 ac-ft. Generally, these districts classify their water distribution networks into two categories: the "mains" and "laterals." The total miles of canals, pipeline and resacas comprising the main irrigation water distribution networks are summarized in Tables 2 and 3. Table 2 lists the total miles of the main canals by size (based on top width) and lining status. Table 3 provides the overall summary the extent of the main distribution networks which include 641.9 miles of canals, 9.7 miles of pipelines, and 44.6 miles of resacas.

Seepage and Conveyance Losses

We conducted a review of the scientific literature on canal seepage losses and improvements in district efficiencies from rehabilitation projects. We only found a few articles that reported seepage rates for different lining materials and soil types. Seepage rates from these studies are summarized in Tables 4 and 5. Table 5 is of particular interest and gives seepage rates measured in five irrigation districts in South Texas, including the United and San Benito Irrigation Districts. Details of the literature search will be given in a later report.

We measured seepage losses in five canals and one pipeline network using the ponding method. This testing was conducted in and with assistance from four districts. The results of the ponding tests are summarized in Table 6. The three lined canals had very high seepage loss rates compared to the scientific literature, indicating problems with their construction or maintenance. The seepage rates of the two unlined canals fell in the ranges reported in the scientific literature. The pipeline network measurements took place in the Brownsville Irrigation District and showed very little seepage during the 24 hour test.

The term *conveyance efficiency* (or *water duty*) is a measurement of all the losses in an irrigation distribution system from the river (or diversion point) to the field. Conveyance efficiency is calculated from the total amount of water diverted in order to supply a specific amount of water to a field (usually 6 inches). Conveyance efficiency is expressed as efficiency, the percent of water lost, or amount of water pumped (in feet). For example, District A must pump 8 inches from the river in order to deliver 6 inches to the field. District A's losses can be expressed as a:

- conveyance efficiency of 75%,
- water duty of 25%, or
- water duty of 0.67 ft.

Table 1. The official and common names of 28 irrigation and water supply districts in the Lower Rio Grande Valley and their authorized agricultural water rights.

Official Name	Common Name	Authorized Water Right (ac-ft)
Adams Gardens Irrigation District No. 19	Adams Garden	18,737
Bayview Irrigation District No. 11	Bayview	17,978
Brownsville Irrigation and Drainage District No. 5	Brownsville	34,876
Cameron County Irrigation District No. 3	La Feria	75,626
Cameron County Irrigation District No. 4	Santa Maria	10,182
Cameron County Irrigation District No. 6	Los Fresnos	52,142
Cameron County Water Improvement District No. 10	Rutherford-Harding	10,213
Cameron County Water Improvement	Cameron	3,913

District No. 16	#16	
Cameron County Water Improvement District No. 17	Cameron #17	625
Cameron County Water Improvement District No. 2	San Benito	151,941
Delta Lake Irrigation District	Delta Lake	174,776
Donna Irrigation District Hidalgo County No. 1	Donna	94,063
Engleman Irrigation District	Engleman	20,031
Harlingen Irrigation District No. 1	Harlingen	98,233
Hidalgo and Cameron Counties Irrigation District No. 9	Mercedes	177,151
Hidalgo County Improvement District No. 19	Sharyland	11,777
Hidalgo County Irrigation District No. 1	Edinburg	85,615
Hidalgo County Irrigation District No. 2	San Juan	147,675
Hidalgo County Water Irrigation District No. 3	McAllen #3	9,752
Hidalgo County Irrigation District No. 5	Progreso	14,234
Hidalgo County Irrigation District No. 6	Mission #6	42,545
Hidalgo County Irrigation District No. 16	Mission #16	30,749
Hidalgo County Irrigation District No. 13	Baptist Seminary	4,856
Hidalgo County Water Control and Irrigation District No. 18	Monte Grande	5,505
Hidalgo County Municipal Utility District No. 1	MUD	1,120
Santa Cruz Irrigation District No. 15	Santa Cruz	82,008
United Irrigation District of Hidalgo County	United	69,491
Valley Acres Water District	Valley Acres	22,500
		TOTAL 1,468,314

Table 2. Canal sizes and lining material for the main irrigation water distribution networks.

Top Width (feet)	Canal Type (or lining material, miles)	
	concrete	earth
< 10	41.6	1.0
10 - 20	98.0	11.9
20 - 30	25.2	52.2
30 - 40	3.8	35.1
40 - 50	1.1	60.1
50 - 75	1.4	30.9
75 - 100	0	11.1
> 100	0	9.7
Unknown Widths	99	134.5
Total Miles	270.1	346.4

Table 3. Miles of canals, pipelines and resacas for the main irrigation water distribution networks as shown on the Regional GIS Map (Fig. 1).

canals (miles)	pipelines (miles)	resacas (miles)	unknown (miles)	total (miles)
641.9	9.7	44.6	0.1	696.3

Conveyance loss includes a number of factors besides seepage and evaporation. Table 7 shows my classification system for conveyance losses which is composed of Transportation, Accounting, and Operational losses. The conveyance efficiencies as reported to us by 19 districts are listed in Table 8. The remaining 9 districts did not respond to survey and telephone requests for this information. The highest efficiencies are reported in smaller districts with extensive pipeline systems, while the lowest efficiencies are in larger districts which have undergone little rehabilitation. It should be pointed out that most districts do not have good data on their current conveyance efficiencies, and more work is needed to quantify these losses in order to target renovation programs.

We looked at the difference between the existing conveyance efficiencies and the efficiencies that which could reasonably be achieved by the districts through renovation projects. . For the present analysis, we assumed that an efficiency of 80 to 90% was obtainable for most districts. Starting with the conveyance efficiency estimates provided by the 19 districts (Table 8), we calculated the potential water savings if all districts were brought up to 80 and 90% conveyance efficiency. For the 9 districts not reporting efficiencies, we assumed a present value of 75%. **The total potential water savings from conveyance efficiency improvement for all districts is 54,000 to 223,000 ac-ft/yr.**

Water saving potentials were computed for low water use years and high water use years. A low water use year is defined as diversion of 35% of the authorized water right and a high water use year as 80%. Since water-short districts use a higher percentage of their water rights, 45 and 90% were used for low and high water use years, respectively. These portions are based on an analysis of water diversions by each district during the period 1989 - 1997.

There is some question about the accuracy of the basic information used to estimate conveyance efficiency, particularly:

1) the amount of water pumped or diverted into the system, and

2) the actual amount of water delivered to the field.

The doppler flow meters currently used at many river pumping plants were "calibrated" for each site based on estimates of the current pumping rates and/or pumping plant capacity, and on engine/motor and pump performance. Due to the physical layout of the pumping plants, it is difficult to independently verify these rates. Likewise, little metering is done at the field turn-out, and the amount delivered is also an estimate in most districts.

Table 4. Canal seepage rates reported in published studies.

Lining/Soil Type	Seepage Rate (gal/ft^2 /day)
plastic	0.08 - 3.74
concrete	0.06 - 3.22
gunite	0.06 - 0.94
compacted earth	0.07 - 0.6
clay	0.37 - 2.99
loam	4.49 - 7.48
sand	9.34 - 19.45

Sources: Bureau of Reclamation (1963); Nofziger, D.L. 1979. The influence of canal seepage on groundwater in Lugert Lake irrigation area. Oklahoma Water Resources Research Institute, OSU.

Table 5. Canal seepage rates reported in the Lower Rio Grande Valley.

Soil Type	Seepage Loss Rate (gal/ft^2 /day)
clay	1.5
silty clay loam	2.24
clay loam	2.99
silt loam earth	4.49
loam	7.48
fine sandy loam	9.35
sandy loam	11.22

Source: Texas Board of Water Engineers. 1946. Seepage Losses from Canals in Texas, Austin. July 1.

Table 6. Seepage rates measured by the DMS Team in 5 irrigation canals in

the Lower Rio Grande Valley.

Test #	Canal Type	Top Width (ft)	Length (ft)	Seepage Rate (gal/ft^2 /day)	Total Loss in Canal (ac-ft/mile)	
					per day	per year*
1	concrete	19	2557	4.28	0.81	243
2	earth (clay)	38	3342	1.62	0.82	246
3	earth (sandy clay loam)	45	6336	1.69	1.05	315
4	concrete	12	2583	2.12	0.20	60
5	concrete	12.5	9525	2.49	0.25	75

*based on 300 days per year.

Table 7. Classification of the sources of water loss in irrigation districts.

