RIO GRANDE
REGIONAL WATER PLANNING GROUP

Rio Grande Regional Water Planning Group
3rd Round of Regional Planning: 1st Phase

Task #2: Classify Irrigation Districts as Water User Groups

Amendment #1 to Final Report

November 3, 2009

Submitted by:

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Study #2: Classify Individual Irrigation Districts as Water User Groups or Wholesale Water Providers

Amendment #1

The final report titled "Study #2: Classify Individual Irrigation Districts as Water User Groups or Wholesale Water Providers", submitted on July 31, 2009 to the Texas Water Development Board, shall be amended as follows:

Executive Summary – Page 4

Remove text that reads:
Based on this information, it is recommended to include individual Irrigation Districts into the Regional Water Plan as Water User Groups. Supply and demand projections should be as previously listed, and conveyance efficiencies for each District should be included. This will allow for an accurate determination to be made as to specific water management strategies recommended for each District.

Replace with text that reads:
Through multiple discussions with the Rio Grande Regional Water Planning Group Board and Committees, it has been decided that the most prudent and accurate method for describing individual Irrigation Districts in future phases of regional planning is to continue referencing irrigation water supply and demand on a county-wide basis. However, future regional plans shall include water supply and demand numbers for each individual Irrigation District as a subdivision of the county-wide reporting unit. For those Irrigation Districts that are located in two or more counties, the fraction of acreage served in each county shall be used to allocate supply and demand figures accordingly. This method will allow for water management strategies to be identified with more accuracy.

Recommendations – Page 36

Remove text that reads:
Therefore, Irrigation Districts serve as water user groups in much the same way that municipalities deliver water to their end users. A blanket characterization that Irrigation Districts are wholesale providers does not fit the role that Irrigation Districts play in the Region. It is hereby recommended that individual Irrigation Districts be classified as Water User Groups.

Replace with text that reads:
Through multiple discussions with the Regional Water Planning Group Board and Committees, it has been decided that the most prudent and accurate method for describing individual Irrigation Districts in future phases of regional planning is to continue referencing irrigation water supply and demand on a county-wide basis. However, future regional plans shall include water supply and demand

numbers for each individual Irrigation District as a subdivision of the county-wide reporting unit. For those Irrigation Districts that are located in two or more counties, the fraction of acreage served in each county shall be used to allocate supply and demand figures. This method will allow for water management strategies to be identified with more accuracy.

RIO GRANDE
REGIONAL WATER PLANNING GROUP

Rio Grande Regional Water Planning Group
3rd Round of Regional Planning: 1st Phase

Task #2: Classify Irrigation Districts as Water User Groups

Final Report

August 14, 2009

Submitted by:

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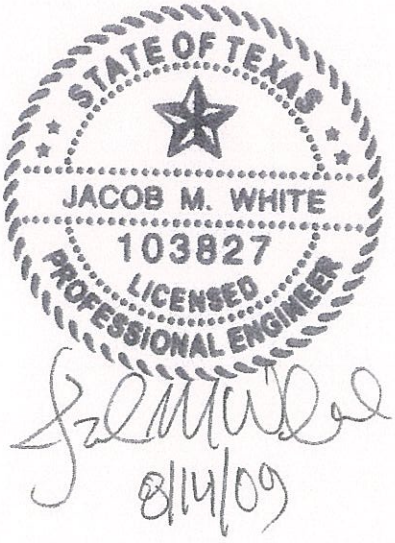

Table of Contents

LIST OF FIGURES

LIST OF TABLES

Study #2: Classify Individual Irrigation Districts as Water User Groups or Wholesale Water Providers

Executive Summary

The purpose of this study is to better clarify actual need for water conservation efforts specific to Region M. Irrigation Districts make up nearly 85% of the total regional demand for water. In the previous rounds of regional planning, water supply and demand analysis were performed for a multitude of Water User Groups (WUGs) in the region including the classification of irrigation water users as a county-wide group (i.e. Irrigation – Cameron County). Utilizing this classification system creates a difficult set of circumstances in which to accurately evaluate irrigation water users including the development of accurate water supply and demand figures and developing water management strategies for implementation.

In terms of Regional water planning, the analysis of individual Irrigation Districts will allow for a better understanding of the Region's water supply and demand. With this information, the Region will be better able to evaluate specific water management strategies needed to meet future water deficits.

A thorough analysis of irrigation water supply and demand data is critical. In Region M, irrigation demand is primarily based on the available supply from the Amistad-Falcon reservoir system. During droughts, supply is limited and allowable irrigation water is allocated accordingly, resulting in a perceived reduction in demand. Ultimately, the demand on any given Irrigation District would be such that all land in the District that is included as flat-rate acreage would have the option to receive irrigation water. In turn, Irrigation Districts typically own enough irrigation water rates (class A, class B, or a combination of both) to serve irrigation water users within their boundaries should the water be available in the reservoir.

Regarding specific water supply and demand figures, the following table summarizes the findings:

Table ES.1: Irrigation District Demand and Supply Projections Summary

	Year	2000	2010	2020	2030	2040	2050	2060
BID	Demand (acre-feet)	50,875	40,186	29,798	22,164	22,164	22,164	22,164
	Supply (acre-feet)	10,008	10,203	10,105	10,015	9,924	9,834	9,750
CCID2	Demand	152,017	137,738	121,821	107,867	107,867	107,867	107,867
	Supply	64,121	65,372	64,747	64,167	63,587	63,007	62,472
HIDCC1	Demand	88,128	84,479	80,175	76,127	76,127	76,127	76,127
	Supply	29,031	29,598	29,315	29,052	28,790	28,527	28,284
CCID6	Demand	52,142	47,244	41,785	36,998	36,998	36,998	36,998
	Supply	27,950	28,495	28,223	27,970	27,718	27,465	27,231
Mercedes	Demand	144,343	125,925	105,301	86,365	86,365	86,365	86,365
	Supply	82,449	86,299	85,495	84,748	84,001	83,253	82,564
Delta Lake	Demand	176,099	174,911	173,395	171,746	171,746	171,746	171,746
	Supply	56,798	59,451	58,897	58,382	57,867	57,352	56,877
Sharyland	Demand	4,053	2,138	841	281	281	281	281
	Supply	6,858	7,179	7,112	7,050	6,987	6,925	6,868
Adams Garden	Demand	18,105	18,624	19,281	19,955	19,955	19,955	19,955
	Supply	7,338	7,481	7,409	7,343	7,277	7,210	7,149
HCID2	Demand	103,008	82,550	61,506	44,290	44,290	44,290	44,290
	Supply	55,948	58,561	58,015	57,508	57,001	56,494	56,026
HCID6	Demand	42,068	36,154	29,901	24,775	24,775	24,775	24,775
	Supply	16,098	16,850	16,693	16,547	16,401	16,255	16,120
Donna	Demand	80,953	77,425	73,274	69,379	69,379	69,379	69,379
	Supply	40,824	42,731	42,332	41,962	41,592	41,223	40,881
Santa Cruz	Demand	82,934	79,967	76,296	72,449	72,449	72,449	72,449
	Supply	27,674	28,966	28,696	28,445	28,195	27,944	27,712
Baptist Seminary	Demand	4,857	2,498	1,005	410	410	410	410
	Supply	460	481	477	473	469	464	461
HCID5	Demand	14,135	13,464	12,643	11,796	11,796	11,796	11,796
	Supply	6,863	7,184	7,117	7,055	6,992	6,930	6,873
Engleman	Demand	19,325	17,874	16,151	14,442	14,442	14,442	14,442
	Supply	3,548	3,714	3,679	3,647	3,615	3,583	3,553
HCID16	Demand	30,749	26,426	21,856	18,109	18,109	18,109	18,109
	Supply	15,255	15,968	15,819	15,681	15,542	15,404	15,277
HCMUD1	Demand	6,011	5,166	4,273	3,540	3,540	3,540	3,540
	Supply	2,080	2,178	2,157	2,138	2,120	2,101	2,083
HCWCID18	Demand	5,505	4,731	3,913	3,242	3,242	3,242	3,242
	Supply	1,864	1,951	1,932	1,916	1,899	1,882	1,866
United	Demand	64,464	55,402	45,821	37,966	37,966	37,966	37,966
	Supply	15,378	16,096	15,946	15,807	15,668	15,528	15,400
HCID1	Demand	85,615	68,611	51,121	36,812	36,812	36,812	36,812
	Supply	28,909	30,259	29,977	29,715	29,453	29,191	28,949
CCID16	Demand	3,773	3,419	3,024	2,677	2,677	2,677	2,677
	Supply	1,285	1,310	1,297	1,286	1,274	1,262	1,252
La Feria	Demand	74,898	69,722	63,795	58,419	58,419	58,419	58,419
	Supply	39,959	40,738	40,349	39,987	39,626	39,265	38,931
Santa Maria	Demand	9,098	8,763	8,367	7,992	7,992	7,992	7,992
	Supply	5,516	5,624	5,570	5,520	5,471	5,421	5,375
Valley Acres	Demand	15,150	15,187	15,233	15,278	15,278	15,278	15,278
	Supply	10,373	10,576	10,475	10,381	10,287	10,193	10,106
Bayview	Demand	17,478	15,836	14,006	12,402	12,402	12,402	12,402
	Supply	6,526	6,653	6,590	6,531	6,472	6,413	6,358
McAllen 3	Demand	9,752	7,815	5,823	4,193	4,193	4,193	4,193
	Supply	3,760	3,935	3,899	3,864	3,830	3,796	3,765

As previously mentioned, each Irrigation District was asked to complete a survey that inquired about a number of District specific items. Of these items, each District was asked to furnish information pertaining to miles of canal (earthen and unlined) and miles of pipeline. Information from these surveys was combined with existing data on major distribution systems for each District. The result is an understanding of the method in which water is conveyed through each District.

Table ES.2: Main Irrigation Distribution Network

Main Irrigation Distribution Network	Canals miles	Pipeline Miles	Total miles	Canal:Pipeline
Adams Garden	21.49	2.01	23.5	10.7 :1
Bayview	14.06	0.43	14.49	32.7 :1
Brownsville	2.36	31.08	33.44	0.1 :1
San Benito	108.52	0.74	109.26	146.6 :1
Los Fresnos	41.82	0	41.82	0.0 :1
Rutherford-Harding	4.67	1.84	6.51	2.5 :1
Cameron 16	3.51	0	3.51	1.0 :0
Delta Lake	69.43	7.71	77.14	9.0 :1
Donna	32.49	0.8	33.29	40.6 :1
Engleman Gardens	12.43	5.7	18.13	2.2 :1
Mercedes	71.8	2.74	74.54	26.2 :1
Harlingen	52.78	7.65	60.43	6.9 :1
Edinburg	35.54	24.37	59.91	1.5 :1
McAllen 3	9.7	3.67	13.37	2.6 :1
Baptist Seminary	0	4.61	4.61	0.0 :1
HCID14	0	0	0	0.0 :0
Mission 16	15.17	2.25	17.42	6.7 :1
Monte Grande	0	0	0	0.0 :0
San Juan	37.5	50.48	87.98	0.7 :1
Progreso	0.8	20.54	21.34	0.0 :1
Mission 6	19.42	0	19.42	1.0 :0
Sharyland Plantation	4.58	0	4.58	1.0 :0
LaFeria	43.74	4.02	47.76	10.9 :1
Meaverick	120.86	0	120.86	1.0 :0
Santa Cruz	34.06	4.58	38.64	7.4 :1
Santa Maria	2.92	0	2.92	1.0 :0
United	29.11	5.9	35.01	4.9 :1
Valley Acres	5.66	10.29	15.95	0.6 :1
Average				11.4 :.75

Conveyance efficiencies were also analyzed to determine the effectiveness of delivering water to the end users. Due to inaccuracies and inconsistencies in District conveyance efficiency reporting, it is recommended to utilize the following conveyance efficiencies.

This analysis will allow for an accurate determination to be made as to potential water management strategies for the Region.

Table ES.3: Irrigation District Conveyance Efficiency

District Name	Conveyance Efficiency
Adams Garden	68.0%
Bayview	68.0%
Brownsville	68.0%
San Benito	68.0%
Los Fresnos	68.0%
Rutherford-Harding	68.0%
Cameron 16	68.0%
Delta Lake	70.6%
Donna	71.0%
Engleman Gardens	71.0%
Mercedes	69.9%
Harlingen	68.0%
Edinburg	71.0%
McAllen 3	71.0%
Baptist Seminary	71.0%
HCID14	71.0%
Mission 16	71.0%
Monte Grande	71.0%
San Juan	71.0%
Progreso	71.0%
Mission 6	71.0%
Sharyland Plantation	71.0%
LaFeria	68.0%
Santa Cruz	71.0%
Santa Maria	68.0%
United	71.0%
Valley Acres	70.6%

Important Note: Using county-wide estimates to qualify individual Irrigation District conveyance system efficiencies does not represent an accurate scenario. Each District has a wide range of conveyance methods including open canals, pipelines, lined canals, and storage. In addition, the age of infrastructure plays a significant role in the efficiency of conveyance. Therefore, this analysis does not represent actual conveyance efficiencies. However, it does represent the best available quantifiable analysis of efficiency.

Based on this information, it is recommended to include individual Irrigation Districts into the Regional Water Plan as Water User Groups. Supply and demand projections should be as previously listed, and conveyance efficiencies for each District should be included. This will allow for an accurate determination to be made as to specific water management strategies recommended for each District.

Purpose of Study

The purpose of this study is to better clarify actual need for water conservation efforts specific to Region M. Irrigation Districts make up nearly 85% of the total regional demand for water.

In the previous rounds of regional planning, water supply and demand analysis were performed for a multitude of Water User Groups (WUGs) in the region including the classification of irrigation water users as a county-wide group (i.e. Irrigation – Cameron County). Utilizing this classification system creates a difficult set of circumstances in which to accurately evaluate irrigation water users. For one, developing accurate and applicable water management strategies for irrigation water users on a county-wide basis does not take into consideration individual irrigation districts that deliver irrigation water. Also, irrigation districts deliver the majority of raw water for municipal users. The conveyance system utilized for irrigation water is also utilized for raw water deliveries. Analyzing the conveyance system for each irrigation district will give valuable insight into conveyance efficiencies. The evaluation of irrigation water users on a county-wide level does not provide this level of insight. The current conveyance efficiencies associated with each irrigation district, and their method of water deliveries, varies significantly from district to district, as does the amount of irrigation water allocated to each district. In addition, individual irrigation districts are in various states of urbanization and the irrigation water demands they serve vary significantly. Again, a county-wide evaluation of irrigation water users cannot take into consideration the wide range of supplies and demands.

In terms of Regional water planning, the analysis of individual Irrigation Districts will allow for a better understanding of the Region's water supply and demand. With this information, the Region will be better able to evaluate specific water management strategies needed to meet future water deficits. Furthermore, funding recommendations for the implementation of specific projects by specific entities can be better made. By incorporating the results of this report into the Region M Regional Water Plan, the 2nd phase of the 3rd round of regional planning will be more detailed and offer a more comprehensive understanding of the Region's water supply and demand.

Water Supply and Demand

Methodology

The following Irrigation District analyses were based on the results of a survey sent to all Irrigation Districts in Region M. A thorough analysis of irrigation water supply and demand data is critical. In Region M, irrigation demand is primarily based on the

available supply from the Amistad-Falcon reservoir system. During droughts, supply is limited and allowable irrigation water is allocated accordingly, resulting in a perceived reduction in demand. With the structure of irrigation water allocations, a paper analysis will show that supply equals demand in times of drought. Therefore, one should not evaluate irrigation water demand solely on allocations or water usage, even during times of non-drought. Rainfall can have a pronounced impact on perceived irrigation water usage. For instance, in the year 2002, there was above average rainfall (24.75") and the reservoir levels were also low (32.49% of conservation). These factors contributed to low irrigation usage. In order to gain an accurate understanding of actual irrigation demand, once must take into consideration all of these factors.

Ultimately, the demand on any given Irrigation District would be such that all land in the District that is included as flat-rate acreage would have the option to receive irrigation water. In turn, Irrigation Districts typically own enough irrigation water rates (class A, class B, or a combination of both) to serve irrigation water users within their boundaries should the water be available in the reservoir. In the original adjudication of water rights in the Lower Rio Grande, a factor of 2.5 acre-feet of water per acre of land was applied for irrigation purposes. This factor still serves as the standard for determining the amount of irrigation water rights that are held by each District. When evaluating irrigation water demand on a specific Irrigation District, the scenario in which supplies the most pertinent information in terms of future water planning is to apply a factor of 2.5 acre-feet of water for each flat-rate acre within a District. Projections for future demands are based on either changes to flat-rate acres or changes in irrigated acres for each District. In terms of regional planning, a scenario was chosen for each Irrigation District that represented the most challenging scenario in terms of projected water demand. For select Irrigation Districts, analyses were performed based on analyzing the rate of urbanization based on aerial imagery. The results of these analyses were compared to the calculated rates based on a reduction in flat rate acres and irrigated acres. These maps, along with an overall aerial map showing the boundaries of irrigation districts in the region can be found in Appendix C as well as in the Digital Appendices. The maps in the Digital Appendices may be used to view the information in more detail. File names in the Digital Appendices are as follows:

- Brownsville Irrigation District Aerial Map: 1996
- Brownsville Irrigation District Aerial Map with Urbanization: 2006
- Cameron County Irrigation District #2 Aerial Map: 1996
- Cameron County Irrigation District #2 Aerial Map with Urbanization: 2006
- Delta Lake Irrigation District Aerial Map: 1996
- Delta Lake Irrigation District Aerial Map with Urbanization: 2006
- Hidalgo County Irrigation District #2 Aerial Map: 1996
- Hidalgo County Irrigation District #2 Aerial Map with Urbanization: 2006

These maps were prepared for the Brownsville Irrigation District, Cameron County Irrigation District No. 2, Delta Lake Irrigation District, and Hidalgo County Irrigation District No. 2. The maps show aerial imagery from 1996 as well as aerial imagery from 2006. On the 2006 maps, yellow blocks are used to distinguish areas that have become urbanized from 1996 through 2006.

An overall aerial map showing the boundaries of irrigation districts in the region can be found in Appendix D as well as in the Digital Appendices. The file in the Digital Appendices is named 'Irrigation District and City Boundaries'.

Flat-rate acreage is typically defined as the acreage within an irrigation district's boundary that pays a yearly flat-rate for the opportunity to utilize irrigation water. This value differs from the overall surface area of a district due to the fact that there are certain areas that do not have the opportunity to receive irrigation water. The method in which acreage is removed from the flat-rate is through a process called exclusion. Furthermore, flat-rate acreage differs from irrigated acres due to the fact that not all flat-rate land is irrigated on a consistent basis.

Additional information was collected associated with population growth in cities that have intersecting boundaries with irrigation districts. Aerial imagery was overlaid with GIS shapefiles. Irrigation District and City boundaries were overlayed on these maps. Census data was then obtained for all cities that have a portion of their boundaries inside of an irrigation district's boundary. A map showing irrigation district boundaries and city boundaries can be found in Appendix D as well as in the Digital Appendices. The file in the Digital Appendices is named 'Irrigation District and City Boundaries'.

In terms of projected water supply, results from the Water Availability Model performed in the 2nd round of Regional Planning were used as a base for Irrigation District supplies. As previously described, Irrigation supplies and demands were based on a county-wide analysis. For this analysis, the base year Irrigation District supply was calculated using the county-wide supply and demand analyses utilized in the 2nd round. The percentage difference between supply and demand was applied to the base year demand (using the method previously described). Irrigation District supply projections then followed the percentage change (increase or decrease) of water availability using results of the WAM.

Results

Cameron County Irrigation District #2 (San Benito)

The results of the Irrigation District survey show a yearly average reduction in flat rate acreage of 1.12% and a yearly average reduction in irrigated acres of 0.94% during the span from 2000 to 2007. Extrapolating this data for a 10 year span yields a flat rate reduction of 11.18% and an irrigated acres reduction of 9.39%. A historical aerial mapping study was performed and, during a similar time frame, the rate of urbanization was proven to be approximately 3.3% throughout the District's boundaries. Maps showing this analysis can be viewed in Appendix C as well as in the Digital Appendices.

The situation that represents the most challenging scenario in terms of future water demand uses data associated with a reduction in irrigated acres. As previously described, the base year irrigation water demand for the District is based on allocations in 1994, which totaled 106,461 acre-feet.

Table 2.1: CCID2 Demand and Supply Projections

Year	2000	2010	2020	2030	2040	2050	2060
Demand (acre-feet)	106,461	96,461	85,314	75,542	75,542	75,542	75,542
Supply (acre-feet)	64,121	65,372	64,747	64,167	63,587	63,007	62,472

Brownsville Irrigation District (Brownsville)
The results of the Irrigation District survey show a yearly average reduction in flat rate acreage of 2.1% and a yearly average reduction in irrigated acres of 2.94% during the span from 2000 to 2007. Extrapolating this data for a 10 year span yields a flat rate reduction of 21.01% and an irrigated acres reduction of 29.41%. A historical aerial mapping study was performed and, during a similar time frame, the rate of urbanization was proven to be approximately 7.7% throughout the District's boundaries. Maps showing this analysis can be seen in Appendix C as well as in the Digital Appendices.

The situation that represents the most challenging scenario in terms of future water demand uses data associated with a reduction in flat rate acres. As previously described, the base year irrigation water demand for the District is based on allocations in 1994, which totaled 16,616 acre-feet.

Table 2.2: BID Demand and Supply Projections

Year	2000	2010	2020	2030	2040	2050	2060
Demand (acre-feet)	16,616	13,125	9,732	7,239	7,239	7,239	7,239
Supply (acre-feet)	10,008	10,203	10,105	10,015	9,924	9,834	9,750

Harlingen Irrigation District No. 1 (Harlingen)
The results of the Irrigation District survey show a yearly average reduction in flat rate acreage of 0.46% and a yearly average reduction in irrigated acres of 0.41% during the span from 2000 to 2007. Extrapolating this data for a 10 year span yields a flat rate reduction of 4.64% and an irrigated acres reduction of 4.14%.

The situation that represents the most challenging scenario in terms of future water demand uses data associated with a reduction in irrigated acres. As previously described, the base year irrigation water demand for the District is based on allocations in 1994, which totaled 48,201 acre-feet.

Table 2.3: HID Demand and Supply Projections

Year	2000	2010	2020	2030	2040	2050	2060
Demand (acre-feet)	48,201	46,205	43,851	41,637	41,637	41,637	41,637
Supply (acre-feet)	29,031	29,598	29,315	29,052	28,790	28,527	28,284

Cameron County Irrigation District #6 (Los Fresnos)
The results of the Irrigation District survey show a yearly average reduction in flat rate acreage of 1.12% and a yearly average increase in irrigated acres of 0.94% during the

span from 2000 to 2007. Extrapolating this data for a 10 year span yields a flat rate reduction of 11.18% and an irrigated acres increase of 9.39%.

The situation that represents the most challenging scenario in terms of future water demand uses data associated with an increase in irrigated acres. As previously described, the base year irrigation water demand for the District is based on allocations in 1994, which totaled 46,406acre-feet.

Table 2.4: CCID6 Demand and Supply Projections

Year	2000	2010	2020	2030	2040	2050	2060
Demand (acre-feet)	52,142	47,244	41,785	36,998	36,998	36,998	36,998
Supply (acre-feet)	27,950	28,495	28,223	27,970	27,718	27,465	27,231

Hidalgo and Cameron Counties Irrigation District No. 9 (Mercedes)
The results of the Irrigation District survey show a yearly average reduction in flat rate acreage of 1.28% and a yearly average reduction in irrigated acres of 1.43% during the span from 2000 to 2007. Extrapolating this data for a 10 year span yields a flat rate reduction of 12.76% and an irrigated acres reduction of 14.29%.

The situation that represents the most challenging scenario in terms of future water demand uses data associated with a reduction in irrigated acres. As previously described, the base year irrigation water demand for the District is based on allocations in 1994, which totaled 48,201 acre-feet.

Table 2.5: HCCID9 Demand and Supply Projections

Year	2000	2010	2020	2030	2040	2050	2060
Demand (acre-feet)	136,974	119,496	99,925	81,956	81,956	81,956	81,956
Supply (acre-feet)	82,449	86,299	85,495	84,748	84,001	83,253	82,564

Delta Lake Irrigation District (Delta Lake)
The results of the Irrigation District survey show a yearly average reduction in flat rate acreage of 0.07% and a yearly average reduction in irrigated acres of 0.07% during the span from 2000 to 2007. Extrapolating this data for a 10 year span yields a flat rate reduction of 0.68% and an irrigated acres reduction of 0.68%. A historical aerial mapping study was performed and, during a similar time frame, the rate of urbanization was proven to be approximately 2.2% throughout the District's boundaries. A map detailing this analysis can be viewed in Appendix C as well as in the Digital Appendices.

The situation that represents the most challenging scenario in terms of future water demand uses data associated with both a reduction in flat rate acres and irrigation acres. As previously described, the base year irrigation water demand for the District is based on allocations in 1994, which totaled 94,360 acre-feet.

Table 2.6: DLID Demand and Supply Projections

Year	2000	2010	2020	2030	2040	2050	2060
Demand (acre-feet)	94,360	93,723	92,911	92,027	92,027	92,027	92,027
Supply (acre-feet)	56,798	59,451	58,897	58,382	57,867	57,352	56,877

Hidalgo County Improvement District No. 19 (Sharyland Plantation)
The results of the Irrigation District survey show a yearly average reduction in flat rate acreage of 6.69% and a yearly average reduction in irrigated acres of 4.73% during the span from 2000 to 2007. Extrapolating this data for a 10 year span yields a flat rate reduction of 66.87% and an irrigated acres reduction of 47.26%.

The situation that represents the most challenging scenario in terms of future water demand uses data associated with a reduction in irrigation acres. As previously described, the base year irrigation water demand for the District is based on allocations in 1994, which totaled 11,394 acre-feet.

Table 2.7: HCID19 Demand and Supply Projections

Year	2000	2010	2020	2030	2040	2050	2060
Demand (acre-feet)	11,394	6,009	2,364	790	790	790	790
Supply (acre-feet)	6,858	7,179	7,112	7,050	6,987	6,925	6,868

Adams Gardens Irrigation District No. 19 (Adams Garden)
The results of the Irrigation District survey show a yearly average reduction in flat rate acreage of 0.32% and a yearly average increase in irrigated acres of 0.29% during the span from 2000 to 2007. Extrapolating this data for a 10 year span yields a flat rate reduction of 3.18% and an irrigated acres increase of 2.87%.

The situation that represents the most challenging scenario in terms of future water demand uses data associated with an increase in irrigation acres. As previously described, the base year irrigation water demand for the District is based on allocations in 1994, which totaled 12,183 acre-feet.

Table 2.8: AGID Demand and Supply Projections

Year	2000	2010	2020	2030	2040	2050	2060
Demand (acre-feet)	12,183	12,532	12,974	13,428	13,428	13,428	13,428
Supply (acre-feet)	7,338	7,481	7,409	7,343	7,277	7,210	7,149

Donna Irrigation District No. 2 (Donna)
The results of the Irrigation District survey show a yearly average reduction in flat rate acreage of 4.95% and a yearly average reduction in irrigated acres of 3.05% during the span from 2000 to 2007. Extrapolating this data for a 10 year span yields a flat rate reduction of 7.07% and an irrigated acres reduction of 4.36%.

The situation that represents the most challenging scenario in terms of future water demand uses data associated with a reduction in irrigated acres. As previously described, the base year irrigation water demand for the District is based on allocations in 1994, which totaled 67,822 acre-feet.

Table 2.9: DID Demand and Supply Projections

Year	2000	2010	2020	2030	2040	2050	2060
Demand (acre-feet)	67,822	64,866	61,388	58,125	58,125	58,125	58,125
Supply (acre-feet)	40,824	42,731	42,332	41,962	41,592	41,223	40,881

Hidalgo County Irrigation District No. 2 (San Juan)
The results of the Irrigation District survey show a yearly average reduction in flat rate acreage of 1.99% and a yearly average reduction in irrigated acres of 4.40% during the span from 2000 to 2007. Extrapolating this data for a 10 year span yields a flat rate reduction of 19.86% and an irrigated acres reduction of 43.98%. A historical aerial mapping study was performed and, during a similar time frame, the rate of urbanization was proven to be approximately 10.2% throughout the District's boundaries. A map detailing this analysis can be viewed in Appendix C as well as in the Digital Appendices.

The situation that represents the most challenging scenario in terms of future water demand uses data associated with a reduction in flat rate acres. As previously described, the base year irrigation water demand for the District is based on allocations in 1994, which totaled 92,948 acre-feet.

Table 2.10: HCID2 Demand and Supply Projections

Year	2000	2010	2020	2030	2040	2050	2060
Demand (acre-feet)	92,948	74,488	55,499	39,965	39,965	39,965	39,965
Supply (acre-feet)	55,948	58,561	58,015	57,508	57,001	56,494	56,026

Hidalgo County Irrigation District No. 6 (Mission #6)
The results of the Irrigation District survey show a yearly average reduction in flat rate acreage of 1.94% and a yearly average reduction in irrigated acres of 1.41% during the span from 2000 to 2007. Extrapolating this data for a 10 year span yields a flat rate reduction of 19.42% and an irrigated acres reduction of 14.06%.

The situation that represents the most challenging scenario in terms of future water demand uses data associated with a reduction in irrigated acres. As previously described, the base year irrigation water demand for the District is based on allocations in 1994, which totaled 26,744 acre-feet.

Table 2.11: HCID6 Demand and Supply Projections

Year	2000	2010	2020	2030	2040	2050	2060
Demand (acre-feet)	92,948	74,488	55,499	39,965	39,965	39,965	39,965
Supply (acre-feet)	55,948	58,561	58,015	57,508	57,001	56,494	56,026

Santa Cruz Irrigation District No. 15 (Santa Cruz)
The results of the Irrigation District survey show a yearly average reduction in flat rate acreage of 0.36% and a yearly average reduction in irrigated acres of 2.75% during the

span from 2000 to 2007. Extrapolating this data for a 10 year span yields a flat rate reduction of 3.58% and an irrigated acres reduction of 27.46%.

The situation that represents the most challenging scenario in terms of future water demand uses data associated with a reduction in flat rate acres. As previously described, the base year irrigation water demand for the District is based on allocations in 1994, which totaled 45,975 acre-feet.

Table 2.12: SCID Demand and Supply Projections

Year	2000	2010	2020	2030	2040	2050	2060
Demand (acre-feet)	45,975	44,330	42,295	40,163	40,163	40,163	40,163
Supply (acre-feet)	27,674	28,966	28,696	28,445	28,195	27,944	27,712

Engleman Irrigation District (Engleman)
The results of the Irrigation District survey show a yearly average reduction in flat rate acreage of 0.75% during the span from 2000 to 2007. Extrapolating this data for a 10 year span yields a flat rate reduction of 7.51%.

The situation that represents the most challenging scenario in terms of future water demand uses data associated with a reduction in flat rate acres. As previously described, the base year irrigation water demand for the District is based on allocations in 1994, which totaled 5,895 acre-feet.

Table 2.13: EID Demand and Supply Projections

Year	2000	2010	2020	2030	2040	2050	2060
Demand (acre-feet)	5,895	5,452	4,927	4,405	4,405	4,405	4,405
Supply (acre-feet)	3,548	3,714	3,679	3,647	3,615	3,583	3,553

Hidalgo County Irrigation District No. 5 (Progreso)
The results of the Irrigation District survey show a yearly average reduction in flat rate acreage of 0.48% during the span from 2000 to 2007. Extrapolating this data for a 10 year span yields a flat rate reduction of 4.75%.

The situation that represents the most challenging scenario in terms of future water demand uses data associated with a reduction in flat rate acres. As previously described, the base year irrigation water demand for the District is based on allocations in 1994, which totaled 11,402 acre-feet.

Table 2.14: HCID5 Demand and Supply Projections

Year	2000	2010	2020	2030	2040	2050	2060
Demand (acre-feet)	11,402	10,860	10,198	9,516	9,516	9,516	9,516
Supply (acre-feet)	6,863	7,184	7,117	7,055	6,992	6,930	6,873

Hidalgo County Irrigation District No. 13 (Baptist Seminary)

The results of the Irrigation District survey show a yearly average reduction in flat rate acreage of 4.86% during the span from 2000 to 2007. Extrapolating this data for a 10 year span yields a flat rate reduction of 48.57%.

The situation that represents the most challenging scenario in terms of future water demand uses data associated with a reduction in flat rate acres. As previously described, the base year irrigation water demand for the District is based on allocations in 1994, which totaled 764 acre-feet.

Table 2.15: HCID13 Demand and Supply Projections

Year	2000	2010	2020	2030	2040	2050	2060
Demand (acre-feet)	764	393	158	64	64	64	64
Supply (acre-feet)	460	481	477	473	469	464	461

Hidalgo County Irrigation District No. 16 (Mission #16)
The results of the Irrigation District survey show a yearly average reduction in flat rate acreage of 1.94% and a yearly average reduction in irrigated acres of 1.41% during the span from 2000 to 2007. Extrapolating this data for a 10 year span yields a flat rate reduction of 19.42% and an irrigated acres reduction of 14.06%.

The situation that represents the most challenging scenario in terms of future water demand uses data associated with a reduction in irrigated acres. As previously described, the base year irrigation water demand for the District is based on allocations in 1994, which totaled 25,344 acre-feet.

Table 2.16: HCID16 Demand and Supply Projections

Year	2000	2010	2020	2030	2040	2050	2060
Demand (acre-feet)	30,749	26,426	21,856	18,109	18,109	18,109	18,109
Supply (acre-feet)	15,255	15,968	15,819	15,681	15,542	15,404	15,277

Hidalgo County Municipal Utility District No. 1 (MUD)
The results of the Irrigation District survey show a yearly average reduction in flat rate acreage of 1.94% and a yearly average reduction in irrigated acres of 1.41% during the span from 2000 to 2007. Extrapolating this data for a 10 year span yields a flat rate reduction of 19.42% and an irrigated acres reduction of 14.06%.

The situation that represents the most challenging scenario in terms of future water demand uses data associated with a reduction in irrigated acres. As previously described, the base year irrigation water demand for the District is based on extrapolations of 1994 allocations, which totaled 3,456 acre-feet.

Table 2.17: HCMUD Demand and Supply Projections

Year	2000	2010	2020	2030	2040	2050	2060
Demand (acre-feet)	6,011	5,166	4,273	3,540	3,540	3,540	3,540
Supply (acre-feet)	2,080	2,178	2,157	2,138	2,120	2,101	2,083

Hidalgo County Water Control and Improvement District No. 18 (Monte Grande)
The results of the Irrigation District survey show a yearly average reduction in flat rate acreage of 1.94% and a yearly average reduction in irrigated acres of 1.41% during the span from 2000 to 2007. Extrapolating this data for a 10 year span yields a flat rate reduction of 19.42% and an irrigated acres reduction of 14.06%.

The situation that represents the most challenging scenario in terms of future water demand uses data associated with a reduction in irrigated acres. As previously described, the base year irrigation water demand for the District is based on allocations in 1994, which totaled 3,096 acre-feet.

Table 2.18: HCWCID18 Demand and Supply Projections

Year	2000	2010	2020	2030	2040	2050	2060
Demand (acre-feet)	5,505	4,731	3,913	3,242	3,242	3,242	3,242
Supply (acre-feet)	1,864	1,951	1,932	1,916	1,899	1,882	1,866

United Irrigation District of Hidalgo County (United)
The results of the Irrigation District survey show a yearly average reduction in flat rate acreage of 1.94% and a yearly average reduction in irrigated acres of 1.41% during the span from 2000 to 2007. Extrapolating this data for a 10 year span yields a flat rate reduction of 19.42% and an irrigated acres reduction of 14.06%.

The situation that represents the most challenging scenario in terms of future water demand uses data associated with a reduction in irrigated acres. As previously described, the base year irrigation water demand for the District is based on allocations in 1994, which totaled 25,548 acre-feet.

Table 2.19: UID Demand and Supply Projections

Year	2000	2010	2020	2030	2040	2050	2060
Demand (acre-feet)	64,464	55,402	45,821	37,966	37,966	37,966	37,966
Supply (acre-feet)	15,378	16,096	15,946	15,807	15,668	15,528	15,400

Hidalgo County Irrigation District No. 1 (Edinburg)
The results of the Irrigation District survey show a yearly average reduction in flat rate acreage of 1.99% and a yearly average reduction in irrigated acres of 4.40% during the span from 2000 to 2007. Extrapolating this data for a 10 year span yields a flat rate reduction of 19.86% and an irrigated acres reduction of 43.98%.

The situation that represents the most challenging scenario in terms of future water demand uses data associated with a reduction in flat rate acres. As previously described, the base year irrigation water demand for the District is based on allocations in 1994, which totaled 48,027 acre-feet.

Table 2.20: HCID1 Demand and Supply Projections

Year	2000	2010	2020	2030	2040	2050	2060
Demand (acre-feet)	85,615	68,611	51,121	36,812	36,812	36,812	36,812
Supply (acre-feet)	28,909	30,259	29,977	29,715	29,453	29,191	28,949

Cameron County Irrigation District No. 16 (Cameron #16)
The results of the Irrigation District survey show a yearly average reduction in flat rate acreage of 1.12% and a yearly average reduction in irrigated acres of 0.94% during the span from 2000 to 2007. Extrapolating this data for a 10 year span yields a flat rate reduction of 11.18% and an irrigated acres reduction of 9.39%.

The situation that represents the most challenging scenario in terms of future water demand uses data associated with a reduction in flat rate acres. As previously described, the base year irrigation water demand for the District is based on allocations in 1994, which totaled 2,133 acre-feet.

Table 2.21: CCID16 Demand and Supply Projections

Year	2000	2010	2020	2030	2040	2050	2060
Demand (acre-feet)	3,773	3,419	3,024	2,677	2,677	2,677	2,677
Supply (acre-feet)	1,285	1,310	1,297	1,286	1,274	1,262	1,252

Cameron County Irrigation District Cameron County No. 3 (LaFeria)
The results of the Irrigation District survey show a yearly average reduction in flat rate acreage of 0.69% during the span from 2000 to 2007. Extrapolating this data for a 10 year span yields a flat rate reduction of 6.91%.