Transportation	Accounting	Operation
seepage in main, unlined canals	accuracy of field-level deliveries (estimates of canal riders/irrigators)	charging empty pipelines and canals
seepage in secondary territory unlined canals (laterals)	unauthorized use	spills (end of canals)
leakage from lined canals	metering at main pumping plant	partial use of water in dead-end lines
leakage from pipelines	water rights accounting system	
evaporation (canals and storage reservoirs)		

Table 8. Estimated conveyance efficiency as supplied by 19 districts.

District	Conveyance Efficiency (%)	District	Efficiency (%)
Adams Garden	85	HCMUD	90
Bayview	85	HCWID#3 (McAllen)	90
Brownsville	90	HCWID#5 (Progresso)	92

CCID#2 (San Benito)	40	HCCID#9 (Mercedes)	75
CCID#6 (Los Fresnos)	60	HCID#16 (Mission)	85
Delta Lake	75	HCWCID#18	95
Donna	58	La Feria IDCC#3	75
Harlingen	85	Santa Cruz ID#15	75
HCID#1 (Edinburg)	80	Santa Maria IDCC#4	75
HCID#2 (San Juan)	77		

On-farm Potential Water Savings

On-farm irrigation efficiency is defined as the ratio of the amount of water needed to grow the crop to the amount of water delivered to a field. The amount of water needed to grow a crop is usually estimated from ET (evapotranspiration) data as adjusted for beneficial rainfall and leaching requirements. Generally, surface irrigation systems, such as found in the Lower Rio Grande Valley, have low efficiencies and ranges from 30 to 80%. Generally, we expect on-farm surface irrigation efficiencies of 60 - 70%. Various practices and field improvements can increase this efficiency to 70 - 80%, or even higher with good management and improved technology.

Table 9 provides the observed water savings reported in 4 districts (Bayview, Brownsville, Delta Lakes, San Benito) from recent experiments with layflat tubbing replacement of siphon tubes and on-farm metering. In some cases, improved technology or water management were also implemented. The numbers reported for Donna and La Feria are for metering only. It should be noted that hard data to support many of these observations do not exist.

These observations and supporting information show that significant water savings at the farm level are possible in the Lower Rio Grande Valley. However, one major limiting factor is that in about half of the area, water is delivered to the field with inadequate "head" (insufficient volume and/or pressure) to allow for efficient furrow irrigation. Without improvements in the distribution systems, on-farm water saving potential in about half the irrigated land will be limited.

For the analysis used in the IWRP project, we classified potential on-farm water savings into three components:

1) metering,
2) gated pipe replacement of field ditches and siphon tubes, and
3) high water management and/or improved irrigation technology.

Table 10 gives the expected range of water savings for each practice and the factor used in this analysis. Table 11 summarizes the assumptions used in applying these factors to this region. For example, the first two factors (metering and gated pipe) were not applied to the area currently under the practice. In addition, benefits from high water management were not applied to the half of the area with head problems. Increased on-farm efficiency can only be achieved in these areas by improvements in the distribution systems and/or adoption of pumped and pressurized irrigation systems such as drip and sprinkler irrigation.

On-farm water saving potential were calculated for high and low water use years as discussed above. **The results are a potential on-farm water savings of 98,000 to 217,000 ac-ft/yr.** However, an intensive technical assistance and education program would be needed to achieve such savings.

Table 9. Water savings observed or estimated from metering and poly pipe experiments during the 1990s in the Lower Rio Grande Valley.	
district	**water savings observed**
Bayview	36% 1
Brownsville	33% 1
Donna	20% 2
La Feria	10% 2
Delta Lakes	33% 1
San Benito	40% 1

1 may include additional benefits from implementing improved on-farm water management practices or due to changes in irrigation technology
2 metering only

Table 10. Factors used for calculation of on-farm water saving potential in the IWRP Project.		
technique	**expected water savings**	**factor used**
metering	0 - 15 %	10 %
poly/gated pipe replacement of field ditches/siphon tubes	5 - 20 %	10 %
high management/improved irrigation technology	10 - 30 %	20 %

Table 11. Assumptions for applying water savings factors in Table 16 to the Lower Rio Grande Valley.	
technique	**assumptions for calculations**
metering	- adopted Valley-wide by 2010 - 20% of land area is assumed to be metering - factor applied to remaining 80%
poly/gated pipe	- adopted by 90% of Valley by 2010 - approximately 50% of Valley already using gated/poly pipe - factor applied to remaining 40% of Valley not currently using poly/gated pipe (0.9 - 0.5 = 0.4)
	- adopted on half of Valley by 2010 - approximately 20% of area currently

high management/improved irrigation technology	under high management or using improved technologies - factor applied to 30% of area (0.5 - 0.2 = 0.3)

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Texas Water Development Board

Report 316

Evaluation of Ground-Water Resources In the Lower Rio Grande Valley, Texas

by
T. Wesley McCoy, Geologist

January 1990

Appendix C
USDA Soil Survey for Cameron County

SOIL SURVEY OF

Cameron County, Texas

United States Department of Agriculture
Soil Conservation Service
In cooperation with
Texas Agricultural Experiment Station

SOIL LEGEND

Each soil symbol consists of letters; for example, BA, CH, HGB, or USX. If slope is given in the soil name, a third letter, A, B, or C, indicates the class of slope. A third letter X indicates that the delineations are much larger and the composition of the units is more variable than that of most other mapping units in the county.

SYMBOL	NAME
BA	Barrada clay
BE	Benito clay
BU	Benito-urban land complex
CA	Camargo silt loam
CC	Camargo silty clay loam
CE	Cameron silty clay
CF	Cameron silty clay, saline
CH	Chargo silty clay
CO	Coastal beach
CU	Coastal dunes
DE	Delfina fine sandy loam
GA	Galveston fine sand, hummocky
GR	Grulla clay
HA	Harlingen clay
HC	Harlingen clay, saline
HE	Harlingen-urban land complex
HGA	Hidalgo fine sandy loam, 0 to 1 percent slopes
HGB	Hidalgo fine sandy loam, 1 to 3 percent slopes
HO	Hidalgo sandy clay loam
HU	Hidalgo-urban land complex
LAA	Laredo silty clay loam, 0 to 1 percent slopes
LAB	Laredo silty clay loam, 1 to 3 percent slopes
LC	Laredo silty clay loam, saline
LD	Laredo-Olmito complex
LEA	Laredo-Reynosa complex, 0 to 1 percent slopes
LEB	Laredo-Reynosa complex, 1 to 3 percent slopes
LG	Laredo-urban land complex
LK	Latina sandy clay loam
LM	Lomalta clay
LO	Lomalta-urban land complex
LR	Lozano fine sandy loam
LY	Lyford sandy clay loam
MA	Matamoros silty clay
MC	Matamoros-Rio Grande complex
MEA	Mercedes clay, 0 to 1 percent slopes
MEB	Mercedes clay
MGC	Mercedes clay, loamy substratum, 1 to 5 percent slopes
MM	Mercedes-urban land complex
MS	Mustang fine sand
MU	Mustang fine sand, saline
OM	Olmito silty clay
ON	Olmito-urban land complex
OR	Orelia clay loam, clayey subsoil variant
PO	Point Isabel clay loam
PU	Point Isabel-urban land complex
RA	* Racombes sandy clay loam
RDX	* Racombes soils and urban land
RE	Raymondville clay loam
RG	Raymondville clay loam, saline
RM	Raymondville-urban land complex
RO	Rio clay loam
RR	Rio Grande silt loam
RT	Rio Grande silty clay loam
RU	Rio Grande-urban land complex
RZ	Rio Grande-Zalla complex
SE	Sejita silty clay loam
SU	Sejita-urban land complex
TC	Tiocano clay
USX	Ustifluvents, clayey
WAA	Willacy fine sandy loam, 0 to 1 percent slopes
WAB	Willacy fine sandy loam, 1 to 3 percent slopes
WM	Willamar soils
ZA	Zalla loamy fine sand

CULTU

BOUNDARIES

National, state or p

County or parish

Minor civil division

Reservation (natio
state forest or p
and large airpor

Land grant

Limit of soil survey

Field sheet matchl

AD HOC BOUNDARY

Small airport, airfi
cemetery, or flo

STATE COORDINATE

LAND DIVISION COR
(sections and land g

ROADS

Divided (median s
if scale permits)