The situation that represents the most challenging scenario in terms of future water demand uses data associated with a reduction in flat rate acres. As previously described, the base year irrigation water demand for the District is based on allocations in 1994, which totaled 66,344acre-feet.

Table 2.22: CCID3 Demand and Supply Projections

Year	2000	2010	2020	2030	2040	2050	2060
Demand (acre-feet)	74,898	69,722	63,795	58,419	58,419	58,419	58,419
Supply (acre-feet)	39,959	40,738	40,349	39,987	39,626	39,265	38,931

Cameron County Irrigation District Cameron County No. 4 (Santa Maria)
The results of the Irrigation District survey show a yearly average reduction in flat rate acreage of 0.37% during the span from 2000 to 2007. Extrapolating this data for a 10 year span yields a flat rate reduction of 3.68%.

The situation that represents the most challenging scenario in terms of future water demand uses data associated with a reduction in flat rate acres. As previously described, the base year irrigation water demand for the District is based on allocations in 1994, which totaled 9,159 acre-feet.

Table 2.23: CCID4 Demand and Supply Projections

Year	2000	2010	2020	2030	2040	2050	2060
Demand (acre-feet)	9,098	8,763	8,367	7,992	7,992	7,992	7,992
Supply (acre-feet)	5,516	5,624	5,570	5,520	5,471	5,421	5,375

Valley Acres Irrigation District (Valley Acres)
The results of the Irrigation District survey show a yearly average increase in flat rate acreage of 0.02% during the span from 2000 to 2007. Extrapolating this data for a 10 year span yields a flat rate increase of 0.24%.

The situation that represents the most challenging scenario in terms of future water demand uses data associated with a reduction in flat rate acres. As previously described, the base year irrigation water demand for the District is based on extrapolations of 1994 allocations, which totaled 17,223 acre-feet.

Table 2.24: VAID Demand and Supply Projections

Year	2000	2010	2020	2030	2040	2050	2060
Demand (acre-feet)	15,150	15,187	15,233	15,278	15,278	15,278	15,278
Supply (acre-feet)	10,373	10,576	10,475	10,381	10,287	10,193	10,106

Bayview Irrigation District No. 11(Bayview)
The results of the Irrigation District survey show a yearly average reduction in flat rate acreage of 1.12% and a yearly average reduction in irrigated acres of 0.94% during the span from 2000 to 2007. Extrapolating this data for a 10 year span yields a flat rate reduction of 11.18% and an irrigated acres reduction of 9.39%.

The situation that represents the most challenging scenario in terms of future water demand uses data associated with a reduction in irrigated acres. As previously described, the base year irrigation water demand for the District is based on allocations in 1994, which totaled 10,835 acre-feet.

Table 2.25: Bayview ID Demand and Supply Projections

Year	2000	2010	2020	2030	2040	2050	2060
Demand (acre-feet)	17,478	15,836	14,006	12,402	12,402	12,402	12,402
Supply (acre-feet)	6,526	6,653	6,590	6,531	6,472	6,413	6,358

Hidalgo County Water Irrigation District No. 3 (McAllen #3)
The results of the Irrigation District survey show a yearly average reduction in flat rate acreage of 1.99% and a yearly average reduction in irrigated acres of 4.40% during the span from 2000 to 2007. Extrapolating this data for a 10 year span yields a flat rate reduction of 19.86% and an irrigated acres reduction of 43.98%.

The situation that represents the most challenging scenario in terms of future water demand uses data associated with a reduction in flat rate acres. As previously described, the base year irrigation water demand for the District is based on allocations in 1994, which totaled 6,246 acre-feet.

Table 2.26: HCID3 Demand and Supply Projections

Year	2000	2010	2020	2030	2040	2050	2060
Demand (acre-feet)	9,752	7,815	5,823	4,193	4,193	4,193	4,193
Supply (acre-feet)	3,760	3,935	3,899	3,864	3,830	3,796	3,765

External Factors Influencing Future Irrigation Water Demands

The major crops grown in the Region include corn, grain sorghum, cotton, sugarcane, and citrus. External factors are at play when attempting to predict future planting scenarios and subsequent water demands. Urbanization plays a major role in determining future demand. This impact can be quantified based on previous rates of urbanization (loss of flat-rate acres and loss of irrigated acres). However, there are a number of factors that cannot be accurately quantified and are therefore not included in the demand projections. Even though these factors were not specifically analyzed, the potential impacts deserve discussion.

For one, climate change could lead to changes in the amount of rainfall in the Region. This, in turn, would lead to a change in the amount of irrigation water needed to produce an equivalent crop yield. In addition, the types of crops planted could be modified based on changes to the overall climate to better utilize rainfall and optimize the use of delivered irrigation water[1].

Second, crop schedules could be modified based on improvements to the irrigation conveyance system. As improvements are made, the delivery efficiency of the system will increase. The potential impact of this is two-fold. First, increasing delivery efficiencies could allow the District to pump less water at the Rio Grande while maintaining status quo water deliveries. Second, increasing efficiencies could allow the District to pump the same amount of water at the River and deliver higher quantities of water to the end user. Under the first scenario, it is not anticipated that changes to the types of crops grown throughout the District would change.
However, the second scenario provides a different impact. Increasing the amount of water delivered to the grower will allow them to modify their crop type to maximize yield with the water available. The result could be the planting of higher water using crops such as sugarcane or citrus.

The third factor impacting future planting scenarios is the potential increase in energy costs. Rising fossil fuel prices increase chemical costs, fertilizer costs, and tractor operation costs. In addition, higher gasoline/diesel costs could raise the prices that people will pay for ethanol from corn. These potential impacts could be offset by the implementation of reusable and clean energy (wind, solar, tide, wave, etc.). Regardless, rising fuel costs cut into farmers' profits.[2] This in turn can lead to changes in farming technologies which could significantly impact the types of crops being grown and the amount of water used.

Fourth, changes to crop subsidies, crop prices, and overall changes to the type of crop being planted which would have a direct impact on water requirements. Historical crop planting schedules were analyzed in order to determine county wide trends. Figures 1, 2, 3, and 4 show crop planting trends for corn, cotton, grain sorghum, and sugarcane. Data

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[1] Doria, R.; Madramootoo, C.A.; Mehdi, B.B. - 2007
[2] Parker, Randall - 2008

was obtained from United States Department of Agriculture – National Agriculture Statistics Service, and the data spans a timeframe from 1970 to 2007.

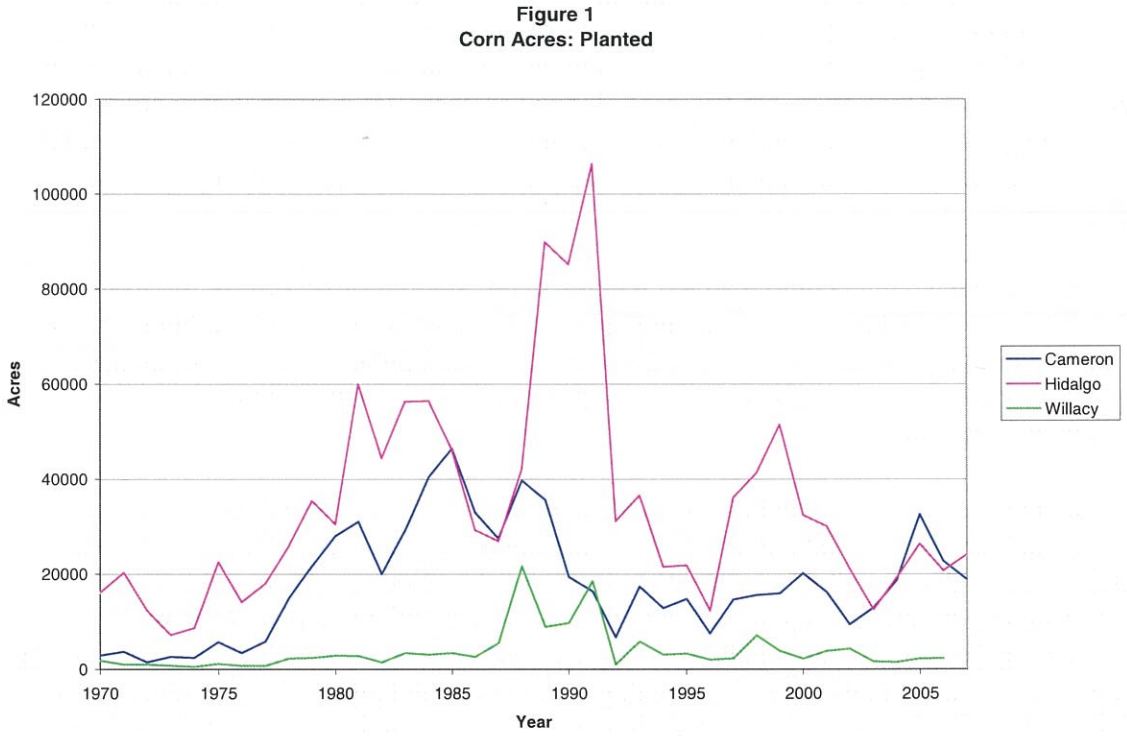

Figure 1: Corn Acres: Planted

As can be seen in Figure 1, the rate of planting corn in the three county area peaked from the mid-1980's until the early 1990's. Beginning in the early 1990's, a general downward trend in planted acreage can be seen. However, in the past few years, an increased interest in ethanol production has caused an upward trend in corn planting[3].

[3] Conversation with Ray Pruett, January 27, 2009

Figure 2
Cotton Acres: Planted (Irrigated)

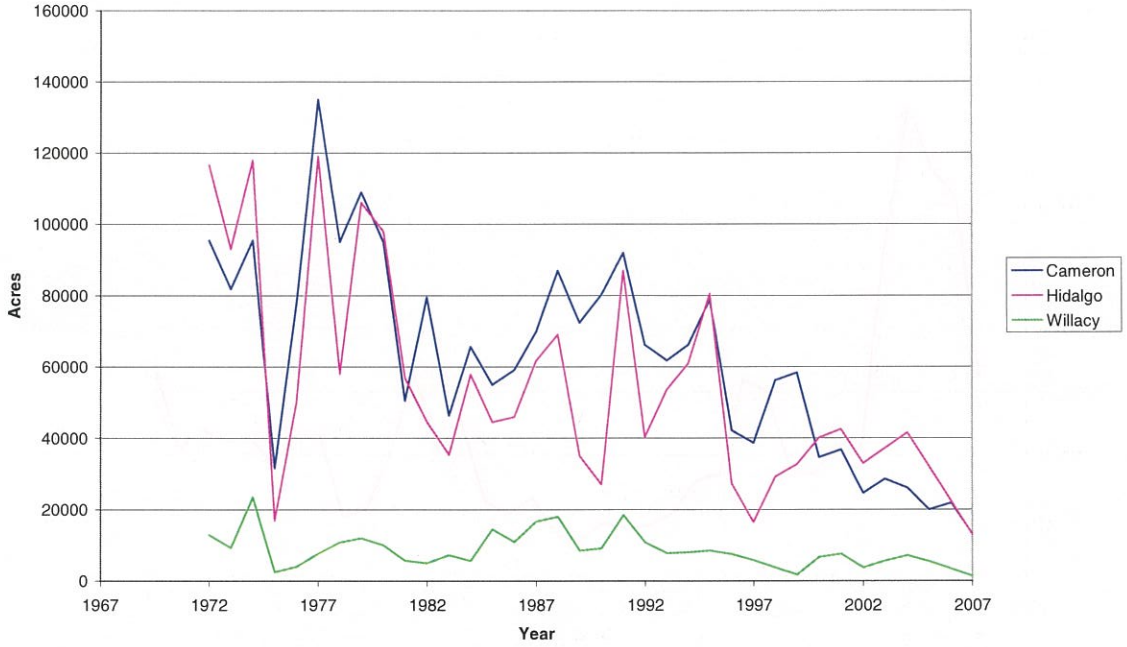

Figure 2: Cotton Acres: Planted (Irrigated)

Figure 2 shows the historical planting schedule of cotton for acreage that is irrigated. The graph shows a fairly consistent downward trend in cotton acreage beginning in the early 1970's and continuing to present.

Figure 3
Grain Sorghum Acres: Planted (Irrigated)

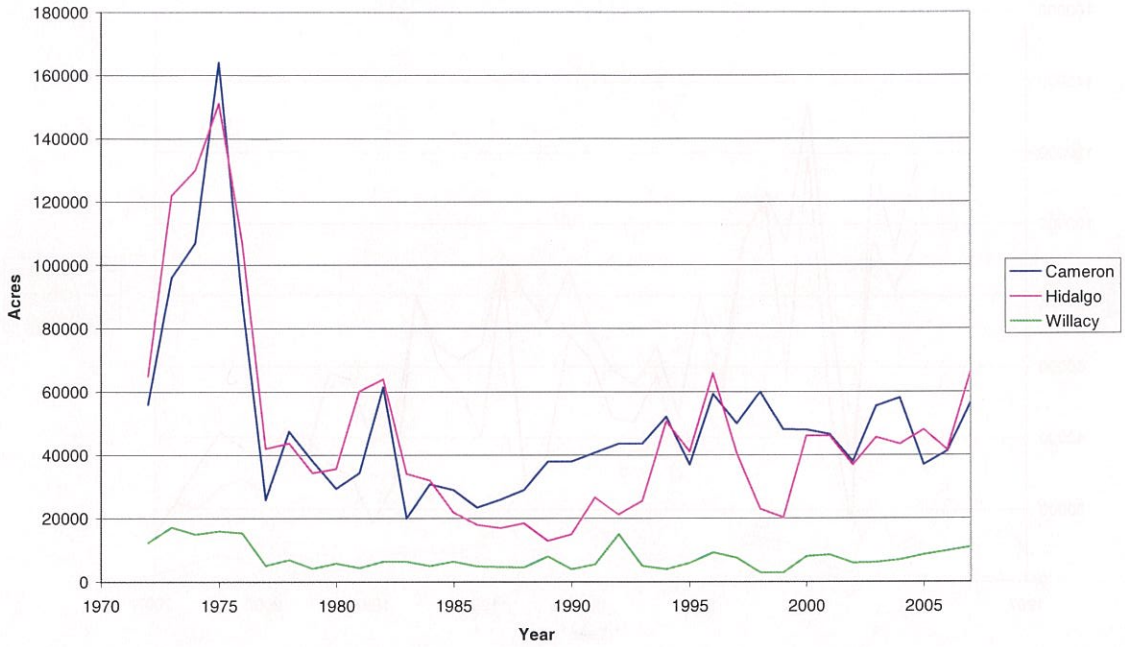

Figure 3: Grain Sorghum Acres: Planted (Irrigated)

Figure 3 shows the historical planting schedule of grain sorghum that is irrigated. After a sharp decline in acreage in the mid-1970's, the rate of sorghum planting has steadily increased.

Figure 4
Sugarcane Acres: Harvested

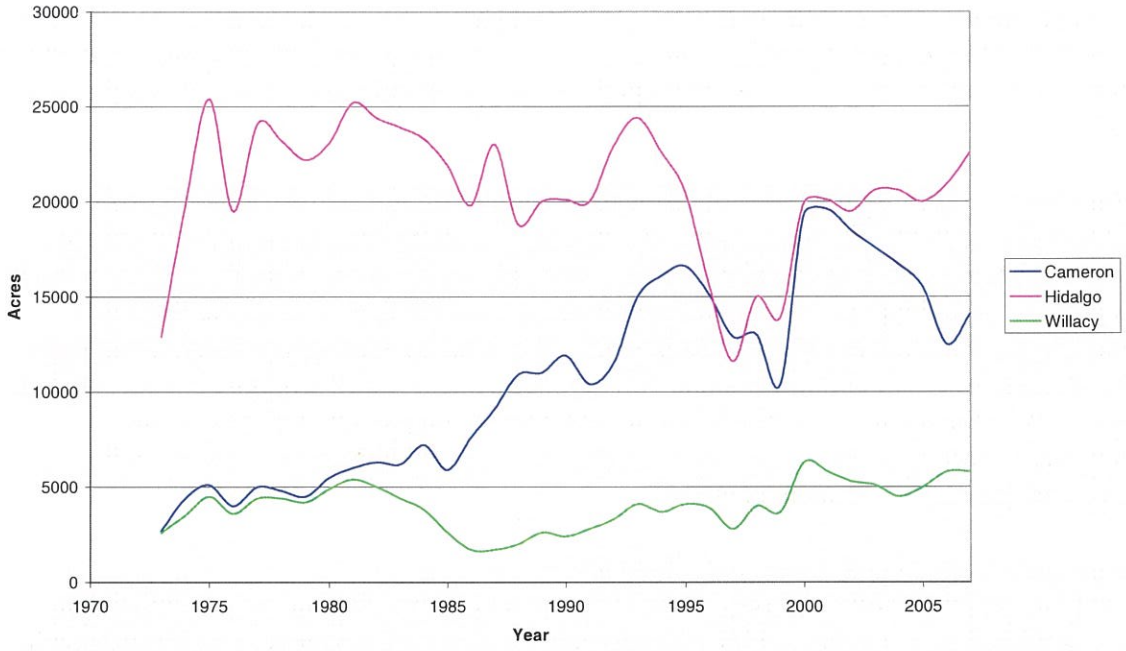

Figure 4: Sugarcane Acres: Harvested

The data represented in Figure 4 represents historical trends in sugarcane harvest in the three county area. The only recognizable trend in sugarcane acreage is for Cameron County which has seen a steady increase in sugarcane production. Hidalgo and Willacy counties have seen fairly steady sugarcane harvests.

The strongest trend in crop planting is a shift from cotton to grain sorghum. This historical trend is expected to continue in the near future due to a number of external factors including rainfall and urbanization. The impact of such a paradigm shift impacts irrigation water deliverers due to a change in water requirements for the crops[4]. It has been reported that the recommended evapotranspiration rate for cotton is 30.0 inches while the recommended evapotranspiration rate for grain sorghum is 20.2 inches[5]. Therefore, as the shift from cotton to sorghum continues, so does the water demand exerted on the irrigation conveyance systems.

The final factor that could impact future irrigation water demands is directly tied into the rate of urbanization. As is the case in many Irrigation Districts, small parcels of land are excluded from the District due to development. Many times this parcel of land is surrounded by acreage that continues to be irrigated. In other instances, land that is irrigable may be completely surrounded by urbanized acreage.

[4] Conversation with Ray Pruett and Luis Rededa – January 27, 2009
[5] Enciso, Juan, Ph.D., P.E. – Irrigation in the Lower Rio Grande Valley of Texas

On the more conservative side, these changes may result in changes to crop due to the inability to apply proper pesticide to the land (i.e. Since cotton requires more pesticide which is traditionally applied aerially, the presence of subdivisions or other cases or urbanization results in the inability to aerially apply pesticide. Therefore, a change in crop may be necessary. This will have a direct impact in the water demand on that parcel of land.[6]). On the more aggressive side, these changes may result in the inability to apply irrigation water to land that is undeveloped due to the surrounding presence of urbanized land.

Ultimately, modifying the types of crops planted throughout each Irrigation District depend on a cost/benefit correlation. In other words, if the grower could increase the amount of money they make off of a parcel of land, or reduce the amount of money being spent to plant and harvest a crop, without making vast changes to the water delivery mechanism, different crops could be planted. It cannot be argued that future conditions will change based on climate change, conveyance system improvements, changes to fuel prices, and changes in crop schedules, but the extent of these impacts cannot be accurately quantified due to the relative difficulty of predicting when changes will take place and the impact of such changes.

Irrigation District Boundaries and City Boundaries

Additional information was collected associated with population growth in cities that have intersecting boundaries with irrigation districts. Aerial imagery was overlaid with GIS shapefiles. Irrigation District and City boundaries were overlayed on these maps. These maps can be found in Appendix D as well as in the Digital Appendices. The file in the Digital Appendices is named 'Irrigation District and City Boundaries'. Census data was then obtained for all cities that have a portion of their boundaries inside of an irrigation district's boundary.

It was quickly realized that information obtained from this analysis could not be used to extrapolate the rate of urbanization of irrigation districts. After discussions with multiple utility general managers, it was learned that population growth does not correlate directly to the loss of irrigable acres. In many instances, population growth occurs in areas that are not irrigable. Therefore, there is no net impact to a District's irrigable acreage. Without being able to tie together population growth of cities to loss of irrigable acreage, there isn't a proper way to tie together population growth of cities to a loss of irrigation water demand for individual irrigation districts.

Even though this is the case, the data obtained does provide pertinent information as to the potential future case of increased municipal water demands that may require additional conveyance of raw water through the irrigation district's conveyance system.

[6] Conversation with Ray Pruett – January 27, 2009

Table 2.27: City populations that intersect with Irrigation District boundaries

Irrigation District Name and Associated Cities	Census Population Data			Projected Yearly Growth Rate 2000-2010 (State Water Plan)
	1990	2000	2008	
HCID 6				
Palmview	1,818	4,107	5,502	24%
Alton	3,069	4,384	11,523	18.15%
Mission	28,653	45,408	67,119	3.47%
Penitas	n/a	1,167	1,181	0.29%
United				
Alton	3,069	4,384	11,523	18.15%
Palmhurst	326	4,872	4,988	8.77%
Mission	28,653	45,408	67,119	3.47%
McAllen	84,021	106,414	129,776	1.98%
HCID 1				
Edinburg	29,885	48,465	71,520	3.37%
McAllen	84,021	106,414	129,776	1.98%
Santa Cruz				
Edinburg	29,885	48,465	71,520	3.37%
HCWID3				
Hidalgo	3,292	7,322	11,984	5.17%
McAllen	84,021	106,414	129,776	1.98%
HCID2				
Hidalgo	3,292	7,322	11,984	5.17%
Pharr	32,921	46,660	65,258	2.77%
San Juan	10,815	26,229	33,970	4.90%
Alamo	8,210	14,760	16,608	4.17%
Edinburg	29,885	48,465	71,520	3.37%
Donna				
Donna	12,652	14,768	17,094	2.10%
Alamo	8,210	14,760	16,608	4.17%
HCCID9				
Elsa	5,242	5,549	6,624	0.52%
Edcouch	2,878	3,342	4,613	1.30%
La Villa	1,388	1,305	1,434	0%
Weslaco	21,877	26,935	33,354	1.46%
Mercedes	12,694	13,649	15,131	0.66%
La Feria	4,360	6,115	7,023	3.01%

Delta Lake				
Raymondville	8,880	9,733	9,522	0.35%
La Feria				
Santa Rosa	2,223	2,833	3,152	2.26%
Combes	2,042	2,553	2,845	2.10%
La Feria	4,360	6,115	7,023	3.01%
Primera	2,030	2,723	4,230	2.67%
Adams Garden				
Harlingen	48,735	57,564	64,843	1.61%
Primera	2,030	2,723	4,230	2.67%
Harlingen				
Harlingen	48,735	57,564	64,843	1.61%
Combes	2,042	2,553	2,845	2.10%
Rangerville	280	203	n/a	n/a
Los Indios	n/a	1,149	1,227	2.34%
Rio Hondo	1,793	1,942	2,128	0.80%
Palm Valley	1,199	1,298	1,262	0.80%
Primera	2,030	2,723	4,230	2.67%
CCID2				
Rio Hondo	1,793	1,942	2,128	0.80%
San Benito	20,125	23,444	25,072	1.48%
Los Indios	n/a	1,149	1,227	2.34%
Harlingen	48,735	57,564	64,843	1.61%
Indian Lake	390	541	559	2.92%
Los Fresnos	2,473	4,512	5,538	4.74%
Rancho Viejo	885	1,754	1,847	5.19%
CCWID16				
Rancho Viejo	885	1,754	1,847	5.19%
BID				
Brownsville	98,962	139,722	175,494	2.45%
Bayview				
Bayview	231	323	535	n/a
Brownsville	98,962	139,722	175,494	2.45%
HCWID5				
Progreso	n/a	4,851	5,511	3.09%
Progreso Lakes	154	234	266	n/a

Existing Conveyance System

Methodology

As previously mentioned, each Irrigation District was asked to complete a survey that inquired about a number of District specific items. Of these items, each District was asked to furnish information pertaining to miles of canal (earthen and unlined) and miles of pipeline. This information was to be used to update information from previous Region M Regional Water Plans. In turn, the data was to be used to determine potential areas of conveyance losses. The following table represents the survey results:

Table 2.28: Survey results for Irrigation District Conveyance System

District Name	Earthen Canal	Lined Canal	Pipeline
	Miles	Miles	Miles
Hidalgo and Cameron Counties Irrigation #9	20	50	250
Adams Garden Irrigation District	8.5	15.8	45
Brownsville Irrigation District	0.5		284
Cameron County Irrigation District No. 6	100	25	25
Donna Irrigation District, Hidalgo County No. 1	4.3	87.7	88
Delta Lake Irrigation District	420	250	122
Hidalgo Co. Irrigation District No. 13	1.6	0	3.8
Hidalgo Co. Irrigation District No. 2	43.5	21.04	226.72
Hidalgo Co. Irrigation District No. 6	0.53	45.41	72.29
HCWC ID No. 19	4	2.5	18
Harlingen Irrigation District	40	15	200

As can be seen, overwhelming majority of Irrigation District's did not respond to this portion of the survey. Therefore, the response to the surveys was such that a detailed analysis of each Irrigation District's conveyance system cannot be determined with the information made available. However, information was obtained in which the main irrigation distribution system network for each District was given. Maps showing the main conveyance system for each irrigation district can be found in Appendix E as well as in the Digital Appendices. The map in the Digital Appendices can be used to view the conveyance system in more detail. The file in the Digital Appendices is named 'Irrigation District Conveyance Systems'. Information pertaining to the miles of canals and pipeline was obtained from Fipps 2005.

Table 2.29: Main Irrigation Distribution Network

Main Irrigation Distribution Network	Canals miles	Pipeline Miles	Total miles	Canal:Pipeline
Adams Garden	21.49	2.01	23.5	10.7 :1
Bayview	14.06	0.43	14.49	32.7 :1
Brownsville	2.36	31.08	33.44	0.1 :1
San Benito	108.52	0.74	109.26	146.6 :1
Los Fresnos	41.82	0	41.82	1 :0
Rutherford-Harding	4.67	1.84	6.51	2.5 :1
Cameron 16	3.51	0	3.51	1.0 :0
Delta Lake	69.43	7.71	77.14	9.0 :1
Donna	32.49	0.8	33.29	40.6 :1
Engleman Gardens	12.43	5.7	18.13	2.2 :1
Mercedes	71.8	2.74	74.54	26.2 :1
Harlingen	52.78	7.65	60.43	6.9 :1
Edinburg	35.54	24.37	59.91	1.5 :1
McAllen 3	9.7	3.67	13.37	2.6 :1
Baptist Seminary	0	4.61	4.61	0.0 :1
HCID14	0	0	0	0.0 :0
Mission 16	15.17	2.25	17.42	6.7 :1
Monte Grande	0	0	0	0.0 :0
San Juan	37.5	50.48	87.98	0.7 :1
Progreso	0.8	20.54	21.34	0.0 :1
Mission 6	19.42	0	19.42	1.0 :0
Sharyland Plantation	4.58	0	4.58	1.0 :0
LaFeria	43.74	4.02	47.76	10.9 :1
Meaverick	120.86	0	120.86	1.0 :0
Santa Cruz	34.06	4.58	38.64	7.4 :1
Santa Maria	2.92	0	2.92	1.0 :0
United	29.11	5.9	35.01	4.9 :1
Valley Acres	5.66	10.29	15.95	0.6 :1
Average				11.4 :.75

It should be noted that the information contained in the above table is only for the main irrigation distribution network and does not include the lengths of canals and pipeline on the secondary and tertiary distribution systems for each District. Regardless, the majority of flow is transported through the main canal distribution system. Therefore, a good understanding of conveyance methods can be established. There are inherent disadvantages in using Fipps 2005 data to analyze individual irrigation district conveyance efficiencies. For instance, each individual irrigation district has a certain

percentage of conveyance that is made up of open canals and pipelines. Therefore, using a county-wide or region-wide value to estimate conveyance efficiencies is erroneous. In turn, it has been decided to use the Fipps 2005 estimate for region-wide conveyance efficiency to serve as a basis for the evaluation of individual irrigation district's efficiencies.

In terms of overall conveyance efficiency, it is estimated that county-wide conveyance efficiencies are as follows:

- Cameron County – 68%
- Willacy County – 70%
- Hidalgo County – 71%

(source: Fipps 2005)

Conveyance efficiency is a measure of the amount of water delivered to the end user when compared to the amount of water pumped from the Rio Grande to serve that user. Water loss can typically occur in one of four areas: seepage, evaporation, spill, or management. For the purpose of this investigation, seepage is defined as water lost through the wetted perimeter of a canal or pipeline. Evaporation is defined as water lost through the conversion from liquid to vapor. Spill is defined as water lost over canal banks or through canal overflow structures. Management is made up of multiple areas including water accounting, flow measurement, water routing, and any other area that operations could benefit conveyance.

Information on conveyance efficiency was polled from each Irrigation District. However, it was discovered that only a few kept suitable information necessary to accurately determine losses. The following table represents the best information available in terms of overall conveyance efficiency for each irrigation district:

Table 2.30: Reported, County, and Region Irrigation District Conveyance Efficiencies

District Name	Reported efficiency	County Efficiency	Regional Efficiency
Adams Garden		68.0%	69.7%
Bayview		68.0%	69.7%
Brownsville		68.0%	69.7%
San Benito		68.0%	69.7%
Los Fresnos	87%	68.0%	69.7%
Rutherford-Harding		68.0%	69.7%
Cameron 16		68.0%	69.7%
Delta Lake	66%	70.6%	69.7%
Donna	75%	71.0%	69.7%
Engleman Gardens		71.0%	69.7%
Mercedes		69.9%	69.7%
Harlingen		68.0%	69.7%
Edinburg	70%	71.0%	69.7%
McAllen 3		71.0%	69.7%
Baptist Seminary		71.0%	69.7%
HCID14		71.0%	69.7%
Mission 16		71.0%	69.7%
Monte Grande		71.0%	69.7%
San Juan	87.7%	71.0%	69.7%
Progreso		71.0%	69.7%
Mission 6	95%	71.0%	69.7%
Sharyland Plantation		71.0%	69.7%
LaFeria		68.0%	69.7%
Santa Cruz		71.0%	69.7%
Santa Maria		68.0%	69.7%
United		71.0%	69.7%
Valley Acres		70.6%	69.7%

There are uncertainties in these estimates. Where Irrigation District's have reported conveyance efficiencies, a thorough analysis was performed on how the figures were obtained. It was discovered that each District uses a different formula for determining efficiency. For instance, some District's evaluate efficiency by calculating the number of irrigated acreage and the amount of water pumped at the river. By dividing acres irrigated by acre feet of water diverted, they arrive at an efficiency. This method does not consideration the amount of water used for irrigation nor does it include the amount of water diverted vs. the amount of water delivered to all users. Other Irrigation Districts include a much more comprehensive evaluation by taking into consideration water diverted and water deliveries to all users including irrigation and municipal. This method does provide an accurate determination of conveyance efficiency. However, not all District's have the capability to accurately measure on-farm deliveries. Even further, many District's don't have the ability to measure smaller water users who divert water from the conveyance system for purposes such as yard watering. In terms of county and regional efficiencies, using only the length of open canals and pipelines does not take into consideration the relative state of each canal or pipeline.

A new, well constructed earthen canal located in a high clay soil area will have much less water loss when compared to an old canal located in a loamy soil. In addition, the age of pipeline has a significant impact on conveyance efficiencies. Older pipelines are more prone to settling and joint leakage when compared to new installations. Other areas of uncertainty are the methods in which individual Irrigation Districts report their efficiency. The need for on-farm meters to be highly accurate is paramount to obtaining an accurate conveyance efficiency. Also, the maintenance schedule of meter calibration, repair, and replacement at the main pumping plant as well as the end user is unknown. Calculating conveyance efficiency without direct and specific input from each District can lead to significant errors due to unknown water management techniques, canal spillage, leaky gates/checks, and other unaccounted for water. In many irrigation districts, small yard watering taps are connected to the conveyance system. The amount of water used is not metered. Finally, many Irrigation District's reported efficiencies do not take into consideration no-charge pumping. This can significantly skew any reported efficiencies.

Therefore, county-wide estimated conveyance efficiencies as prepared by Fipps 2005 shall be used for each irrigation district.

Important Note: Using county-wide estimates to qualify individual Irrigation District conveyance system efficiencies does not represent an accurate scenario. Each District has a wide range of conveyance methods including open canals, pipelines, lined canals, and storage. In addition, the age of infrastructure plays a significant role in the efficiency of conveyance. Therefore, this analysis does not represent actual conveyance efficiencies. However, it does represent the best available quantifiable analysis of efficiency.

In addition to information pertaining to the conveyance system, information was gathered on the storage of each District. Information pertaining to storage surface area was adapted from Fipps 2005.

Table 2.31: Reservoir and Resaca Evaporation Losses

	Reservoir	Resaca	Evaporation	Losses
	acres	acres	ft	acre-feet/yr
Bayview	0	0	7	0
Brownsville	0	531	7	3717
San Benito	530	320	7	5950
Los Fresnos	0	1130	7	7910
Cameron 16	165	0	7	1155
Delta Lake	0	0	7	0
Donna	0	0	7	0
Engelman Gardens	60	0	7	420
Mercedes	750	0	7	5250
Harlingen	160	0	7	1120
Edinburg	0	0	7	0
Baptist Seminary	0	0	7	0
San Juan	350	0	7	2450
Mission 6	175	0	7	1225
Monte Grande	0	0	7	0
McAllen 3	0	0	7	0
Progresso	48	0	7	336
La Feria	0	0	7	0
Santa Cruz	0	0	7	0
United	0	0	7	0
Valley Acres	325	0	7	2275
Adams Garden	470	0	7	3290
Rutherford-Harding	0	0	7	0
Santa Maria	0	0	7	0
Mission 16	500	0	7	3500

An evaporation rate of 84 inches (7 feet) per year was utilized based on data from several local reservoirs (Reclamation 2003). Multiplying the surface area of each reservoir and resaca by 7 feet gives a yearly estimation of evaporation losses (acre-feet/year). The surface area data in the above table is only for those reservoirs/resacas in which the storage surface area and volume were known as indicated in Fipps 2005. Therefore, it is not an all-inclusive evaluation but does give an indication of expected losses due to evaporation.

Results

Cameron County Irrigation District No. 2 (San Benito)

The District's conveyance system is predominantly open canals. It was estimated that the average conveyance efficiency for all irrigation districts is 69.7%. For Cameron County as a whole, the average conveyance efficiency is reported at 68% (Fipps 2005). Therefore, it is estimated that the conveyance efficiency of the District is 68%.

Furthermore, it is estimated that the District is losing 5,950 acre-feet/year due to evaporation from reservoirs and resacas.

In addition to irrigation water users, the District provides raw water to the cities of San Benito and Rio Hondo as well as East Rio Hondo Water Supply Corporation.

Brownsville Irrigation District (Brownsville)
The District's conveyance system is predominantly pipelines. It was estimated that the average conveyance efficiency for all irrigation districts is 69.7%. For Cameron County as a whole, the average conveyance efficiency is reported at 68% (Fipps 2005). Therefore, it is estimated that the conveyance efficiency of the District is 68%. Furthermore, it is estimated that the District is losing 3,717 acre-feet/year due to evaporation from reservoirs and resacas.

In addition to irrigation water users, the District provides raw water to El Jardin WSC, Aqua SUD, and the City of McAllen.

Harlingen Irrigation District No. 1 (Harlingen)
The District's conveyance system has a higher percentage of open canals than pipelines. It was estimated that the average conveyance efficiency for all irrigation districts is 69.7%. For Cameron County as a whole, the average conveyance efficiency is reported at 68% (Fipps 2005). Therefore, it is estimated that the conveyance efficiency of the District is 68%. Furthermore, it is estimated that the District is losing 1,120 acre-feet/year due to evaporation from reservoirs and resacas.

In addition to irrigation water users, the District provides raw water to the cities of Harlingen, Combes, and Palm Valley.

Cameron County Irrigation District #6 (Los Fresnos)
The District's conveyance system is predominantly open canal. It was estimated that the average conveyance efficiency for all irrigation districts is 69.7%. For Cameron County as a whole, the average conveyance efficiency is reported at 68% (Fipps 2005). Therefore, it is estimated that the conveyance efficiency of the District is 68%. Furthermore, it is estimated that the District is losing 7,910 acre-feet/year due to evaporation from reservoirs and resacas.

In addition to irrigation water users, the District provides raw water to the cities of Los Fresnos and Olmito as well as to the Brownsville PUB.

Hidalgo and Cameron Counties Irrigation District No. 9 (Mercedes)
The District's conveyance system is predominantly open canal. It was estimated that the average conveyance efficiency for all irrigation districts is 69.7%. The District has acreage in both Cameron (4%) and Hidalgo Counties (96%). The weighted average using Fipps 2005 figures is 69.9%. Therefore, it is estimated that the conveyance efficiency of the District is 69.9%. Furthermore, it is estimated that the District is losing 5,250 acre-feet/year due to evaporation from reservoirs and resacas.

In addition to irrigation water users, the District provides raw water to the cities of La Villa, Mercedes, Elsa, Weslaco, and Edcouch as well as to North Alamo WSC.

Delta Lake Irrigation District (Delta Lake)
The District's conveyance system is predominantly open canals. It was estimated that the average conveyance efficiency for all irrigation districts is 69.7%. The District has acreage in both Willacy (43%) and Hidalgo Counties (57%). The weighted average using Fipps 2005 figures is 70.6%. Therefore, it is estimated that the conveyance efficiency of the District is 70.6%.

In addition to irrigation water users, the District provides raw water to the cities of Lyford, Raymondville, LaSara, Monte Alto, and Hargill as well as to North Alamo WSC.

Hidalgo County Improvement District No. 19 (Sharyland Plantation)
The District's conveyance system is predominantly open canals. It was estimated that the average conveyance efficiency for all irrigation districts is 69.7%. For Hidalgo County as a whole, the average conveyance efficiency is reported at 71% (Fipps 2005). Therefore, it is estimated that the conveyance efficiency of the District is 71%.

The District only provides water to irrigators.

Adams Gardens Irrigation District No. 19 (Adams Garden)
The District's conveyance system is predominantly open canals. It was estimated that the average conveyance efficiency for all irrigation districts is 69.7%. For Cameron County as a whole, the average conveyance efficiency is reported at 68% (Fipps 2005). Therefore, it is estimated that the conveyance efficiency of the District is 68%.