Other roads

Trail

ROAD EMBLEMS & D

Interstate

Federal

State

County, farm or ra

RAILROAD

POWER TRANSMISS
(normally not show

PIPE LINE
(normally not show

FENCE
(normally not show

LEVEES

Without road

With road

With railroad

DAMS

Large (to scale)

Medium or small

PITS

Gravel pit

Mine or quarry


Lateral

(Joins sheet 55)

Appendix D
FEMA Combustible Emissions Calculation Sheet

CALCULATION SHEET-COMBUSTIBLE EMISSIONS

Assumptions for Combustible Emissions					
Type of Construction Equipment	Num. of Units	HP Rated	Hrs/day	Days/yr	Total hp-hrs
Water Truck	1	300	8	240	576000
Diesel Road Compactors	1	100	8	90	72000
Diesel Dump Truck	2	300	8	90	432000
Diesel Excavator	1	300	8	15	36000
Diesel Hole Trenchers	1	175	8	15	21000
Diesel Bore/Drill Rigs	1	300	8	15	36000
Diesel Cement & Mortar Mixers	1	300	8	240	576000
Diesel Cranes	1	175	8	240	336000
Diesel Graders	1	300	8	90	216000
Diesel Tractors/Loaders/Backhoes	2	100	8	90	144000
Diesel Bull Dozers	1	300	8	90	216000
Diesel Front End Loaders	1	300	8	90	216000
Diesel Fork Lifts	2	100	8	90	144000
Diesel Generator Set	6	40	8	240	460800

Emission Factors							
Type of Construction Equipment	VOC g/hp-hr	CO g/hp-hr	NOx g/hp-hr	PM-10 g/hp-hr	PM-2.5 g/hp-hr	SO2 g/hp-hr	CO2 g/hp-hr
Water Truck	0.440	2.070	5.490	0.410	0.400	0.740	536.000
Diesel Road Compactors	0.370	1.480	4.900	0.340	0.330	0.740	536.200
Diesel Dump Truck	0.440	2.070	5.490	0.410	0.400	0.740	536.000
Diesel Excavator	0.340	1.300	4.600	0.320	0.310	0.740	536.300
Diesel Trenchers	0.510	2.440	5.810	0.460	0.440	0.740	535.800
Diesel Bore/Drill Rigs	0.600	2.290	7.150	0.500	0.490	0.730	529.700
Diesel Cement & Mortar Mixers	0.610	2.320	7.280	0.480	0.470	0.730	529.700
Diesel Cranes	0.440	1.300	5.720	0.340	0.330	0.730	530.200
Diesel Graders	0.350	1.360	4.730	0.330	0.320	0.740	536.300
Diesel Tractors/Loaders/Backhoes	1.850	8.210	7.220	1.370	1.330	0.950	691.100
Diesel Bull Dozers	0.360	1.380	4.760	0.330	0.320	0.740	536.300
Diesel Front End Loaders	0.380	1.550	5.000	0.350	0.340	0.740	536.200
Diesel Fork Lifts	1.980	7.760	8.560	1.390	1.350	0.950	690.800
Diesel Generator Set	1.210	3.760	5.970	0.730	0.710	0.810	587.300

CALCULATION SHEET-COMBUSTIBLE EMISSIONS

Emission factors (EF) were generated from the NONROAD2005 model for the 2006 calendar year. The VOC EFs includes exhaust and evaporative emissions. The VOC evaporative components included in the NONROAD2005 model are diurnal, hotsoak, running loss, tank permeation, hose permeation, displacement, and spillage. The construction equipment age distribution in the NONROAD2005 model is based on the population in U.S. for the 2006 calendar year.

Emission Calculations							
Type of Construction Equipment	VOC tons/yr	CO tons/yr	NOx tons/yr	PM-10 tons/yr	PM-2.5 tons/yr	SO2 tons/yr	CO2 tons/yr
Water Truck	0.279	1.314	3.485	0.260	0.254	0.470	340.227
Diesel Road Paver	0.029	0.117	0.389	0.027	0.026	0.059	42.544
Diesel Dump Truck	0.209	0.985	2.614	0.195	0.190	0.352	255.170
Diesel Excavator	0.013	0.052	0.182	0.013	0.012	0.029	21.276
Diesel Hole Cleaners\Trenchers	0.012	0.056	0.134	0.011	0.010	0.017	12.399
Diesel Bore/Drill Rigs	0.024	0.091	0.284	0.020	0.019	0.029	21.014
Diesel Cement & Mortar Mixers	0.387	1.473	4.621	0.305	0.298	0.463	336.228
Diesel Cranes	0.163	0.481	2.118	0.126	0.122	0.270	196.318
Diesel Graders	0.083	0.324	1.126	0.079	0.076	0.176	127.657
Diesel Tractors/Loaders/Backhoes	0.294	1.303	1.146	0.217	0.211	0.151	109.669
Diesel Bull Dozers	0.086	0.328	1.133	0.079	0.076	0.176	127.657
Diesel Front End Loaders	0.090	0.369	1.190	0.083	0.081	0.176	127.633
Diesel Aerial Lifts	0.314	1.231	1.358	0.221	0.214	0.151	109.622
Diesel Generator Set	0.614	1.909	3.032	0.371	0.361	0.411	298.232
Total Emissions	**2.599**	**10.034**	**22.811**	**2.005**	**1.952**	**2.931**	**2125.647**

Conversion factors	
Grams to tons	1.102E-06

CALCULATION SHEET-TRANSPORTATION COMBUSTIBLE EMISSIONS

Construction Worker Personal Vehicle Commuting to Construction Site-Passenger and Light Duty Trucks									
	Emission Factors		Assumptions				Results by Pollutant		
Pollutants	Passenger Cars g/mile	Pick-up Trucks, SUVs g/mile	Mile/day	Day/yr	Number of cars	Number of trucks	Total Emissions Cars tns/yr	Total Emissions Trucks tns/yr	Total tns/yr
VOCs	1.36	1.61	60	240	20	20	0.43	0.51	0.94
CO	12.4	15.7	60	240	20	20	3.94	4.98	8.92
NOx	0.95	1.22	60	240	20	20	0.30	0.39	0.69
PM-10	0.0052	0.0065	60	240	20	20	0.00	0.00	0.00
PM 2.5	0.0049	0.006	60	240	20	20	0.00	0.00	0.00

Heavy Duty Trucks Delivery Supply Trucks to Construction Site									
	Emission Factors		Assumptions				Results by Pollutant		
Pollutants	10,000-19,500 lb Delivery Truck	33,000-60,000 lb semi trailer rig	Mile/day	Day/yr	Number of trucks	Number of trucks	Total Emissions Cars tns/yr	Total Emissions Trucks tns/yr	Total tns/yr
VOCs	0.29	0.55	60	240	2	2	0.01	0.02	0.03
CO	1.32	3.21	60	240	2	2	0.04	0.10	0.14
NOx	4.97	12.6	60	240	2	2	0.16	0.40	0.56
PM-10	0.12	0.33	60	240	2	2	0.00	0.01	0.01
PM 2.5	0.13	0.36	60	240	2	2	0.00	0.01	0.02

	Emission Factors		Assumptions				Results by Pollutant		
Pollutants	Passenger Cars g/mile	Pick-up Trucks, SUVs g/mile	Mile/day	Day/yr	Number of Cars	Number of trucks	Total Emissions cars tns/yr	Total Emissions Trucks tns/yr	Total tns/yr
VOCs	1.36	1.61	30	240			-	0.00	-
CO	12.4	15.7	30	240			-	0.00	-
NOx	0.95	1.22	30	240			-	0.00	-
PM-10	0.0052	0.0065	30	240			-	0.00	-
PM 2.5	0.0049	0.006	30	240			-	0.00	-

Truck Emission Factor Source: USEPA 2005 Emission Facts: Average annual emissions and fuel consumption for gasoline-fueled passenger cars and light trucks. EPA 420-F-05-022 August 2005. Emission rates were generated using MOBILE.6 highway vehicle emission factor model.

CALCULATION SHEET-FUGITIVE DUST

Construction Fugitive Dust Emissions

Construction Fugitive Dust Emission Factors

	Emission Factor	Units	Source
General Construction Activities	0.19	ton PM10/acre-month	MRI 1996; EPA 2001; EPA 2006
New Road Construction	0.42	ton PM10/acre-month	MRI 1996; EPA 2001; EPA 2006

PM2.5 Emissions

PM2.5 Multiplier	0.10	(10% of PM10 emissions assumed to be PM2.5)	EPA 2001; EPA 2006
Control Efficiency	0.50	(assume 50% control efficiency for PM10 and PM2.5 emissions)	EPA 2001; EPA 2006

Project Assumptions

Construction Area (0.19 ton PM10/acre-month)

Duration of Construction Project	12	months
Length	0	miles
Length (converted)	0	feet
Width	0	feet
Area	20.00	acres

Conversion Factors

0.000022957	acres per feet
5280	feet per mile

Staging Areas

Duration of Construction Project		months
Length		miles
Length (converted)		feet
Width		feet
Area	0.00	acres

	Project Emissions (tons/year)			
	PM10 uncontrolled	PM10 controlled	PM2.5 uncontrolled	PM2.5 controlled
Construction Area (0.19 ton PM10/ac	45.60	22.80	4.56	2.28
Staging Areas	0.00	0.00	0.00	0.00
Total	**45.60**	**22.80**	**4.56**	**2.28**

Construction Fugitive Dust Emission Factors

General Construction Activities Emission Factor

0.19 ton PM10/acre-month Source: MRI 1996; EPA 2001; EPA 2006

The area-based emission factor for construction activities is based on a study completed by the Midwest Research Institute (MRI) Improvement of Specific Emission Factors (BACM Project No. 1), March 29, 1996. The MRI study evaluated seven construction projects in Nevada and California (Las Vegas, Coachella Valley, South Coast Air Basin, and the San Joaquin Valley). The study determined an average emission factor of 0.11 ton PM10/acre-month for sites without large-scale cut/fill operations. A worst-case emission factor of 0.42 ton PM10/acre-month was calculated for sites with active large-scale earth moving operations. The monthly emission factors are based on 168 work-hours per month (MRI 1996). A subsequent MRI Report in 1999, Estimating Particulate Matter Emissions From Construction Operations, calculated the 0.19 ton PM10/acre-month emission factor by applying 25% of the large-scale earthmoving emission factor (0.42 ton PM10/acre-month) and 75% of the average emission factor (0.11 ton PM10/acre-month).

The 0.19 ton PM10/acre-month emission factor is referenced by the EPA for non-residential construction activities in recent procedures documents for the National Emission Inventory (EPA 2001; EPA 2006). The 0.19 ton PM10/acre-month emission factor represents a refinement of EPA's original AP-42 area-based total suspended particle (TSP) emission factor in Section 13.2.3 Heavy Construction Operations. In addition to the EPA, this methodology is also supported by the South Coast Air Quality Management District and the Western Regional Air Partnership (WRAP) which is funded by the EPA and is administered jointly by the Western Governor's Association and the National Tribal Environmental Council. The emission factor is assumed to encompass a variety of non-residential construction activities including building construction (commercial, industrial, institutional, governmental), public works, and travel on unpaved roads. The EPA National Emission Inventory documentation assumes that the emission factors are uncontrolled and recommends a control efficiency of 50% for PM10 and PM2.5 in PM nonattainment areas.

New Road Construction Emission Factor

0.42 ton PM10/acre-month Source: MRI 1996; EPA 2001; EPA 2006

The emission factor for new road construction is based on the worst-case conditions emission factor from the MRI 1996 study described above (0.42 tons PM10/acre-month). It is assumed that road construction involves extensive earthmoving and heavy construction vehicle travel resulting in emissions that are higher than other general construction projects. The 0.42 ton PM10/acre-month emission factor for road construction is referenced in recent procedures documents for the EPA National Emission Inventory (EPA 2001; EPA 2006).

PM2.5 Multiplier **0.10**

PM2.5 emissions are estimated by applying a particle size multiplier of 0.10 to PM10 emissions. This methodology is consistent with the procedures documents for the National Emission Inventory (EPA 2006).

Control Efficiency for PM10 and PM2.5 **0.50**

The EPA National Emission Inventory documentation recommends a control efficiency of 50% for PM10 and PM2.5 in PM nonattainment areas. Wetting controls will be applied during project construction (EPA 2006).

References:

EPA 2001. *Procedures Document for National Emissions Inventory, Criteria Air Pollutants, 1985-1999.* EPA-454/R-01-006. Office of Air Quality Planning and Standards, United States Environmental Protection Agency. March 2001.

EPA 2006. *Documentation for the Final 2002 Nonpoint Sector (Feb 06 version) National Emission Inventory for Criteria and Hazardous Air Pollutants.* Prepared for: Emissions Inventory and Analysis Group (C339-02) Air Quality Assessment Division Office of Air Quality Planning and Standards, United States Environmental Protection Agency. July 2006.

MRI 1996. *Improvement of Specific Emission Factors (BACM Project No. 1).* Midwest Research Institute (MRI). Prepared for the California South Coast Air Quality Management District, March 29, 1996.

CALCULATION SHEET-SUMMARY OF EMISSIONS

Proposed Action Construction Emissions for Criteria Pollutants (tons per year)						
Emission source	VOC	CO	NOx	PM-10	PM-2.5	SO2
Combustible Emissions	2.60	10.03	22.81	2.01	1.95	2.93
Construction Site-fugitive PM-10	NA	NA	NA	22.80	2.28	NA
Construction Workers Commuter & Trucking	0.97	9.06	1.25	0.02	0.02	NA
Total emissions	**3.57**	**19.10**	**24.06**	**24.82**	**4.25**	**2.93**
De minimis threshold	NA	NA	NA	NA	NA	NA

Appendix E

"Gulf Coast Jaguarundi Recovery Plan, First Revision," U.S Fish and Wildlife Service; December, 2013

"Ocelot Recovery Plan, Draft First Revision", U.S Fish and Wildlife Service Sothern Region; August, 1990

USFWS List of Endangered Species in Texas

GULF COAST JAGUARUNDI RECOVERY PLAN
(*Puma yagouaroundi cacomitli*)

FIRST REVISION
Original version part of
Listed Cats of Texas and Arizona, 1990

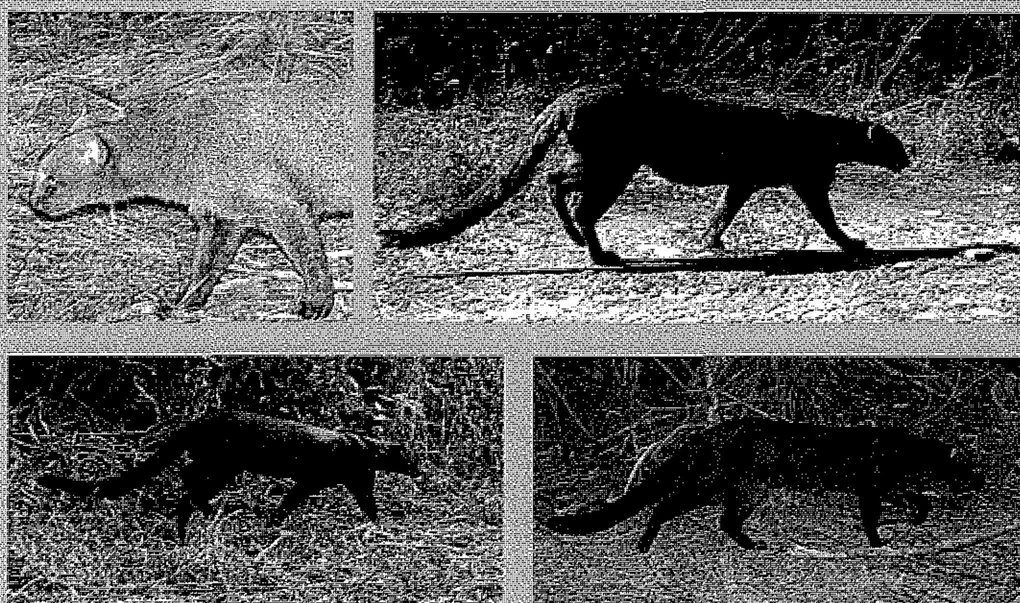

Photo Credit: Feline Research Center/CKWRI

Southwest Region
U.S. Fish and Wildlife Service
Albuquerque, New Mexico
December 2013

Approved: ______________________ Date: 12/20/13
Regional Director, Region 2,
U.S. Fish and Wildlife Service

ACTING

OCELOT RECOVERY PLAN

(*Leopardus pardalis*)

DRAFT FIRST REVISION

Original Approval: August 22, 1990

Southwest Region
U.S. Fish and Wildlife Service
Albuquerque, New Mexico

U.S. Fish & Wildlife Service

ECOS

ECOS / Species Reports / Species occurrence by state / Listed species believed to or known to occur in Texas

Listed species believed to or known to occur in Texas

Notes:

- **As of 02/13/2015 the data in this report has been updated to use a different set of information. Results are based on where the species is believed to or known to occur. The FWS feels utilizing this data set is a better representation of species occurrence. Note: there may be other federally listed species that are not currently known or expected to occur in this state but are covered by the ESA wherever they are found; Thus if new surveys detected them in this state they are still covered by the ESA. The FWS is using the best information available on this date to generate this list.**
- This report shows listed species or populations believed to or known to occur in Texas
- This list does not include experimental populations and similarity of appearance listings.
- This list includes species or populations under the sole jurisdiction of the National Marine Fisheries Service.
- Click on the highlighted scientific names below to view a Species Profile for each listing.