The District only provides water to irrigators.

Donna Irrigation District No. 2 (Donna)
The District's conveyance system is predominantly open canals. It was estimated that the average conveyance efficiency for all irrigation districts is 69.7%. For Hidalgo County as a whole, the average conveyance efficiency is reported at 71% (Fipps 2005). Therefore, it is estimated that the conveyance efficiency of the District is 71%.

In addition to irrigation water users, the District provides raw water to the City of Donna as well as to North Alamo WSC.

Hidalgo County Irrigation District No. 2 (San Juan)
The District's conveyance system is predominantly pipelines. It was estimated that the average conveyance efficiency for all irrigation districts is 69.7%. For Hidalgo County as a whole, the average conveyance efficiency is reported at 71% (Fipps 2005). Therefore, it is estimated that the conveyance efficiency of the District is 71%. Furthermore, it is estimated that the District is losing 2,450 acre-feet/year due to evaporation from reservoirs and resacas.

In addition to irrigation water users, the District provides raw water to the cities of McAllen, Pharr, San Juan, Alamo, and Edinburg as well as to North Alamo WSC.

Hidalgo County Irrigation District No. 6 (Mission #6)
The District's conveyance system is predominantly open canals. It was estimated that the average conveyance efficiency for all irrigation districts is 69.7%. For Hidalgo County as a whole, the average conveyance efficiency is reported at 71% (Fipps 2005). Therefore, it is estimated that the conveyance efficiency of the District is 71%. Furthermore, it is estimated that the District is losing 1,225 acre-feet/year due to evaporation from reservoirs and resacas.

In addition to irrigation water users, the District provides raw water to Aqua SUD.

Santa Cruz Irrigation District No. 15 (Santa Cruz)
The District's conveyance system is predominantly open canals. It was estimated that the average conveyance efficiency for all irrigation districts is 69.7%. For Hidalgo County as a whole, the average conveyance efficiency is reported at 71% (Fipps 2005). Therefore, it is estimated that the conveyance efficiency of the District is 71%.

In addition to irrigation water users, the District provides raw water to North Alamo WSC.

Engleman Irrigation District (Engleman)
The District's conveyance system is predominantly open canals. It was estimated that the average conveyance efficiency for all irrigation districts is 69.7%. For Hidalgo County as a whole, the average conveyance efficiency is reported at 71% (Fipps 2005). Therefore, it is estimated that the conveyance efficiency of the District is 71%. Furthermore, it is estimated that the District is losing 420 acre-feet/year due to evaporation from reservoirs and resacas.

In addition to irrigation water users, the District provides raw water to North Alamo WSC.

Hidalgo County Irrigation District No. 5 (Progreso)
The District's conveyance system is predominantly pipelines. It was estimated that the average conveyance efficiency for all irrigation districts is 69.7%. For Hidalgo County as a whole, the average conveyance efficiency is reported at 71% (Fipps 2005). Therefore, it is estimated that the conveyance efficiency of the District is 71%. Furthermore, it is estimated that the District is losing 336 acre-feet/year due to evaporation from reservoirs and resacas.

The District only serves water to irrigation users.

Hidalgo County Irrigation District No. 13 (Baptist Seminary)
The District's conveyance system is predominantly pipelines. It was estimated that the average conveyance efficiency for all irrigation districts is 69.7%. For Hidalgo County as a whole, the average conveyance efficiency is reported at 71% (Fipps 2005). Therefore, it is estimated that the conveyance efficiency of the District is 71%.

The District only serves water to irrigation users.

Hidalgo County Irrigation District No. 16 (Mission #16)
The District's conveyance system is predominantly open canals. It was estimated that the average conveyance efficiency for all irrigation districts is 69.7%. For Hidalgo County as a whole, the average conveyance efficiency is reported at 71% (Fipps 2005). Therefore, it is estimated that the conveyance efficiency of the District is 71%. Furthermore, it is estimated that the District is losing 3,500 acre-feet/year due to evaporation from reservoirs and resacas.

In addition to irrigation water users, the District provides raw water to Aqua SUD and the City of LaJoya.

Hidalgo County Water Control and Improvement District No. 18 (Monte Grande)
No data was provided for the District's conveyance system. It was estimated that the average conveyance efficiency for all irrigation districts is 69.7%. For Hidalgo County as a whole, the average conveyance efficiency is reported at 71% (Fipps 2005). Therefore, it is estimated that the conveyance efficiency of the District is 71%.

The District only delivers water to irrigation users.

United Irrigation District (United)
The District's conveyance system is predominantly open canals. It was estimated that the average conveyance efficiency for all irrigation districts is 69.7%. For Hidalgo County as a whole, the average conveyance efficiency is reported at 71% (Fipps 2005). Therefore, it is estimated that the conveyance efficiency of the District is 71%.

In addition to irrigation water users, the District provides raw water to the cities of Mission and McAllen as well as to Sharyland WSC.

Hidalgo County Irrigation District No. 1 (Edinburg)
The District's conveyance system is predominantly open canals. It was estimated that the average conveyance efficiency for all irrigation districts is 69.7%. For Hidalgo County as a whole, the average conveyance efficiency is reported at 71% (Fipps 2005). Therefore, it is estimated that the conveyance efficiency of the District is 71%.

In addition to irrigation water users, the District provides raw water to the City of Edinburg, North Alamo WSC, and Sharyland WSC.

Cameron County Irrigation District No. 16 (Cameron #16)
The District's conveyance system is predominantly open canals. It was estimated that the average conveyance efficiency for all irrigation districts is 69.7%. For Cameron County as a whole, the average conveyance efficiency is reported at 68% (Fipps 2005). Therefore, it is estimated that the conveyance efficiency of the District is 68%. Furthermore, it is estimated that the District is losing 3,717 acre-feet/year due to evaporation from reservoirs and resacas.

The District only provides service to irrigation water users.

Cameron County Irrigation District Cameron County No. 3 (La Feria)
The District's conveyance system is predominantly open canals. It was estimated that the average conveyance efficiency for all irrigation districts is 69.7%. For Cameron County as a whole, the average conveyance efficiency is reported at 68% (Fipps 2005). Therefore, it is estimated that the conveyance efficiency of the District is 68%. Furthermore, it is estimated that the District is losing 1,155 acre-feet/year due to evaporation from reservoirs and resacas.

In addition to irrigation water users, the District provides raw water to the cities of LaFeria, Santa Rosa, and Sebastian.

Cameron County Irrigation District Cameron County No. 4 (Santa Maria)
The District's conveyance system is predominantly open canals. It was estimated that the average conveyance efficiency for all irrigation districts is 69.7%. For Cameron County as a whole, the average conveyance efficiency is reported at 68% (Fipps 2005). Therefore, it is estimated that the conveyance efficiency of the District is 68%.

The District only provides water to irrigation users.

Valley Acres Irrigation District (Valley Acres)
The District's conveyance system is predominantly pipelines. It was estimated that the average conveyance efficiency for all irrigation districts is 69.7%. The District is located in both Cameron County (13%) and Hidalgo County (87%). Using Fipps 2005 figures, the weighted average conveyance efficiency is 70.6%. Therefore, it is estimated that the conveyance efficiency of the District is 70.6%. Furthermore, it is estimated that the District is losing 2,275 acre-feet/year due to evaporation from reservoirs and resacas.

In addition to irrigation water users, the District provides raw water to the Rio Grande Valley Sugarmill.

Bayview Irrigation District No. 11 (Bayview)
The District's conveyance system is predominantly open canals. It was estimated that the average conveyance efficiency for all irrigation districts is 69.7%. For Cameron County as a whole, the average conveyance efficiency is reported at 68% (Fipps 2005). Therefore, it is estimated that the conveyance efficiency of the District is 68%.

The District only provides water to irrigation users.

Hidalgo County Water Irrigation District No. 3 (McAllen #3)
The District's conveyance system is predominantly open canals. It was estimated that the average conveyance efficiency for all irrigation districts is 69.7%. For Hidalgo County as a whole, the average conveyance efficiency is reported at 71% (Fipps 2005). Therefore, it is estimated that the conveyance efficiency of the District is 71%.

In addition to irrigation water users, the District provides raw water to the City of McAllen.

Recommendations

In terms of the method in which individual Irrigation Districts could be included in the Regional Water Plan, there are three options available: wholesale water provider, water user group, and county-wide. The reason for evaluating individual Irrigation Districts is to increase the effectiveness of the plan by allowing for more accuracy in pinpointing specific water management strategies for specific users. In the previous rounds of regional planning, water supply and demand analysis were performed for a multitude of Water User Groups (WUGs) in the region including the classification of irrigation water users as a county-wide group (i.e. Irrigation – Cameron County). Utilizing this classification system creates a difficult set of circumstances in which to accurately evaluate irrigation water users including the development of accurate water supply and demand figures and developing water management strategies for implementation. In terms of Regional water planning, the analysis of individual Irrigation Districts will allow for a better understanding of the Region's water supply and demand. With this information, the Region will be better able to evaluate specific water management strategies needed to meet future water deficits.

Due to the number and type of water rights held, the primary purpose of an Irrigation District is to provide water for agricultural purposes. The District holds the irrigation water right that is being diverted from the river and delivers it to agricultural users of the District. The secondary function is to convey water for other water users. In some cases, the District owns the DMI water right that is being diverted. In other instances, the District simply conveys a water right that is owned by others. Therefore, Irrigation Districts serve as water user groups in much the same way that municipalities deliver water to their end users. A blanket characterization that Irrigation Districts are wholesale providers does not fit the role that Irrigation Districts play in the Region. It is hereby recommended that individual Irrigation Districts be classified as Water User Groups.

Regarding specific water supply and demand figures, the following table summarizes the findings:

Table 2.32: Irrigation District Demand and Supply Projections Summary

	Year	2000	2010	2020	2030	2040	2050	2060
BID	Demand (acre-feet)	50,875	40,186	29,798	22,164	22,164	22,164	22,164
	Supply (acre-feet)	10,008	10,203	10,105	10,015	9,924	9,834	9,750
CCID2	Demand	152,017	137,738	121,821	107,867	107,867	107,867	107,867
	Supply	64,121	65,372	64,747	64,167	63,587	63,007	62,472
HIDCC1	Demand	88,128	84,479	80,175	76,127	76,127	76,127	76,127
	Supply	29,031	29,598	29,315	29,052	28,790	28,527	28,284
CCID6	Demand	52,142	47,244	41,785	36,998	36,998	36,998	36,998
	Supply	27,950	28,495	28,223	27,970	27,718	27,465	27,231
Mercedes	Demand	144,343	125,925	105,301	86,365	86,365	86,365	86,365
	Supply	82,449	86,299	85,495	84,748	84,001	83,253	82,564
Delta Lake	Demand	176,099	174,911	173,395	171,746	171,746	171,746	171,746
	Supply	56,798	59,451	58,897	58,382	57,867	57,352	56,877
Sharyland	Demand	4,053	2,138	841	281	281	281	281
	Supply	6,858	7,179	7,112	7,050	6,987	6,925	6,868
Adams Garden	Demand	18,105	18,624	19,281	19,955	19,955	19,955	19,955
	Supply	7,338	7,481	7,409	7,343	7,277	7,210	7,149
HCID2	Demand	103,008	82,550	61,506	44,290	44,290	44,290	44,290
	Supply	55,948	58,561	58,015	57,508	57,001	56,494	56,026
HCID6	Demand	42,068	36,154	29,901	24,775	24,775	24,775	24,775
	Supply	16,098	16,850	16,693	16,547	16,401	16,255	16,120
Donna	Demand	80,953	77,425	73,274	69,379	69,379	69,379	69,379
	Supply	40,824	42,731	42,332	41,962	41,592	41,223	40,881
Santa Cruz	Demand	82,934	79,967	76,296	72,449	72,449	72,449	72,449
	Supply	27,674	28,966	28,696	28,445	28,195	27,944	27,712
Baptist Seminary	Demand	4,857	2,498	1,005	410	410	410	410
	Supply	460	481	477	473	469	464	461
HCID5	Demand	14,135	13,464	12,643	11,796	11,796	11,796	11,796
	Supply	6,863	7,184	7,117	7,055	6,992	6,930	6,873
Engleman	Demand	19,325	17,874	16,151	14,442	14,442	14,442	14,442
	Supply	3,548	3,714	3,679	3,647	3,615	3,583	3,553
HCID16	Demand	30,749	26,426	21,856	18,109	18,109	18,109	18,109
	Supply	15,255	15,968	15,819	15,681	15,542	15,404	15,277
HCMUD1	Demand	6,011	5,166	4,273	3,540	3,540	3,540	3,540
	Supply	2,080	2,178	2,157	2,138	2,120	2,101	2,083
HCWCID18	Demand	5,505	4,731	3,913	3,242	3,242	3,242	3,242
	Supply	1,864	1,951	1,932	1,916	1,899	1,882	1,866
United	Demand	64,464	55,402	45,821	37,966	37,966	37,966	37,966
	Supply	15,378	16,096	15,946	15,807	15,668	15,528	15,400
HCID1	Demand	85,615	68,611	51,121	36,812	36,812	36,812	36,812
	Supply	28,909	30,259	29,977	29,715	29,453	29,191	28,949
CCID16	Demand	3,773	3,419	3,024	2,677	2,677	2,677	2,677
	Supply	1,285	1,310	1,297	1,286	1,274	1,262	1,252
La Feria	Demand	74,898	69,722	63,795	58,419	58,419	58,419	58,419
	Supply	39,959	40,738	40,349	39,987	39,626	39,265	38,931
Santa Maria	Demand	9,098	8,763	8,367	7,992	7,992	7,992	7,992
	Supply	5,516	5,624	5,570	5,520	5,471	5,421	5,375
Valley Acres	Demand	15,150	15,187	15,233	15,278	15,278	15,278	15,278
	Supply	10,373	10,576	10,475	10,381	10,287	10,193	10,106
Bayview	Demand	17,478	15,836	14,006	12,402	12,402	12,402	12,402
	Supply	6,526	6,653	6,590	6,531	6,472	6,413	6,358
McAllen 3	Demand	9,752	7,815	5,823	4,193	4,193	4,193	4,193
	Supply	3,760	3,935	3,899	3,864	3,830	3,796	3,765

In terms of canal conveyance efficiencies for each District, it is recommended to utilize the following table. Data reported by each District will take precedence over the county-wide average.

Table 2.32: Irrigation District Conveyance Efficiency

District Name	Conveyance Efficiency
Adams Garden	68.0%
Bayview	68.0%
Brownsville	68.0%
San Benito	68.0%
Los Fresnos	68.0%
Rutherford-Harding	68.0%
Cameron 16	68.0%
Delta Lake	70.6%
Donna	71.0%
Engleman Gardens	71.0%
Mercedes	69.9%
Harlingen	68.0%
Edinburg	71.0%
McAllen 3	71.0%
Baptist Seminary	71.0%
HCID14	71.0%
Mission 16	71.0%
Monte Grande	71.0%
San Juan	71.0%
Progreso	71.0%
Mission 6	71.0%
Sharyland Plantation	71.0%
LaFeria	68.0%
Santa Cruz	71.0%
Santa Maria	68.0%
United	71.0%
Valley Acres	70.6%

Important Note: Using county-wide estimates to qualify individual Irrigation District conveyance system efficiencies does not represent an accurate scenario. Each District has a wide range of conveyance methods including open canals, pipelines, lined canals, and storage. In addition, the age of infrastructure plays a significant role in the efficiency of conveyance. Therefore, this analysis does not represent actual conveyance efficiencies. However, it does represent the best available quantifiable analysis of efficiency.

References

Doria, R., C.A. Madramootoo P.Eng., B.B. Mehdi, A. Suchorski. 2007. Irrigation Scheduling Technology for Peach and Wine Grape Production in Southern Ontario. Factsheet.

Enciso, Juan, Ph. D., P.E. Published data unavailable. Irrigation in the Lower Rio Grande Valley of Texas. White Paper.

Parker, Randall. 2008. Farming Costs Rise Faster Than Crop Prices Increase. Internet Article.
Available on-line at: http://www.futurepundit.com/archives/005200.html

Fipps, Guy, P.E. 2005. Potential Water Savings in Irrigation Agriculture for the Rio Grande Planning Region (Region M).

Appendix A

June 23, 2009

Mr. Kenneth N. Jones, Jr.
Executive Director
Lower Rio Grande Valley Development Council
311 North 15th Street
McAllen, Texas 78501

Re: Region M, Region-Specific Studies Contract for Regional Water Planning between the Texas Water Development Board (TWDB) and the Lower Rio Grande Valley Development Council (LRGVDC), TWDB Contract No. 0704830698, Draft Final Study Report Comments.

Dear Mr. Jones: Ken

Staff members of TWDB have completed a review of the Draft Final Study Report under TWDB Contract No. 0704830698. As stated in the above-referenced contract, LRGVDC will consider incorporating Draft Final Study Report comments, shown in Attachment I, as well as other comments received, into the Final Study Report. In accordance with paragraph F, Article III, Section II of the contract, a copy of these TWDB Executive Administrator comments as well as a written summary of how the Draft Final Study Report was revised in response must be included in the Final Study Report documents, for example, as an appendix.

TWDB looks forward to receiving two (2) electronic copies of all files, two (2) electronic copies of each Final Study Report in Portable Document Format (PDF), and nine (9) bound double-sided copies of each Final Study Report to the TWDB Executive Administrator no later than the contract Final Study Report Deadline (July 31, 2009). Please also transfer copies of all data and reports generated by the planning process and used in developing the Final Study Report to the TWDB Executive Administrator no later than the contract Final Study Report Deadline.

As a reminder, if any portion of the Final Study Report is to be included in the 2011 regional water plan it will be reviewed as part of the Initially Prepared Plan for meeting all statutory and agency rule requirements regarding the preparation of regional water plans.

If you have any questions concerning this contract, please contact Connie Townsend, TWDB's designated Contract Manager for this study at (512) 463-8290.

Sincerely,

Carolyn L. Brittin
Deputy Executive Administrator
Water Resources Planning and Information

Enclosures
Attachment 1

c: Connie Townsend, TWDB

ATTACHMENT 1
TWDB Contract No. 0704830698

TWDB Comments on Draft Final Phase 1 Special Studies Reports
Rio Grande (M) Region-Specific Studies #1-3

#1 – Surface Water Right Management Evaluation (Cost = $41,838)
#2: Classify Individual Irrigation Districts as Water User Groups or Wholesale Water Providers (Cost = $45,150)
#3: Analyze Results of Demonstration Projects (Cost = $28,040)

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(1) General: Please submit all data, maps, and functioning analytic models in an appropriate electronic format along with the final double-sided reports for each study as stated in the contract between TWDB and Region M.

(2) General: Please revise the titles of final reports #1 & #2 to reflect each study's purpose.

(3) General: The contract Scope of Work (SOW) Deliverables sections state that each report will include *"the following sections: Executive Summary, Purpose of Study (including how the study supports regional water planning), Methodology, Results, and Recommendations."* Please include all of these sections in each of the final reports. Also, please consider providing a Table of Contents and numbering the figures and tables in the final reports.