Listed species -- 99 listings

Animals -- 69 listings

Status	Species/Listing Name
E	Amphipod, diminutive (*Gammarus hyalleloides*)
E	Amphipod, Peck's cave (*Stygobromus (=Stygonectes) pecki*)
E	Amphipod, Pecos (*Gammarus pecos*)
E	Bat, Mexican long-nosed Entire (*Leptonycteris nivalis*)

T	Bear, Louisiana black Entire (*Ursus americanus luteolus*)
E	Beetle, American burying Entire (*Nicrophorus americanus*)
E	Beetle, Coffin Cave mold Entire (*Batrisodes texanus*)
E	Beetle, Comal Springs dryopid (*Stygoparnus comalensis*)
E	Beetle, Comal Springs riffle (*Heterelmis comalensis*)
E	Beetle, Helotes mold (*Batrisodes venyivi*)
E	Beetle, Kretschmarr Cave mold Entire (*Texamaurops reddelli*)
E	Beetle, [no common name] (*Rhadine exilis*)
E	Beetle, [no common name] (*Rhadine infernalis*)
E	Beetle, Tooth Cave ground Entire (*Rhadine persephone*)
E	Crane, whooping except where EXPN (*Grus americana*)
T	Cuckoo, yellow-billed Western U.S. DPS (*Coccyzus americanus*)
E	Curlew, Eskimo Entire (*Numenius borealis*)
E	Darter, fountain Entire (*Etheostoma fonticola*)
E	falcon, northern aplomado Entire, except where listed as an experimental population (*Falco femoralis septentrionalis*)
E	Flycatcher, southwestern willow Entire (*Empidonax traillii extimus*)
E	Gambusia, Big Bend Entire (*Gambusia gaigei*)
E	Gambusia, Clear Creek Entire (*Gambusia heterochir*)
E	Gambusia, Pecos Entire (*Gambusia nobilis*)
E	Harvestman, Bee Creek Cave Entire (*Texella reddelli*)
E	Harvestman, Bone Cave Entire (*Texella reyesi*)
E	Harvestman, Cokendolpher Cave (*Texella cokendolpheri*)

E	Jaguarundi, Gulf Coast Wherever found (*Herpailurus (=Felis) yagouaroundi cacomitli*)
T	Knot, red (*Calidris canutus rufa*)
E	Manatee, West Indian Entire (*Trichechus manatus*)
E	Meshweaver, Braken Bat Cave (*Cicurina venii*)
E	Meshweaver, Government Canyon Bat Cave (*Cicurina vespera*)
E	Meshweaver, Madla's Cave (*Cicurina madla*)
E	Meshweaver, Robber Baron Cave (*Cicurina baronia*)
T	Minnow, Devils River Entire (*Dionda diaboli*)
E	Ocelot wherever found (*Leopardus (=Felis) pardalis*)
T	Owl, Mexican spotted Entire (*Strix occidentalis lucida*)
T	Plover, piping except Great Lakes watershed (*Charadrius melodus*)
E	Prairie-chicken, Attwater's greater Entire (*Tympanuchus cupido attwateri*)
T	Prairie-chicken, lesser (*Tympanuchus pallidicinctus*)
E	Pseudoscorpion, Tooth Cave Entire (*Tartarocreagris texana*)
E	Pupfish, Comanche Springs Entire (*Cyprinodon elegans*)
E	Pupfish, Leon Springs Entire (*Cyprinodon bovinus*)
E	Salamander, Austin blind (*Eurycea waterlooensis*)
E	Salamander, Barton Springs Entire (*Eurycea sosorum*)
T	Salamander, Georgetown (*Eurycea naufragia*)
T	Salamander, Jollyville Plateau (*Eurycea tonkawae*)
T	Salamander, Salado (*Eurycea chisholmensis*)
T	Salamander, San Marcos Entire (*Eurycea nana*)
E	Salamander, Texas blind Entire (*Typhlomolge rathbuni*)

T	Sea turtle, green Except where endangered (*Chelonia mydas*)
E	Sea turtle, hawksbill Entire (*Eretmochelys imbricata*)
E	Sea turtle, Kemp's ridley Entire (*Lepidochelys kempii*)
E	Sea turtle, leatherback Entire (*Dermochelys coriacea*)
T	Sea turtle, loggerhead Northwest Atlantic Ocean DPS (*Caretta caretta*)
T	Shiner, Arkansas River Arkansas R. Basin (*Notropis girardi*)
E	Shiner, sharpnose (*Notropis oxyrhynchus*)
E	Shiner, smalleye (*Notropis buccula*)
E	Snail, Pecos assiminea (*Assiminea pecos*)
E	Spider, Government Canyon Bat Cave (*Neoleptoneta microps*)
E	Spider, Tooth Cave Entire (*Neoleptoneta myopica*)
E	Springsnail, Phantom (*Pyrgulopsis texana*)
E	Tern, least interior pop. (*Sterna antillarum*)
E	Toad, Houston Entire (*Bufo houstonensis*)
E	Tryonia, Diamond (*Pseudotryonia adamantina*)
E	Tryonia, Gonzales (*Tryonia circumstriata (=stocktonensis)*)
E	Tryonia, Phantom (*Tryonia cheatumi*)
E	Vireo, black-capped Entire (*Vireo atricapilla*)
E	Warbler (=wood), golden-cheeked Entire (*Dendroica chrysoparia*)
E	Woodpecker, red-cockaded Entire (*Picoides borealis*)

Plants -- 30 listings

Status	**Species/Listing Name**
E	Ambrosia, south Texas (*Ambrosia cheiranthifolia*)

E	Ayenia, Texas (*Ayenia limitaris*)
E	Bladderpod, white (*Lesquerella pallida*)
E	Bladderpod, Zapata (*Lesquerella thamnophila*)
E	Cactus, black lace (*Echinocereus reichenbachii var. albertii*)
T	Cactus, Chisos Mountain hedgehog (*Echinocereus chisoensis var. chisoensis*)
T	Cactus, Lloyd's Mariposa (*Echinomastus mariposensis*)
E	Cactus, Nellie cory (*Coryphantha minima*)
E	Cactus, Sneed pincushion (*Coryphantha sneedii var. sneedii*)
E	Cactus, star (*Astrophytum asterias*)
E	cactus, Tobusch fishhook (*Sclerocactus brevihamatus ssp. tobuschii*)
E	Cat's-eye, Terlingua Creek (*Cryptantha crassipes*)
T	Cory cactus, bunched (*Coryphantha ramillosa*)
E	Dawn-flower, Texas prairie (*Hymenoxys texana*)
E	Dogweed, ashy (*Thymophylla tephroleuca*)
E	Gladecress, Texas golden (*Leavenworthia texana*)
E	Ladies'-tresses, Navasota (*Spiranthes parksii*)
E	Manioc, Walker's (*Manihot walkerae*)
T	No common name (*Geocarpon minimum*)
T	Oak, Hinckley (*Quercus hinckleyi*)
E	Phlox, Texas trailing (*Phlox nivalis ssp. texensis*)
E	Pitaya, Davis' green (*Echinocereus viridiflorus var. davisii*)
E	Pondweed, Little Aguja (=Creek) (*Potamogeton clystocarpus*)

E	Poppy-mallow, Texas (*Callirhoe scabriuscula*)
T	Rose-mallow, Neches River (*Hibiscus dasycalyx*)
E	Rush-pea, slender (*Hoffmannseggia tenella*)
E	Sand-verbena, large-fruited (*Abronia macrocarpa*)
E	Snowbells, Texas (*Styrax texanus*)
T	Sunflower, Pecos (=puzzle, =paradox) (*Helianthus paradoxus*)
E	Wild-rice, Texas (*Zizania texana*)

Appendix F
"Economic Impact Estimate of Irrigation Water shortage on the Lower Rio Grande Valley Agriculture", Texas A&M University AgriLife Extension, June, 2013

TEXAS A&M AGRILIFE EXTENSION

Economic Impact Estimate of Irrigation Water Shortages on the Lower Rio Grande Valley Agriculture

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Texas A&M AgriLife Extension Service

The value of agricultural production in the Lower Rio Grande Valley (LRGV) region, which includes Cameron, Hidalgo, Starr and Willacy counties, was approximately $820 million in 2012 (Table 1). Total crop production accounted for about $666 million or 81.2 % of total agricultural production led by feed crops, cotton, vegetables, miscellaneous crops, and fruits and nuts. Livestock production and agricultural related production was $67.5 and $87.7 million, respectively.

Table 1. Estimated Value of Agricultural Production for the LRGV, 2012

	Cameron	Hidalgo	Starr	Willacy	Total LRGV
		(Thousands of Dollars)			
Feed Crops	52,639	66,410	5,718	53,392	178,159
Cotton	60,034	37,317	1,890	27,669	126,910
Oil Crops	374	9,836	2,342	0	12,552
Vegetable Crops	7,955	100,000	3,931	7,857	119,743
Fruits & Nuts	7,494	64,196	0	318	72,008
Sugar Cane	12,186	24,402	0	5,231	41,819
Misc. Crops	50,000	64,503	0	0	114,503
Beef	1,860	20,353	32,874	6,675	61,762
Other Meat Animals	0	5,550	58	31	5,639
Livestock Products	0	70	0	0	70
Ag. Related	51,454	31,200	3,400	1,682	87,736
Total Crops	190,682	366,664	13,881	94,468	665,695
Total Livestock	1,860	25,973	32,932	6,706	67,471
Ag. Related	51,454	31,200	3,400	1,682	87,736
Total Agriculture	**243,996**	**423,837**	**50,213**	**102,856**	**820,902**

Source: Estimated Value of Agricultural Production and Related Items, Texas AgriLife Extension Service, May 2013.

Irrigation water is very important to agricultural production in the LRGV region where about half of its crop production acreage is irrigated. Irrigation water shortages in the LRGV have occurred since the mid-1990s (Robinson, 2002). These shortages followed the point in 1992, when Mexico began undersupplying the average minimum annual amount of 350,000 acre-feet of water into the Rio Grande and continue nowadays. The treaty of 1944 requires Mexico to deliver the 350,000 minimum average annual acre-feet over the defined five-year cycles. The water deficit for the current five-year cycle is 430,000 acre-feet (TCEQ, 2013).

The purpose of this paper is to estimate the economic impact of the absence of irrigation water for crop production in the LRGV region. The crops affected by the absence of irrigation water are row crops (mainly sorghum, cotton and corn) and specialty crops (mainly vegetables, citrus and sugarcane). Row crops can be grown either irrigated or dryland while specialty crops can only be grown irrigated. All row crops and specialty crops are annual crops except for citrus and sugarcane. The lifespan of a citrus tree is over 30 years while sugarcane is typically five years. The methodology used in this study is an *ex post* historical crop damage approach where the economic impacts are estimated by measuring the change in farm gate or regional gross value of affected row crops and specialty crops.

Row Crops

To estimate the impact of the lack of irrigation water in row crops, the difference between irrigated and dryland yields are estimated and multiplied by the irrigated acreage for the crop. To account for the year-to-year fluctuations in yields and crop acres, a 5-year average (2008-2012) of crop yields and acreage is used to project the impacts for 2013. For example, using the estimated cotton yield difference between irrigated and dryland production (488 lbs. per acre), the 5-year average irrigated cotton acres, and the 2013 estimated cotton price; the loss in farm-gate cotton revenue is estimated at $12.5 million for 2013 (Table 2). Therefore, with the absence of water, irrigated row crops will produce dryland yields, causing a reduction in row crop farm-gate values of $12.5, $4.5 and $14.1 million for cotton, corn and sorghum, respectively. The total farm-gate loss for row crops is estimated at $31.2 million.

Table 2. Row Crop Losses due to Lack of Irrigation Water in the LRGV

	Yield[1]	Yield Loss[1]	Acreage[2]	2013 Price[3]	Total
	5-year average				Farm Gate
Cotton					
Irrigated	1,017 (lbs)	-488 (lbs)	32,273	$0.80/lb	$12,554,709
Dryland	528 (lbs)		76,572		
Corn					
Irrigated	99 (bu)	-22 (bu)	31,317	$6.61/bu	$4,533,345
Dryland	77 (bu)		8,034		
Sorghum					
Irrigated	77 (bu)	-29 (bu)	80,267	$6.00/bu	$14,134,952
Dryland	48 (bu)		284,450		
Total Row Crop Loss					$31,223,006

1/ USDA-NASS Quick Stats for LRGV region, 2008-2012.
2/ USDA-FSA annual crop acreage report for LRGV region, 2008-2012.
3/ CME Group Cotton, Corn and Sorghum July 2013 Prices.

Specialty Crops

To estimate the impact of the lack of irrigation water in specialty crops, these crops were divided between perennial, i.e. citrus, and annual crops, i.e. vegetables and sugarcane. Citrus production would be close to zero, but in general, trees would survive a season without irrigation water. It is assumed that citrus orchards would not be turned into an annual crop since replacing mature trees is very expensive. Therefore, the economic loss of the lack of irrigation water at the farm-level would be the 5-year average value of citrus production in the LRGV region, $45.82 million (Table 3). Vegetables and sugarcane production would be lost as well as irrigation water is needed for their production. Estimated economic loss at the farm-level would be the 5-year average value of production, $128.21 and $47.36 million for vegetable and sugarcane production, respectively (Table 3). The total value of specialty crop production is $221.3 million.

Table 3. Specialty Crop Acreage and Value of Production Loss

	Acreage[1]	Value of Production[2]
	5-year average	
Citrus	27,038	$45,822,200
Vegetables	29,303	$128,211,200
Sugarcane	40,812	$47,361,180
Total Specialty Crop Loss		$221,394,580

1/ USDA-FSA annual crop acreage report for LRGV region, 2008-2012.
2/ Estimated Value of Agricultural Production and Related Items, Texas AgriLife Extension Service, May 2013.

However, it is improbable that the acreage used in vegetable and sugarcane production would remain out of crop production; instead they would be converted into dryland crop production, which for the LRGV region would most likely be cotton, corn or sorghum. The methodology used to redistribute this acreage includes the 5-year average crop mix in the LRGV region and using the same crop mix ratio to convert the vegetable and sugarcane acreage into row crops (Table 4). Therefore, 21% of the converted acreage would go into cotton, 8% into corn and 71% into sorghum production; accounting for $23.39 million in production value at the farm-level. This value, $23.39 million, is subtracted from the total loss of specialty crop production. Therefore, the total crop production loss due to the lack of irrigation water in the LRGV region is estimated at $229.24 million, which includes row crop losses of $31.22 million, plus the specialty crops losses of $221.39 million, less the value of row crop production of the converted vegetable and sugarcane acreage, $23.39 million.

Table 4. Value of Production of Vegetables and Sugarcane Acreage Turned Into Row Crop Production

	Crop Mix[1]	Acreage Mix	Yield[2]	Price[3]	Value
	5-year average		Dryland		
Cotton	21%	14,879	528	$0.80	$6,284,925
Corn	8%	5,379	77	$6.61	$2,737,867
Sorghum	71%	49,857	48	$6.00	$14,358,794
Total Gross Revenue					$23,381,586

1/ USDA-FSA annual crop acreage report for LRGV region, 2008-2012.
2/ USDA-NASS Quick Stats for LRGV region, 2008-2012.
3/ CME Group Cotton, Corn and Sorghum July 2013 Prices.

Total Economic Impact

The IMPLAN input-output model was used to assess the broader economic effects associated with the estimated $229.24 million crop revenue loss associated with a loss of irrigation water. These effects are measured via three indicators – employment, value added, and economic output. Employment represents both full and part-time jobs, value added is a measure of net business income and employee compensation, and economic output represents gross business activity (spending) associated with irrigated crop production. Value added also represents a contribution to Texas' Gross Domestic Product (GDP), the most commonly used indicator of the health of the state's economy.