Study #1: Evaluation of Alternate Water Supply Management Strategies Regarding the Use and Classification of Existing Water Rights on the Lower and Middle Rio Grande

1. The contract SOW Deliverables section states that the results will include *"information on how water right conversions from irrigation to municipal uses might be undertaken, what overall water supply management strategies might be considered by the Planning Group for implementation in order to more effectively use and enhance the available future supply of water from Amistad and Falcon Reservoirs."* Please document and discuss these results and recommendations in the final report.
2. The contract SOW, Task B states *that potential changes to operating rules will be identified for possible inclusion as potential feasible water management strategies (WMSs)* through the completion of the 6 specific SOW subtasks. Please document all work related to these subtasks and discuss the identification process for both rule changes and potential WMSs in the final report. Also, please specify what potential WMSs were identified.
3. The contract SOW, Task C states that *modifications to the existing WAM* (Water Availability Model) *will be made to incorporate simplified water rights representations and other procedures in order to facilitate more efficient modeling and evaluation of the potentially feasible WMSs.* Please document and discuss all work related to the 7 subtasks in the final report.
4. The contract SOW, Task D states that *modifications will be made to the Task C WAM to incorporate the potentially feasible WMSs identified in Task B.* Please document and discuss this process in the final report.
5. The contract SOW, Task E states that *WMSs will be evaluated with respect to water supply reliabilities, river flows, and reservoir storage.* Please include this evaluation and discuss the impacts on river flows, reservoir storage, and water supply availabilities in the final report.
6. The contract SOW, Tasks F & H state *that results will be reviewed with the Rio Grande Regional Water Planning Group (RGRWPG) and other water users for the WMSs evaluated in Tasks E & G.* Please include the results of these reviews and discussions in the final report.
7. The contract SOW, Task G states *that up to two additional WMSs identified in Task F will be evaluated using the Task C-modified WAM.* Please include these evaluations in the final report.

8. Throughout the draft report (e.g. - page 3 data values): The terms "Water Rights Diversion" and "Demands" seem to be used interchangeably; however these concepts are different from one another. Please review and reconcile, if appropriate, in the final report.
9. Pages 2-3, Preliminary Analyses section:
    a. Please clarify rationale for using simulation data from years 1992, 2000, and 2005;
    b. Please clarify the difference between the 2 model run scenarios: (1) "with only municipal demands" and (2) "with all current irrigation rights converted to municipal demands";
    c. Please define "reduced irrigation demands" for run scenario (1);
    d. Please provide firm yield results and define the value 1,200,341AFY, for run scenario (2);
    e. Please define "storage factor" and specify how it is computed;
    f. Please complete SOW subtask (B.a.) by running the WAM with at least 2 more changes for this model parameter (conversion rates). Testing a minimum of 3 different conversion rates is required to sufficiently define and demonstrate a relationship between the conversion rate and supply and availability. Only one conversion rate was examined - all current irrigation rights converted to municipal demands (page 2, #2). Also, please provide the firm yield for this scenario. This comment also applies to page 5, subtask B.c.
10. Page 5, Common Assumptions and Results sections – Please address in the final report:
    a. Please review and reconcile, if appropriate, the total US and Mexico demands on Amistad-Falcon reservoir system in the final report.
    b. Please define the parameters that can be used as variables within the WAM for the Rio Grande and clarify what values are direct results from the model versus external calculations using model results. (i.e. diversions and reserves vs. storage factor, etc.).
    c. Please clarify which recommended WMSs the following 5 model runs belong to – 2 runs on changed storage factors (2.7 & 1.58); 1 run on changed DMI reserve (60,000AFY); and, 1 run on changed use (all DMI becomes agriculture). Also, please provide the rationale for the last 2 scenarios.
11. Figures on pages 6 and 7 – Please address in the final report:
    a. Please review and reconcile, if appropriate, numerical values in both figure legends.
    b. Please define the terms "Class A Municipal", "Class B Municipal" and "account balance".
    c. Please provide an explanation for why the storage factor does not seem to affect storage content for the "System" pair, even though the "Class A" and "Class B" pair results indicate that an increase in storage factor results in an increase in storage content.
12. Page 15: In the final report, please clarify the original author of this material and how it relates to the scope of work.
13. Page 16, draft report conclusions list – Please clarify conclusions #3 and #10.

Study #2: Classify Individual Irrigation Districts as Water User Groups or Wholesale Water Providers

1. Page 1, paragraph 3: Please define the concepts of "flat-rate" acreage and "irrigation" acreage in the final report.
2. The contract SOW, Task A, states the result of this task *will be an aerial "master map" of all of the irrigation districts in the region showing city boundaries, irrigation district boundaries, conveyance systems, and major delivery points.* Please document and discuss this task in the final report and provide the appropriately-sized and detailed "master map" that will label and delineate city boundaries, as well as irrigation district (District) boundaries, conveyance systems, and major delivery points.
3. Contract SOW, Task B: Please document and discuss in the final report the quantitative results of the census data analysis on the historic and projected population growth for each District, especially where city boundaries overlap District boundaries. Also, please document, discuss, and provide aerial maps for each irrigation district showing historical and projected areas of urbanization in the final report.

4. Contract SOW B.2 and D: Please document and discuss in the final report the methodology used for the demand and supply analyses in order to clarify how the numbers are produced.
5. Contract SOW, Task C: Please include a thorough discussion of the results of this task in the final report.
6. Contract SOW, Task D: Please include a thorough discussion of the results of this task in the final report for the Wholesale Water Provider (WWP) scenario, and compare the three scenarios – WWPs, Water User Groups, and the County-wide category. Also, identify potential customers as specified in the SOW.
7. Based on review of this study, TWDB staff has determined that no evidence exists to allow the qualification of Irrigation Districts as Municipal Water User Groups. Designation as Wholesale Water Providers, which is more appropriate under the Regional Water Planning rules (TAC 357.7(a)(2)(B)), will achieve all stated goals of the regional water planning group, including qualification for TWDB financial assistance programs.

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Study #3: Analyze Results of Demonstration Projects

1. The contract SOW, Task A states that *"a thorough analysis will be performed ……"*. Please provide the full analysis in the final report of the irrigation conservation demonstration projects' results, which will require that statistics be included and the numerical results be presented in an organized tabular and/or graphical format, as appropriate.
2. The contract SOW, Task A states that *……this analysis will be used to develop an on-farm incentive for implementation of such strategies in the Regional Water Plan.* Please discuss how the analysis results can be used for this process in the final report.
3. The contract SOW, Deliverables section for Task A states that *"In addition, recommendations will be developed by the Regional Water Planning Group regarding the development of an on-farm incentive program to increase implementation of such strategies throughout the region;…"* In the final report, please include these recommendations and discuss the Region M on-farm incentive program that was developed. Also, please document whether or not the irrigation conservation demonstration projects' results support the regional water plan statements presented on page 1, paragraph 2.
4. Page 1: Please consider providing pertinent information on the Agricultural Water Conservation Demonstration Initiative (ADI) demonstration project in the final report such as project's start and projected completion dates, at what stage in the data collection process was the project when data was analyzed for this report, defining the quality and reliability of the data used in this analysis; and project site description information such as the site map available at http://www.hidcc1.org/adi.
5. The contract SOW, Task B states that *Results of the seawater desalination pilot study will be analyzed and incorporated into the regional water plan to gain a better understanding as to the applicability of seawater desalination as a regional water management strategy.* The page 5 discussion of the results of the study is limited to financial considerations for a full-scale seawater desalination plant. Please include the technical aspects of the study in the final report.
6. Pages 6-7: The *Advantages and Challenges* sections in the report are taken verbatim from a separate October 2008 report entitled "Final Pilot Study Report: Texas Seawater Desalination Demonstration Project" prepared by Brownsville PUB and NRS Consulting Engineers for TWDB. Please reference this prior study and appropriately reference all recommendations from it in the final report.
7. The contract SOW Deliverables section states that *recommendations will be developed by the Regional Water Planning Group regarding the feasibility of Seawater Desalination as a Region-wide Water Management Strategy.* In the final report, please document this process and discuss the Region M feasibility recommendations that were developed.
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Appendix B

Responses to TWDB Comments on Draft Final Phase 1 Special Studies Reports
Rio Grande (M) Region-Specific Studies #2

1. Page 1, paragraph 3: Please define the concepts of "flat-rate" acreage and "irrigation" acreage in the final report.

Text was added to the report explaining the concept of flat-rate acreage and irrigation acreage (page 6).

2. The revised Scope of Work, as provided by the Contractor April 12, 2007 in the "Scope of Work Clarification" document, Task 2.1. states the result of this task *will be an aerial "master map" of all of the irrigation districts in the region showing city boundaries, irrigation district boundaries, conveyance systems, and major delivery points.* Please document and discuss this task in the final report and provide the appropriately-sized and detailed "master map" that will label and delineate city boundaries, as well as irrigation district (District) boundaries, conveyance systems, and major delivery points.

The Digital Appendices include the master map that shows city boundaries, irrigation district boundaries, conveyance systems, and major delivery points. Due to the sheer amount of information to display, it was decided that the best method for presenting the information was to provide individual maps each with pertinent information. The combination of maps supplied in the Digital Appendices includes all of the information as laid out in the scope of work. In addition, text was added throughout the report referencing these maps.

3. Revised SOW Task 2.2.: Please document and discuss in the final report the quantitative results of the census data analysis on the historic and projected population growth for each District, especially where city boundaries overlap District boundaries. Also, please document, discuss, and provide aerial maps for each irrigation district showing historical and projected areas of urbanization in the final report.

Based on the approved scope of work, census data was obtained for cities whose boundaries overlap with Irrigation Districts. This data provided historical population growth for the cities in question. However, census data alone cannot be used to evaluate projected population. Therefore, projected populations, as included in the previous State Water Plan, were utilized to evaluate projected population growth for cities whose boundaries overlap with Irrigation Districts (page 23). Text was added to the report that discussed how information obtained from this analysis could not accurately be used to extrapolate the rate of urbanization of Irrigation Districts (page 21). The scope of work

stated that historical aerial maps would be acquired to visually determine the rate of urban growth. Historical aerial imagery was evaluated for each Irrigation District to visually interpret rates of urbanization from 1996 to 2006. Maps showing the urbanization of representative Irrigation Districts were selected to evaluate urbanization growth. Representative District's were selected from each county. These maps were included in the Digital Appendices. Data obtained from this analysis for Irrigation Districts in more rural settings was inaccurate and did not properly indicate urban growth. Rather, the rate of growth was lot by lot. Therefore, information obtained from each Irrigation District was deemed suitable to determining rates of urbanization. The results showed that the most challenging scenario in terms of future water demand did not include visual interpretation of urbanization from historical aerial imagery. Instead, it was determined that records of urbanization from each Irrigation District in which the reduction in flat-rate acres and irrigated acres was more reliable.

4. Revised SOW Task 2.3. Please include a thorough discussion of the results of this task in the final report.

A thorough discussion of conveyance systems of each Irrigation District was included in the Final Report (page 25).

5. Revised SOW Task 2.4.: Please include a thorough discussion of the results of this task in the final report for the Wholesale Water Supplier (WWP) scenario, and compare the three scenarios – WWPs, Water User Groups, and the County-wide category. Also, identify potential customers as specified in the SOW.

Verbiage was added to the Final Report discussing the recommendation for classifying Irrigation Districts as WUGs (page 35). The existing distribution system network for each Irrigation District is such that current customers (with the exception of agricultural users) are consistent with potential future customers. Text was added to the Final Report regarding existing customers, where information was provided (beginning on page 30).

6. Revised SOW Tasks 2.5 through 2.9.: Please document these tasks and include a thorough discussion of the results in the final report.

A copy of the executed contract was included in the digital attachments. Though included in the original application, SOW Tasks 2.5 through 2.9 were not funded and were removed from the executed SOW.

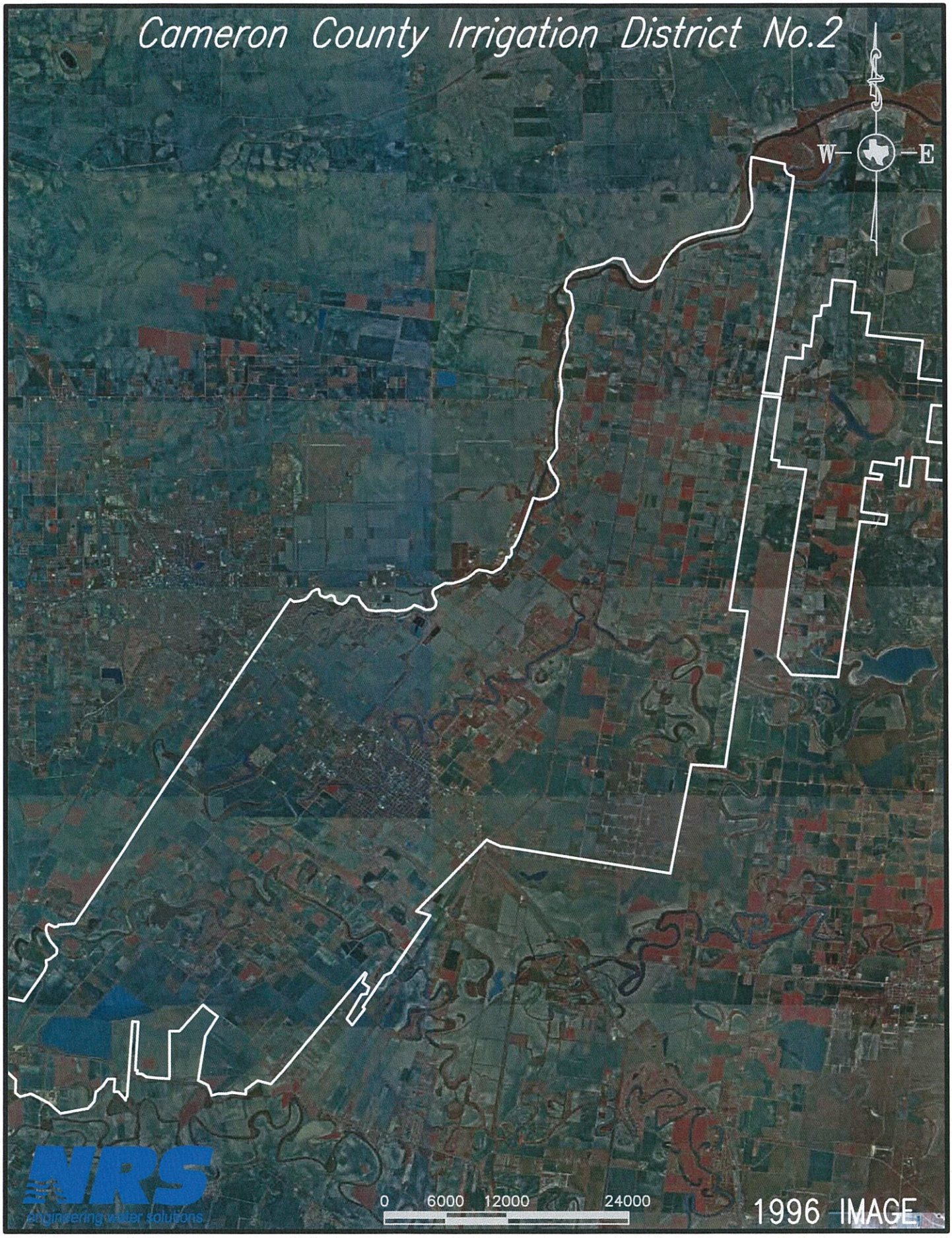
7. Based on the review of the study, the TWDB staff has determined that no evidence exists to allow the qualification of Irrigation Districts as Municipal Water User Groups.

Amendment #1 to the report properly addresses this concern. The amendment reflects the Region M Board's decision to list individual Irrigation District's as a subdivision of the county-wide reporting unit.

Appendix C


Brownsville Irrigation District
W
E
NRS
engineering water solutions
0
2500
5000
10000
1996 IMAGE


Brownsville Irrigation District
N
W
E
NRS
engineering water solutions
0
2500
5000
10000
7.7% Growth Since 1996
2006 IMAGE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engineering water solutions
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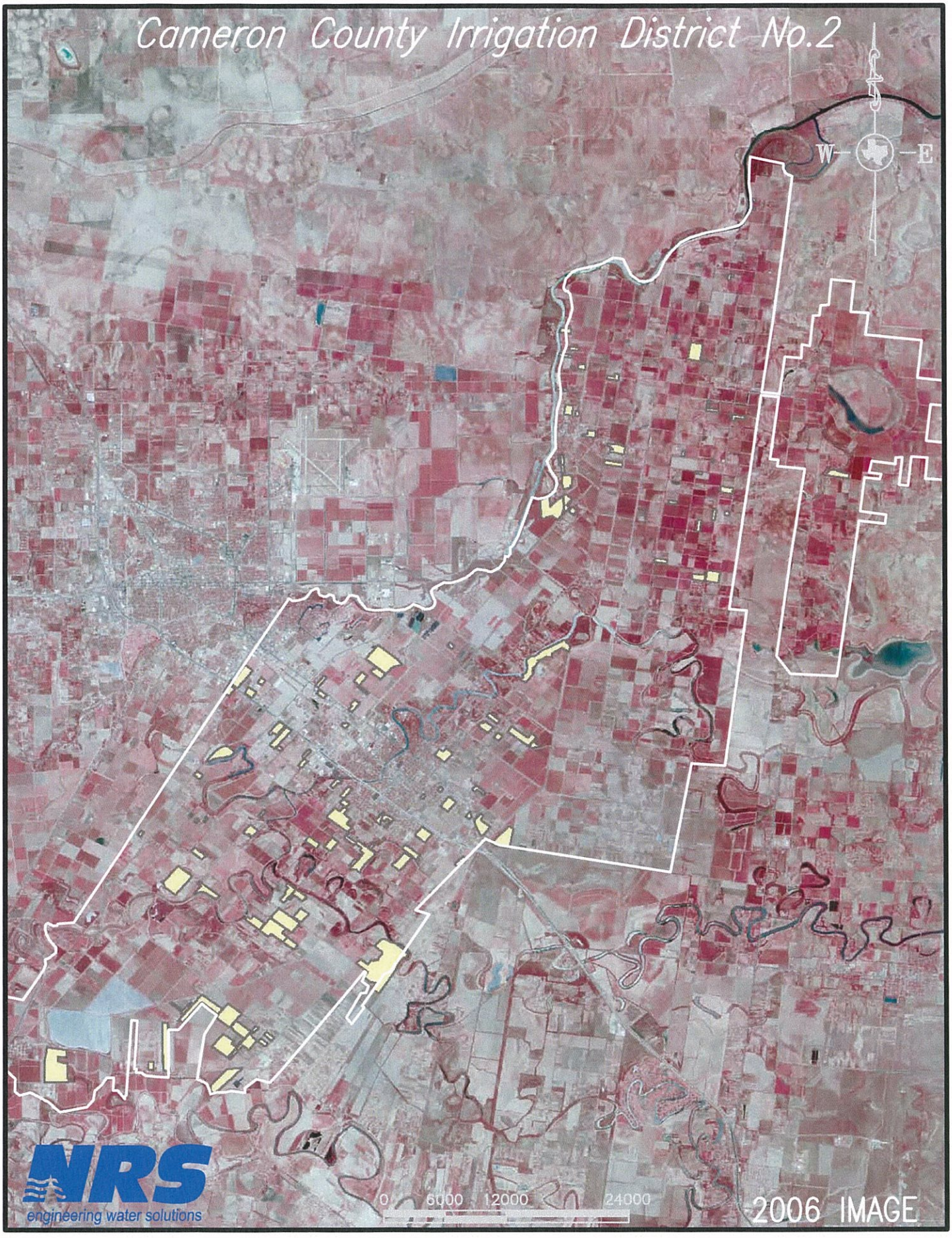
6000
12000
24000
1996 IMAGE