Each of these indicators is measured at three different levels: direct effects represent the farm-level effects; indirect effects represent effects in industries that provide input supplies (fertilizer, fuel, etc.) to farms, and induced effects represent the economic impacts associated with the spending of salaries and wages on household goods. The loss of irrigated crop production in the LRGV region would lead to an estimated $394.9 million loss in economic output (Table 5). Likewise, the loss of irrigated crop production in the LRGV region would generate a loss of $217.61 million in value added. In terms of employment, the loss of irrigation would result in an estimated loss of 4,840 jobs that depend on the production and sales of these commodities for some portion of their income.

Table 5. 2013 Projected Economic Losses Associated with Lack of Irrigation Water in the LRGV

Impact Type	Employment	Total Value Added	Output
Direct Effect	3,041.6	$117,175,997	$229,235,999
Indirect Effect	1,292.2	$66,615,832	$109,530,397
Induced Effect	506.3	$33,820,341	$56,130,084
Total Effect	4,840.1	$217,612,170	$394,896,481

Texas A&M AgriLife Extension

Value added and economic output are two distinct indicators, and as such are not to be added together.

This analysis represents the impacts of all economic activities that occur in the production of the described crops, up until the point of sale of the crops at the farm-level. These results are on the conservative side as they do not include the impacts (losses) that occur beyond the farm-level sale of the crops, such as transportation, storage, processing, packaging, and marketing.

References

Minnesota IMPLAN Group, Inc., 2009, IMPLAN System, 502 2nd St., Hudson, WI 54016 (Implan.com).

Robinson, John R.C. "Alternative Approaches to Estimate the Impact of Irrigation Water Shortages on Rio Grande Valley Agriculture." Texas Cooperative Extension, May 17, 2012.

[TCEQ] Texas Commission on Environmental Quality. "Rio Grande Valley Suffers While Mexico Withholds Water." News release, April 16, 2013. Available at: http://www.tceq.texas.gov/news/releases/4-16waterdeficit

Appendix G
CCID2 Water Conservation Plan and a Drought Contingency Plan

WATER CONSERVATION PLAN
FOR THE
CAMERON COUNTY IRRIGATION DISTRICT #2
April 22, 2014

In an effort to establish an Irrigation District where water is used efficiently and conservatively, Cameron County Irrigation District #2 sets forth the following water conservation plan.

Cameron County Irrigation District #2 currently has approximately 48,000 acres production, which include acreage for vegetables, cotton, grain, pasture, orchards, and sugar cane. Our total servicing area is approximately 110 square miles. Water is diverted from the Irrigation District's pumping plant facilities located on the United States side of the Rio Grande River at Los Indios, Texas. After pumping from the river, the water is then transported to two main canals one of, which provides water to the south side of the District, and the other to two reservoirs, which provide water to the north side of the District along with other resacas. All water travels north through open canals.

The District delivers approximately 10,611 acre-feet of Rio Grande water to the City of San Benito, East Rio Hondo Water Supply, City of Rio Hondo and Arroyo Water Supply Corporation under existing water supply and delivery contracts. This water is delivered from the District's irrigation canal and pipeline system and is metered at the delivery point to the City of San Benito, East Rio Hondo Water Supply, City of Rio Hondo and Arroyo Water Supply Corporation. The amount of water measured at the Rio Grande is reported monthly to the Rio Grande Watermaster and is based upon the amount of water delivered plus transportation losses. The Rio Grande Watermaster charges these deliveries against the applicable municipal priority water allocation.

In the future, water supply and delivery contracts entered into for the furnishing of Rio Grande water to municipal suppliers, or any extension of existing contract, shall contain provisions that the customer shall develop and implement a water conservation plan or water conservation measures using the applicable elements contained in Title 30, Texas Administrative Code, Chapter 288, and in the event, after treatment, such water is resold to another supplier, then such contract shall also contain provisions dealing with water conservation requirements in accordance with Title 30, Texas Administrative Code, Chapter 288.

A copy of this Water Conservation Plan shall be filed with the Rio Grande Regional Water Planning Group (Region M, Texas Water Development Board), or its successor, and the District will coordinate its activities in order to ensure consistency with approved Regional Water Plans.

Conservation Goals:

1. Landowners and/or canal riders report all leaks to the District's office.
2. Water is shut off at the gate immediately after acreage has been irrigated to avoid spills.
3. No irrigation will begin until canal rider has been notified of intent to irrigate, conservation measures have been taken, and amount of acreage to be irrigated is specified for the control of quantity of water.
4. Land leveling is recommended for long term permanent reduction in irrigation water use.
5. Poly pipes are being installed to use water more effectively and efficiently.
6. District has sold water rights to begin to rehabilitate the District by putting canals underground into pipeline for conservation.

Monitoring and Record Management

Cameron County Irrigation District #2 uses a canal rider supervisor to check the structural facilities for storage, conveyance and delivery of water. Canal riders monitor the water being used to account for the water paid in the amount of $8.00 per acre. A copy of the order placed for water is provided to the canal rider who will turn the order back in when completed or with notification of cancellation of such order.

Penalties:

Any person who willfully opens, closes, changes or interferes with any headgate or used water in violation of section 11.083 of the Texas Code may be assessed an administrative penalty up to $5,000.00 a day under section 11.0842 of the Texas Water Code. Additionally, if the violator is also taking, diverting, or appropriating state water, the violator may be assessed a civil penalty in court of up to $5,000.00 a day. Someone who is aggrieved by these violations may sue the violator for injunctive relief and civil damages in court.

Severability

It is hereby declared to be the intention of the Board of Cameron County Irrigation District #2 that the sections paragraphs, sentences, clauses, and phrases of this Plan are severable and, if any phrase clause sentence, paragraph, or section of this Plan shall be declared unconstitutional by the judgment or decree of any court of competent jurisdiction, such unconstitutionality shall not affect any of the remaining phrases, clauses, sentences, paragraphs, and sections of this Plan since the same would not have been enacted by the Board of Cameron County Irrigation District #2 without the incorporation into this Plan of any such unconstitutional phrase clause, sentence, paragraph, or section.

Effective Date:

The effective date of the above shall be immediately upon its passage. Resolution is attached to the water conservation plan.

WATER ALLOCATION GUIDELINES
OF THE
CAMERON COUNTY IRRIGATION DISTRICT #2

April 22, 2014

Section I: Declaration of Policy, Purpose and Intent

The Board of Directors of the Cameron County Irrigation District #2 deems it to be in the best interest on the District to adopt Guidelines governing the equitable and efficient allocation of limited water supplies during times of shortage. These Guidelines constitute the District's drought contingency plan required under Section 11.1272, Texas Water Code, *Vernon's Texas Codes Annotated,* and associated administrative rules of the Texas Natural Resource Conservation Commission (Title 30, Texas Administrative Code, Chapter 288).

Section II: User Involvement

Opportunity for users of water from the Cameron County Irrigation District #2 was provided by means of a notice posted at the District's main office.

Section III: User Education

The Cameron County Irrigation District #2 will periodically provide water users with information about the Plan, including information about the conditions under which allocation is to be initiated or terminated and the district's policies and procedures for water allocation. This information will be provided by means of posting water allocation guidelines on the district's public bulletin board.

Section IV: Authorization

The General Manager is hereby authorized and directed to implement the applicable provisions of this Plan upon determination by the Board that such implementation is necessary to ensure the equitable and efficient allocation of limited water supplies during times of shortage.

Section V: Application

The provisions of this Plan shall apply to all persons utilizing water provided by the Cameron County Irrigation District #2. The term "person" as used in the Plan includes individuals, corporations, partnerships, associations, and all other legal entities.

Section VI: Initiation of Water Allocation

The General Manager shall monitor water supply conditions on a monthly basis and shall make recommendations to the Board regarding initiation of water allocation. Upon approval of the Board, water allocation will become effective when the storage balance in the District's irrigation water right account reaches less that fifty percent (50%) of the available amount of water that the District is entitled to have in the current year, in Falcon and Amistad Reservoirs.

Section VII: Termination of Water Allocation

The district's water allocation policies will remain in effect until the conditions defined in Section IV of the Plan no longer exist and the Board deems that the need to allocate water no longer exits.

Section VIII: Notice

Notice of the initiation or termination of water allocation will be given by notice posted on the District's public bulletin board and by publication in the local newspaper.

Section IX: Water Allocation

(a) Upon initiation of water allocation, each irrigation user shall be allocated an equal amount of irrigation(s) per acre, depending on the amount of water in the District's irrigation account, for each flat rate acre on which all flat rate assessments have been paid, and on which the water account has remained active for a (24) twenty-four month period. The water allotment in each irrigation account will be expressed in acres.

(b) As additional water supplies become available to the District in an amount reasonably sufficient for allocation to the District's irrigation users, the additional water made available to the District will be equally distributed to those irrigation users as defined in Section 11.039 of the Texas Water Code.

(c) The amount of water charged against a user's water allocation will be one acre-foot per acre irrigated, or one allocation unit, unless water deliveries to the land are metered. Metered water deliveries will be charged based on actual measured use. It shall be a violation of these guidelines for a water user to use water in excess of water contained in the user irrigation account.

(d) Acreage in an irrigation account that has not been irrigated for any reason within the last two- (2) consecutive years will be considered inactive and will not be allocated water. Any landowner whose land has not been irrigated within the last two- (2) consecutive years may, upon application to the District expressing intent to irrigate the land, receive future allocations. However, irrigation water allocated shall be applied only upon the acreage to which it was allocated and such water allotment cannot be transferred until there have been two consecutive years of use.

Section X: Transfers of Allotments

(a) A water allocation in an active irrigation account may be transferred within the boundaries of the District from one irrigation account to another. The transfer of water can only be made by the landowner's agent who is authorized in writing to act on behalf of the landowner in the transfer of all or a part of the water allocation from the described land of the landowner covered by the irrigation account.

(b) A water allocation may not be transferred to land owned by the landowner outside the District boundaries.

(b) Water from outside the District may be transferred by a landowner for use within the District. The District will divert and deliver the water on the same basis as District water is delivered, except that a (25%) twenty-five percent conveyance loss will be charged against the amount of water transferred for use in the District as the water is delivered.

Section XI: Water Delivered to Municipal Suppliers

Water is delivered to municipal suppliers in accordance with existing contracts and the District's water conservation plan and drought contingency plan. Upon the activation of the District's drought contingency provisions, the District will coordinate with municipal suppliers to whom it delivers Rio Grande water for treatment. Normally, if the District expects a shortage in irrigation deliveries which could make it difficult to maintain deliveries to municipal suppliers, it will advise its municipal suppliers, if reasonably possible, at least sixty (60) days in advance, of this possibility, otherwise, as soon as is possible. A copy of this notice will be sent to Rio Grande Watermaster and Texas Water Development Board. Following such notice, the District will monitor available water supply and irrigation deliveries in coordination with the Rio Grande Watermaster, Texas Water Development Board and municipal suppliers during the shortage period.

Section XII: Coordination With Regional Water Planning Group

A copy of this drought management plan shall be filed with the Rio Grande Regional Water Planning Group (Region M, Texas Water Development Board) and the District will coordinate its activities so as to ensure consistency with the approved Regional Water Plan.

Section XIII: Penalties

Any person who willfully opens, closes, changes or interferes with any headgate or uses water in violation of section 11.083 of the Texas Code may be assessed an administrative penalty up to $5,000.00 a day under section 11.0842 of the Texas Water Code. Additionally, if the violator is also taking, diverting, or appropriating state water, the violator may be assessed a civil penalty in court of up to $5,000.00 a day. Someone who is aggrieved by these violations may sue the violator for injunctive relief and civil damages in court.

Section XII: Severability

It is hereby declared to be the intention of the Board of Directors of the Cameron County Irrigation District #2, that the sections, paragraphs sentences, clauses, and phrases of the Plan are severable and, if any phrase, clause, sentence, paragraph, or section of this plan shall be declared unconstitutional by the valid judgment or decree of any court of competent jurisdiction, such unconstitutionality shall not affect any remaining phrases, clauses, sentences, paragraphs, and sections of this Plan, since the same would not have been enacted by the Board without the incorporation into this Plan of any such unconstitutional phrase, clause, sentence, paragraph, or section.

Section XIII: Authority

The foregoing guidelines are adopted pursuant to and in accordance with Sections 11.039, 11.083, 11.1272; Section 49.004; and Section 58.127-130 of the Texas Water Code, *Vernon's Texas Codes Annotated.*

Section XIV: Effective Date of Plan

The effective date of this Plan shall be five (5) days following the date of Publication hereof and ignorance of the guidelines is not a defense for a prosecution for enforcement of the violation of the guidelines.

RESOLUTION OF THE BOARD OF DIRECTORS ADOPTING A WATER CONSERVATION PLAN FOR THE CAMERON COUNTY IRRIGATION DISTRICT #2
April 22, 2014

WHEREAS, the Board recognizes that the amount of water available to the Cameron County Irrigation District #2 and to its irrigation water customers is limited and subject to depletion during periods of extended drought;

WHEREAS, the Board recognizes that natural limitations due to drought conditions and other acts of God cannot guarantee an uninterrupted water supply for all purposes.

WHEREAS, Applicable rules of the Texas Natural Resource Conservation Commission require all public water supply systems in Texas to prepare a water conservation plan.

WHEREAS, Section 11.039 of the Texas Water Code authorizes water suppliers to distribute available water supplies on a pro rata basis during times of water supply shortage; and

WHEREAS, as authorized under law, and in the best interests of the customers of the Cameron County Irrigation District #2, the Board deems it expedient and necessary to establish certain rules and policies for the orderly and efficient management of limited water supplies during drought and other water supply emergencies;

NOW THEREFORE, BE IT RESOLVED BY THE BOARD OF DIRECTORS OF THE CAMERON COUNTY IRRIGATION DISTRICT #2:

SECTION 1. That the Water Conservation Plan attached hereto and hereby adopted as the official policy of the Cameron County Irrigation District #2.

SECTION 2. That the General Manager is hereby directed to implement, administer, and enforce the Water Conservation Plan.

SECTION 3. That this resolution shall take effect immediately upon its passage.

DULY PASSED BY THE BOARD OF DIRECTORS OF THE CAMERON COUNTY IRRIGATION DISTRICT #2, ON THIS THE 22 ND DAY OF April 2014.

Bill McMurray
President, Board of Directors

Attested to:

William Goral
Secretary, Board of Directors

CAMERON COUNTY IRRIGATION DISTRICT NO. TWO

1301 FM 510 P.O. BOX 687 SAN BENITO, TEXAS 78586
Phone (956) 399-2484 Fax (956) 399-4721
Sonia Lambert- General Manager

April 25, 2014

Rio Grande Regional Water Planning Group, Region M
Glenn Jarvis, Chairman
301 W. Railroad St.
Weslaco, Texas 78596

Dear Mr. Jarvis,

Enclosed please find Cameron County Irrigation District #2's Water Conservation Plan and a copy of the Board adopted resolution approving the plan. This Water Conservation Plan is for the period of May 1, 2014 through April 30, 2019.

If you have any questions please do not hesitate to contact me at (956) 399-2484.

Sincerely,

Sonia Lambert
General Manager

SL/le
Enclosures

Appendix H
CCID2 Grant Application Board Resolution

CAMERON COUNTY IRRIGATION DISTRICT NO. TWO

26041 FM 510 P.O. BOX 687 SAN BENITO, TEXAS 78586
Phone (956) 399-2484 Fax (956) 399-4721
Sonia Lambert- General Manager

RESOLUTION
January 12, 2016
2016-001

LATERAL J

APPLICANT'S NAME: Cameron County Irrigation District No. 2

WHEREAS, Cameron County Irrigation District No. 2 is an Irrigation District operating pursuant to Vernon's Texas Civil Statutes, Water Code, Chapter 58, and under Article XVI, Section 59, of the Texas Constitution; and

WHEREAS, the Cameron County Irrigation District No. 2, (District), is committed to water conservation, and;

WHEREAS, the District is seeking opportunities to implement projects that account for water use, and;

WHEREAS, Cameron County Irrigation District No. 2, San Benito, Texas, has identified a project that involves replacement of an open earthen canal to a pipeline.

WHEREAS, the District has sufficient resources to match available funds to complete such improvements;

NOW THEREFORE, BE IT RESOLVED that the Board of Directors of the Cameron County Irrigation District No. 2 agrees and authorizes that:

1. The Board authorizes its General Manager, Sonia Lambert, to submit an application for the WaterSMART Grant.
2. The Board or governing body has reviewed and supports the proposal submitted;
3. The applicant is capable of providing the amount of funding and/or in-kind contributions, specified in the funding plan; and
4. If selected, the applicant will work with Reclamation to meet established deadlines for entering into a cooperative agreement.

DATED: January 12, 2016

Bill McMurray, President

ATTEST:

William Goad, Secretary

Appendix I
CCID2 Accounting Balance Sheet