Cameron County Irrigation District No.2
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engineering water solutions
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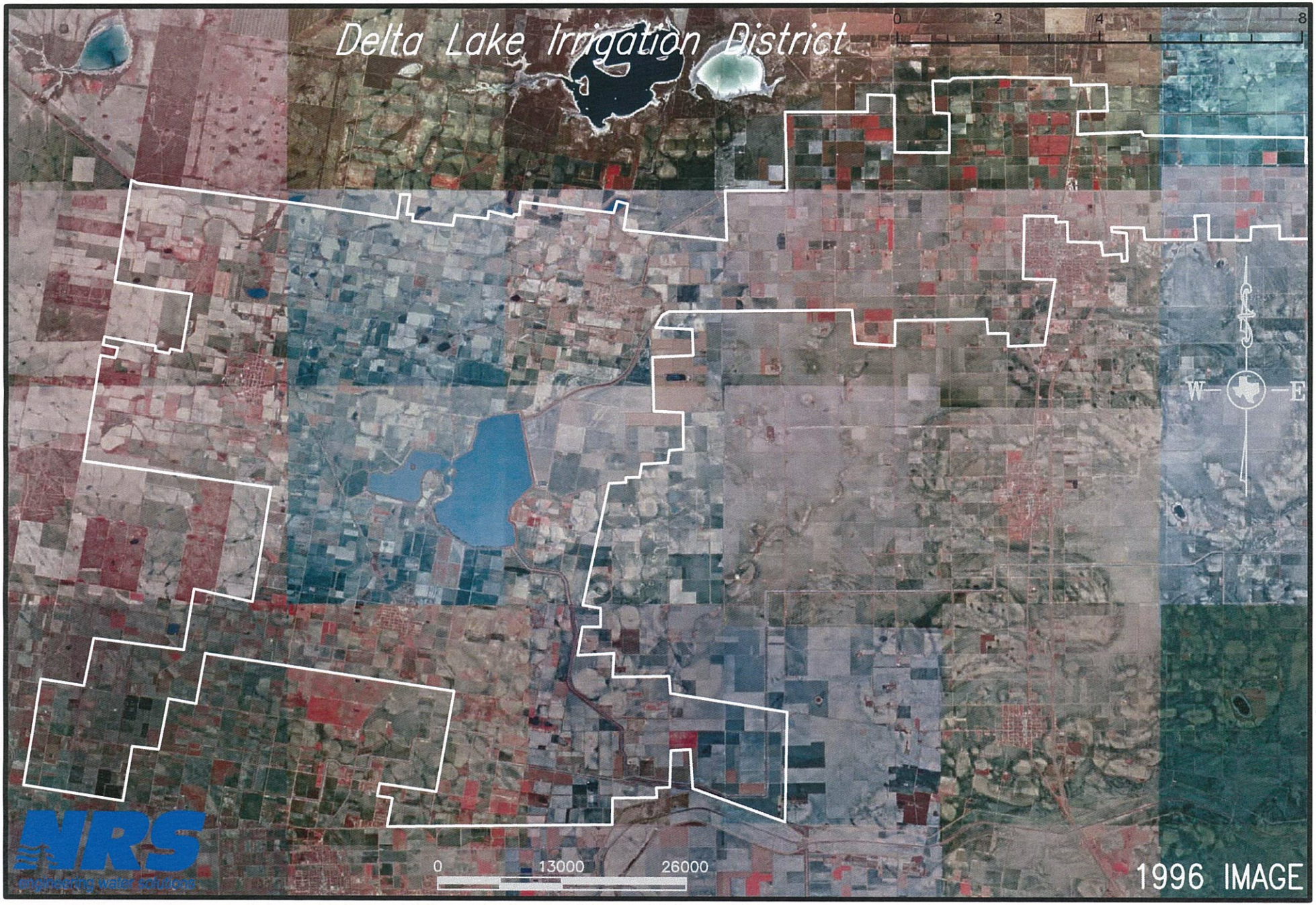
6000
12000
24000
2006 IMAGE


Delta Lake Irrigation District
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13000
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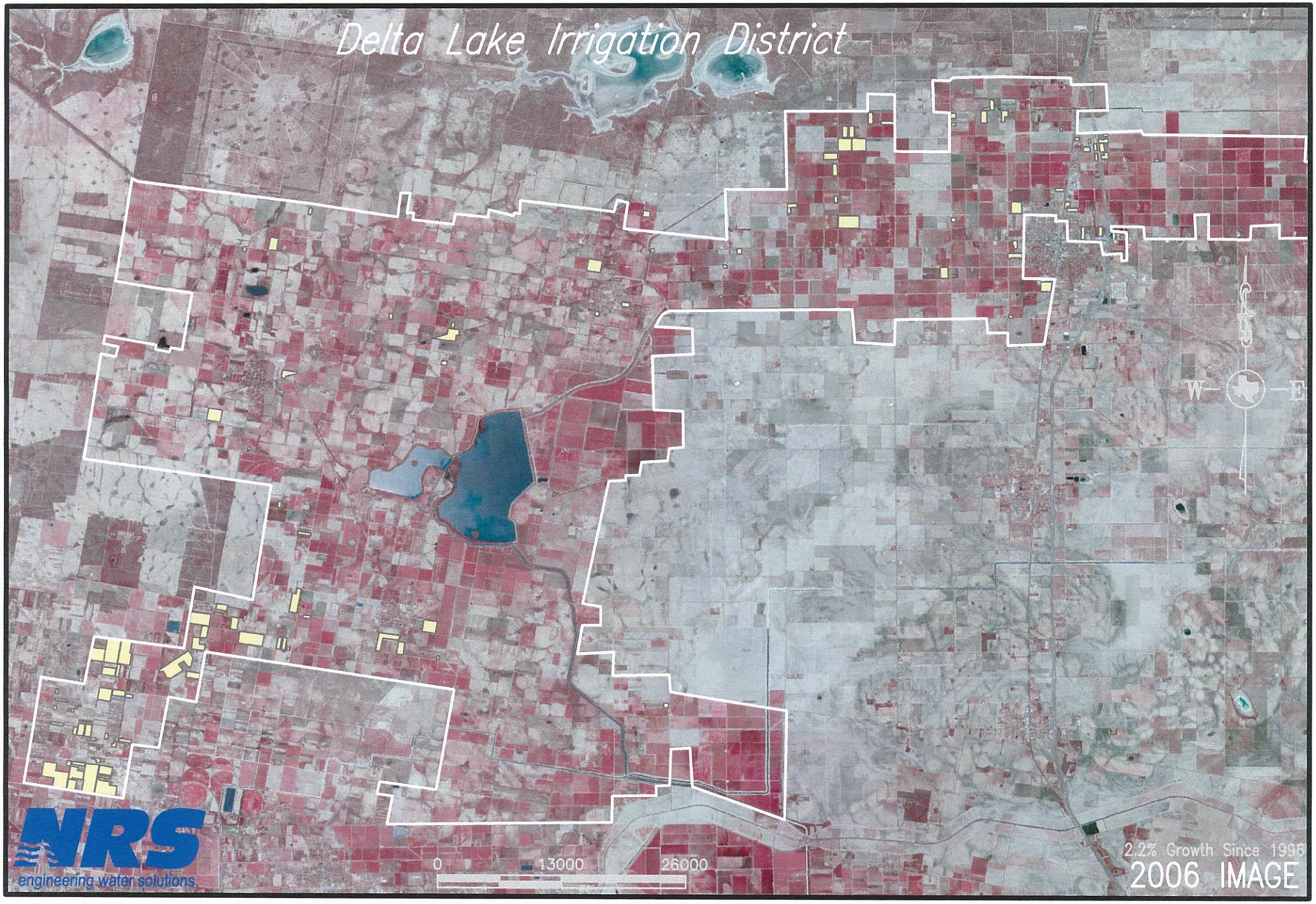
NRS
engineering water solutions
1996 IMAGE


Delta Lake Irrigation District
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NRS
engineering water solutions
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13000
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2.2% Growth Since 1996
2006 IMAGE


Hidalgo County Irrigation District No.2
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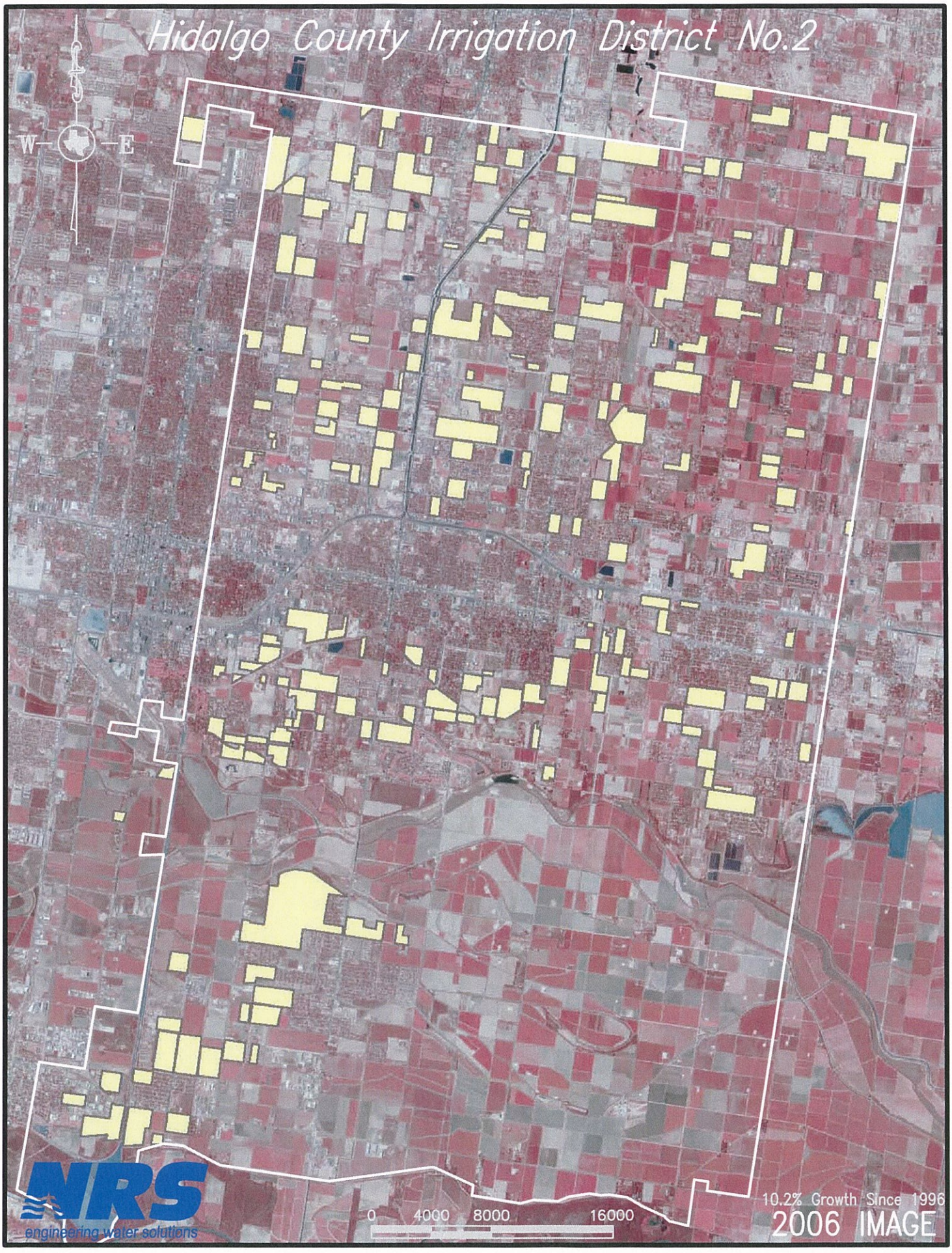
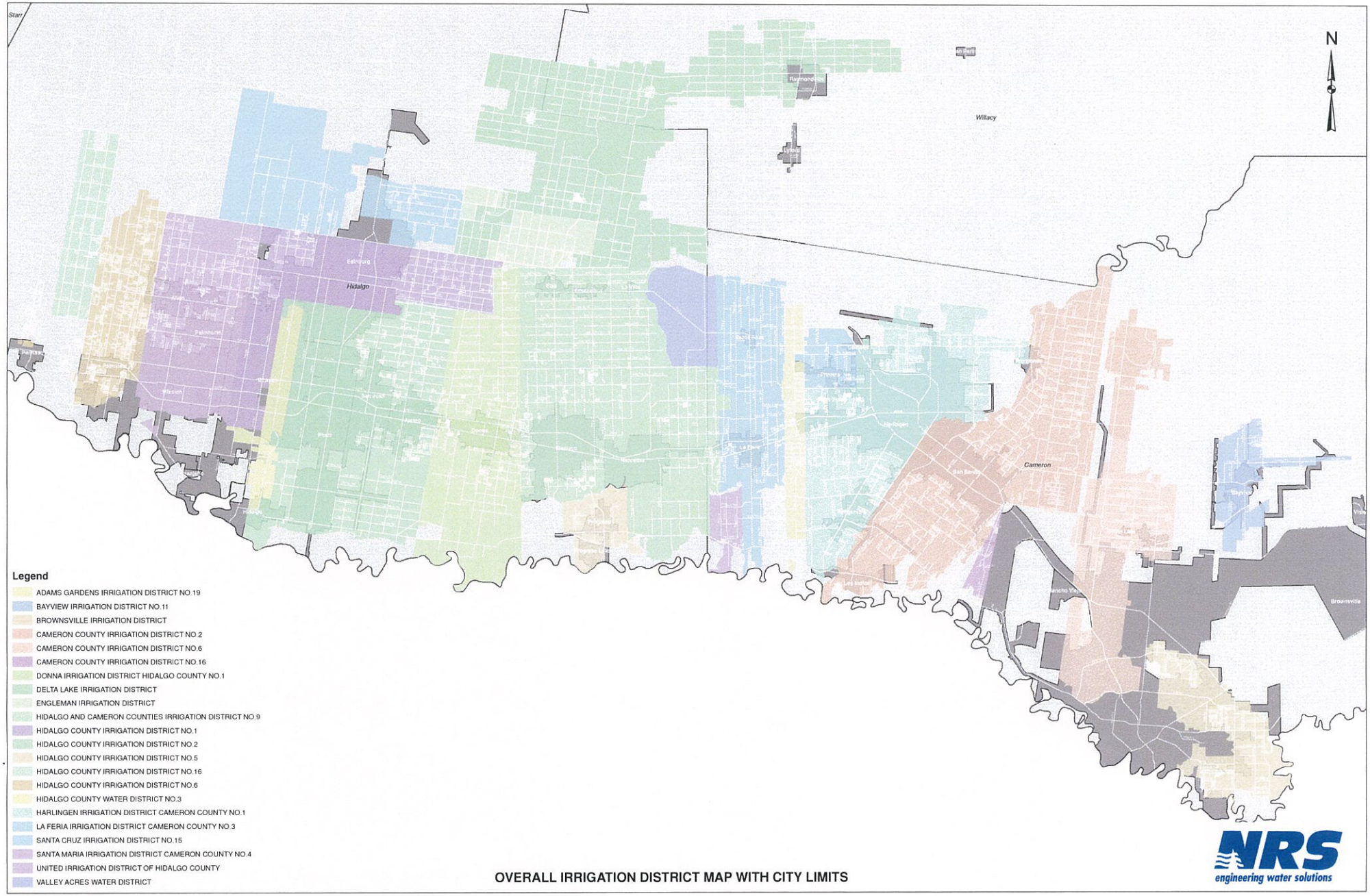
4000
8000
16000
1996 IMAGE


Hidalgo County Irrigation District No.2
W
E
NRS
engineering water solutions
0 4000 8000 16000
10.2% Growth Since 1996
2006 IMAGE

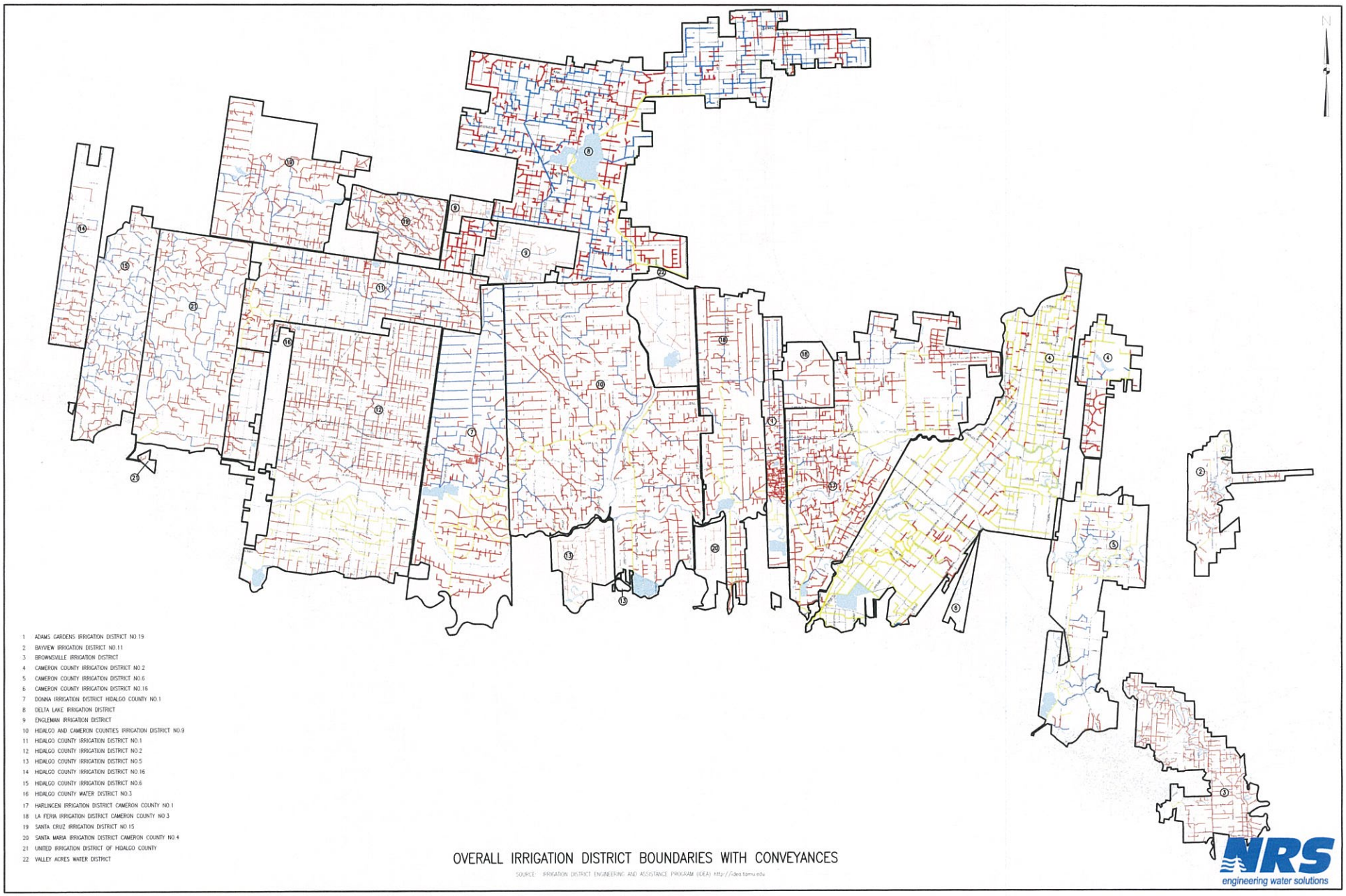
Appendix D



OVERALL IRRIGATION DISTRICT MAP WITH CITY LIMITS

NRS engineering water solutions

Appendix E



1 ADAMS GARDENS IRRIGATION DISTRICT NO.19
2 BAYVIEW IRRIGATION DISTRICT NO.11
3 BROWNSVILLE IRRIGATION DISTRICT
4 CAMERON COUNTY IRRIGATION DISTRICT NO.2
5 CAMERON COUNTY IRRIGATION DISTRICT NO.6
6 CAMERON COUNTY IRRIGATION DISTRICT NO.16
7 DONNA IRRIGATION DISTRICT HIDALGO COUNTY NO.1
8 DELTA LAKE IRRIGATION DISTRICT
9 ENGLEMAN IRRIGATION DISTRICT
10 HIDALGO AND CAMERON COUNTIES IRRIGATION DISTRICT NO.9
11 HIDALGO COUNTY IRRIGATION DISTRICT NO.1
12 HIDALGO COUNTY IRRIGATION DISTRICT NO.2
13 HIDALGO COUNTY IRRIGATION DISTRICT NO.5
14 HIDALGO COUNTY IRRIGATION DISTRICT NO.16
15 HIDALGO COUNTY IRRIGATION DISTRICT NO.6
16 HIDALGO COUNTY WATER DISTRICT NO.3
17 HARLINGEN IRRIGATION DISTRICT CAMERON COUNTY NO.1
18 LA FERIA IRRIGATION DISTRICT CAMERON COUNTY NO.3
19 SANTA CRUZ IRRIGATION DISTRICT NO.15
20 SANTA MARIA IRRIGATION DISTRICT CAMERON COUNTY NO.4
21 UNITED IRRIGATION DISTRICT OF HIDALGO COUNTY
22 VALLEY ACRES WATER DISTRICT

OVERALL IRRIGATION DISTRICT BOUNDARIES WITH CONVEYANCES

SOURCE: IRRIGATION DISTRICT ENGINEERING AND ASSISTANCE PROGRAM (IDEA) http://idea.tamu.edu

NRS
engineering water solutions

Digital Appendices

- TWDB Contract
- Brownsville Irrigation District Aerial Map: 1996
- Brownsville Irrigation District Aerial Map with Urbanization: 2006
- Cameron County Irrigation District No. 2 Aerial Map: 1996
- Cameron County Irrigation District No. 2 Aerial Map with Urbanization: 2006
- Delta Lake Irrigation District Aerial Map: 1996
- Delta Lake Irrigation District Aerial Map with Urbanization: 2006
- Hidalgo County Irrigation District No. 2 Aerial Map: 1996
- Hidalgo County Irrigation District No. 2 Aerial Map with Urbanization: 2006
- Irrigation District and City Boundaries
- Irrigation District Conveyance Systems

RM0601

Lower Rio Grande Valley Development Council

May 14, 2007

Ms. Phyllis Thomas
Agency Contract Administrator
Texas Water Development Board
1700 N. Congress Ave, Room 513
Austin, TX 78701

RE: TWDB Contract No. 0704830698

Dear Ms. Thomas:

I have attached an original executed contract (TWDB Contract No. 0704830698) as required by the TWDB. Thank you for the assistance in finalizing details of this contract and I look forward to a successful completion of this project.

When the Lower Rio Grande Valley Development Council (LRGVDC) can be of additional assistance please do not hesitate to contact me.

Sincerely,

Kenneth N. Jones, Jr.
Executive Director

cc: Glenn Jarvis, RGRWPG Chairman
Kathleen Ligon, TWDB
D. Ann Lyles, LRGVDC Director of Finance

MAIN OFFICE ✦ 311 N. 15th ST. ✦ McALLEN, TX 78501-4705 ✦ TEL: (956) 682-3481 ✦ FAX: (956) 631-4670
TTY FOR HEARING IMPAIRED: 1-800-735-2989
Website: www.lrgvdc.org

May 10, 2007

Mr. Kenneth N. Jones, Jr.
Executive Director
Lower Rio Grande Valley Development Council
311 North 15th Street
McAllen, Texas 78501

Re: Region Specific Studies Contract for Regional Water Planning Between the Lower Rio Grande Valley Development Council (LRGVDC) and the Texas Water Development Board (Board), TWDB Contract No. 0704830698

Dear Mr. Jones:

Enclosed are two copies of a region specific study contract between the Board and the LRGVDC to aid in the development of the regional water plan for Region M. The deadline for execution of this contract is May 17, 2007.

The Board's commitment to the planning effort is$174,398.

Please sign and date both originals by May 17, 2007, retain one for your files and return the remaining original to the attention of Ms. Phyllis Thomas at the address shown below.

A Payment Request Checklist, Vendor Direct Deposit Authorization form, and return address labels are enclosed for your information and use. If you have any questions concerning this contract, please contact Ms. Kathleen Ligon, the Board's designated Contract Manager for this study, at (512) 463-9284.

Sincerely,

William F. Mullican, III
Deputy Executive Administrator
Office of Planning

Enclosures

c: Kathleen Ligon, TWDB

STATE OF TEXAS

TWDB Contract No. 0704830698

COUNTY OF TRAVIS

Research and Planning Fund
Regional Water Planning
Region Specific Studies

THIS Contract, (hereinafter "CONTRACT"), between the Texas Water Development Board (hereinafter "BOARD") and CONTRACTOR, the political subdivision designated by the REGIONAL WATER PLANNING GROUP as its representative, is composed of two parts: Section I. Specific Conditions and Exceptions to the Standard Agreement and Section II. Standard Agreement. The terms and conditions set forth in Section I will take precedence over terms and conditions in Section II.

SECTION I. SPECIFIC CONDITIONS AND EXCEPTIONS TO STANDARD AGREEMENT

ARTICLE I. DEFINITIONS: For the purposes of this CONTRACT, the following terms or phrases shall have the meaning ascribed herein:

A. BOARD - the Texas Water Development Board, or its designated representative.

B. BOARD APPROVAL DATE – February 27, 2007

C. CONTRACT INITIATION DATE - Date board approved.

D. CONTRACTOR – Lower Rio Grande Valley Development Council.

E. DEADLINE FOR CONTRACT EXECUTION – May 17, 2007

F. EXECUTIVE ADMINISTRATOR - The Executive Administrator of the Board or his designated representative.

G. DRAFT FINAL STUDY REPORTS – Detailed, stand-alone draft final reports for each study component in Exhibit C will be developed in accordance with Exhibit A, Original Grant Application and Exhibit B, Guidelines for Final Study Report Development describing the work completed and outlining any recommendations.

H. DRAFT FINAL STUDY COMPLETION DEADLINE – December 31, 2008

I. FINAL STUDY REPORTS DEADLINE – April 30, 2009

J. REGIONAL WATER PLAN - a plan including amendments thereto that has been adopted by the REGIONAL WATER PLANNING GROUP that meets the requirements contained in the Texas Water Code §16.053 and 31 Texas Administrative Code Chapters 357 and 358 and submitted to the BOARD for approval.

K. REGIONAL WATER PLANNING AREA – Region M, designated under Texas Water Code §16.053 and 31 Texas Administrative Code §357.3.

L. REGIONAL WATER PLANNING GROUP – Rio Grande Regional Water Planning Group, designated under and in compliance with Texas Water Code §16.053 and 31 Texas Administrative Code §357.4 to develop regional water plans.

M. TOTAL STUDIES COSTS -$174,398

N. BOARD'S SHARE OF TOTAL STUDIES COSTS - Not to exceed$174,398 or 100 percent of the necessary and direct planning costs for the development of the Region Specific Studies that were incurred after February 27, 2007; and Administrative Tasks related to scope of work development that were incurred after June 13, 2006.

ARTICLE II. OTHER SPECIAL CONDITIONS AND EXCEPTIONS TO STANDARD AGREEMENT OF THIS CONTRACT.

A. The number of region specific studies for this CONTRACT is three (3).

ARTICLE III. CORRESPONDENCE

All correspondence between the parties shall be made to the following addresses:

For the **BOARD**:

Contract Issues:
Texas Water Development Board
1700 N. Congress Avenue
Austin, Texas 78701
Attention: Phyllis Thomas
Agency Contract Administrator

Payment Request Submission:
Texas Water Development Board
1700 N. Congress Avenue
Austin, Texas 78701
Attention: Shared Services

For the **CONTRACTOR(S):**

Mr. Kenneth N. Jones, Jr.
Executive Director
311 North 15th Street
McAllen, Texas 78501

IN WITNESS WHEREOF, the parties have caused this CONTRACT to be duly executed in multiple originals.

TEXAS WATER DEVELOPMENT BOARD

William F. Mullican, III
Deputy Executive Administrator

Date: 5/11/07

CONTRACTOR

Kenneth W. Jones, Jr.
Executive Director

Date: 5/14/07

SECTION II. STANDARD AGREEMENT

ARTICLE I. RECITALS

Whereas, the CONTRACTOR has been designated by the REGIONAL WATER PLANNING GROUP as its representative to enter into contracts with the BOARD for financial assistance to conduct region specific studies to aid in the development of a REGIONAL WATER PLAN for the REGIONAL WATER PLANNING AREA;

Whereas, the CONTRACTOR applied to the BOARD for a planning grant for region specific studies;

Whereas, the CONTRACTOR is the entity which will act as administrator of the BOARD's planning grant and will be responsible for the execution of this CONTRACT; and

Whereas, on the BOARD APPROVAL DATE, the BOARD approved the CONTRACTOR's application for financial assistance.

Whereas, the CONTRACTOR agrees to act at the direction of the REGIONAL WATER PLANNING GROUP in order to fulfill all terms of this CONTRACT.

Now, therefore, the BOARD and the CONTRACTOR, agree as follows:

ARTICLE II. PROJECT DESCRIPTION AND SERVICES TO BE PERFORMED

A. The CONTRACTOR will perform region specific studies that will aid in the development of a REGIONAL WATER PLAN for the REGIONAL WATER PLANNING AREA according to the Exhibit A, Original Application, Exhibit B, Guidelines for Final Study Report Development, and Exhibit C, the Scope of Work, Exhibit D, Task and Expense Budget, and in accordance with the requirements of Texas Water Code Chapters 15 and 16, with 31 Texas Administrative Code Chapter 355, Subchapter C, Chapter 357 and Chapter 358, including specifically §§357.5(a), 357.5(c)-(f), 357.5(h), (i), (k), and (l), 357.7(a), (b), (c) and (d), 357.10, 357.12(a)(3), 357.12(b), and 358.3(b)(10), which Texas Water Code and Texas Administrative Code chapters are incorporated by reference into and made a permanent part of this CONTRACT.

B. The EXECUTIVE ADMINISTRATOR shall provide technical assistance within available resources to the CONTRACTOR requesting such assistance in performing regional water planning activities and, if requested, may facilitate resolution of conflicts within the REGIONAL WATER PLANNING AREA or between regions.

C. The CONTRACTOR shall provide for public participation in the planning process as specified in Texas Water Code §16.053 and 31 Texas Administrative Code §357.12.

D. The CONTRACTOR shall obtain the prior approval of the REGIONAL WATER PLANNING GROUP of the region specific studies to be evaluated as part of the REGIONAL WATER PLAN development.

ARTICLE III. SCHEDULE, REPORTS, AND OTHER PRODUCTS

A. The CONTRACTOR shall, on or before the DEADLINE FOR CONTRACT EXECUTION, execute this CONTRACT or the BOARD's commitment to reimburse the TOTAL STUDIES COSTS will be rescinded.

B. The term of this CONTRACT shall commence on the CONTRACT INITIATION DATE and shall expire on the FINAL STUDY REPORTS DEADLINE.

C. The CONTRACTOR shall provide written progress reports with each payment reimbursement request or release of advance funds. The progress reports shall include a brief statement of the overall progress on each Region Specific Study made since the last progress report; a brief description of any problems that have been encountered during the previous reporting period that may affect the study, delay the timely completion of any portion of this CONTRACT, or inhibit the completion of or cause a change in any of the study's products or objectives; and a description of any action the CONTRACTOR plans to take to correct any problems that have been encountered or identified.

D. The CONTRACTOR will complete the Scope of Work, Exhibit C according to Article II, and Paragraph A of this Section. The CONTRACTOR shall submit the DRAFT FINAL STUDY REPORTS to the REGIONAL WATER PLANNING GROUP to allow the REGIONAL WATER PLANNING GROUP to conduct a public meeting to receive and consider comments on the DRAFT FINAL STUDY REPORTS. After such meeting the CONTRACTOR shall submit the DRAFT FINAL STUDY REPORTS to the EXECUTIVE ADMINISTRATOR. CONTRACTOR will deliver twelve (12) double-sided copies and electronic copies of the DRAFT FINAL STUDY REPORTS to the EXECUTIVE ADMINISTRATOR no later than the DRAFT FINAL STUDY REPORTS DEADLINE. The EXECUTIVE ADMINISTRATOR will provide any written comments to the CONTRACTOR within 60 calendar days.

E. The DRAFT FINAL STUDY REPORTS DEADLINE may be extended at the discretion of the EXECUTIVE ADMINISTRATOR either on his own initiative or upon a written request received from the CONTRACTOR, at least thirty (30) days prior to the deadline, stating good cause for the extension.

F. All comments on the DRAFT FINAL STUDY REPORTS must be considered before preparing the FINAL STUDY REPORTS. A copy of the EXECUTIVE ADMINISTRATOR's comments and a written summary of how the DRAFT FINAL STUDY REPORTS were revised will be included in the FINAL STUDY REPORTS.

G. The CONTRACTOR will submit one (1) unbound camera-ready original, one (1) electronic copy of all files, one electronic copy of each of the FINAL STUDY REPORTS

in Portable Document Format (PDF), and nine (9) bound double-sided copies of each of the FINAL STUDY REPORTS to the EXECUTIVE ADMINISTRATOR no later than the FINAL STUDY REPORTS DEADLINE. The CONTRACTOR also will transfer copies of all data and reports generated by the planning process and used in developing the FINAL STUDY REPORTS to the EXECUTIVE ADMINISTRATOR no later than the FINAL STUDY REPORTS DEADLINE. The FINAL STUDY REPORTS and the data collected and transmitted for the FINAL STUDY REPORTS will be prepared in the format and according to specifications prescribed in Exhibit B to this CONTRACT, which exhibit is incorporated herein and made a permanent part of this CONTRACT.

H. Delivery of the FINAL STUDY REPORTS that meet the Scope of Work (Exhibit C) as determined by the EXECUTIVE ADMINISTRATOR on or before the FINAL STUDY REPORTS DEADLINE shall constitute completion of the terms of this CONTRACT by CONTRACTOR.

ARTICLE IV. COMPENSATION AND REIMBURSEMENT

A. The BOARD agrees to compensate and reimburse the CONTRACTOR in a total amount not to exceed the TOTAL STUDIES COSTS for costs incurred and paid by the CONTRACTOR pursuant to performance of this CONTRACT, however, reimbursement is limited to the total amount of BOARD'S SHARE OF TOTAL STUDIES COSTS as specified in Section I, Article I.

B. The BOARD agrees to compensate and reimburse the CONTRACTOR for eligible expenses related to Region Specific Study Tasks that were incurred after February 27, 2007; and Administrative Tasks related to scope of work development that were incurred after June 13, 2006.

C. Requests for Advance or Reimbursement for Subcontractor Expenses. Requests for advance or reimbursement for subcontractor expenses will only be considered where such subcontracts or agreements have been approved by the EXECUTIVE ADMINISTRATOR as described herein. The EXECUTIVE ADMINISTRATOR must provide written review and approval of contracts or agreements between the CONTRACTOR and subcontractor(s) and between such subcontractors and any other subcontractors prior to CONTRACTOR finalizing such subcontracts or agreements. The purpose of this review is SOLELY to ensure that the subcontracts and agreements are not inconsistent with this CONTRACT and that the rights of the BOARD, particularly in regard to ownership of data, are protected. CONTRACTOR understands that CONTRACTOR should obtain its own legal review of subcontracts and agreements that CONTRACTOR enters into. CONTRACTOR agrees that the Board assumes no legal obligations under its subcontracts or agreements and is merely a third-party beneficiary of the same. Each subcontract or agreement shall include a detailed budget estimate with specific cost details for each task or specific item of work to be performed by the subcontractor and for each category of reimbursable expenses. The subcontracts shall conform to the terms of the CONTRACT and include provisions which require subcontractor compliance with BOARD rules. In addition, each subcontract or

agreement that in any manner involves the collection or manipulation of data, shall include the following provisions in Paragraph E of this Article.

D. The CONTRACTOR must adhere to all requirements in state law and Board rules pertaining to the procurement of professional services, including 31 TAC §355.93(e). Expenses incurred under subcontracts or agreements that have not been approved by the EXECUTIVE ADMINISTRATOR or do not otherwise comply with the terms of this CONTRACT are not eligible for reimbursement.

E. All subcontract agreements to provide technical or other data resulting directly from the performance of services related to this CONTRACT shall contain the following provision:

"It is agreed that all reports, drafts of reports, or other material, data, drawings, computer programs and codes associated with this contract and developed by the (Name of Subcontractor) pursuant to this contract shall become the joint property of the REGIONAL WATER PLANNING GROUP, (Name of CONTRACTOR), (Name of Subcontractor), and the Texas Water Development Board. These materials shall not be copyrighted or patented by the (name of Subcontractor). (Name of Subcontractor) agrees that neither the Regional Water Planning Group nor the Texas Water Development Board are parties to this contract and agrees that that these entities have no liability under the terms of this contract. The Texas Water Development Board is solely a third-party beneficiary under this contract."

F. At the discretion of the EXECUTIVE ADMINISTRATOR and upon written memorandum to the contract file, the CONTRACTOR has budget flexibility within each study's task and expense budget categories as contained in Exhibit D to the extent that the resulting change in amount in any one task or expense category within a single Region Specific Study does not exceed thirty five percent (35%) of the total amount authorized by this CONTRACT for the task or category to be changed. Larger deviations shall require a formal contract amendment.

G. The CONTRACTOR and its subcontractors shall maintain satisfactory financial accounting documents and records, including copies of invoices, receipts, time and attendance records, supporting salaries and wages, in accordance with generally accepted accounting principles for a term of three years after completion of this CONTRACT and shall make them available for examination and audit by the BOARD at any time upon 24 hours notice by the EXECUTIVE ADMINISTRATOR or his designee. Accounting by the CONTRACTOR and its subcontractors shall be in a manner consistent with generally accepted accounting principles.

H. By executing this CONTRACT, the CONTRACTOR accepts the authority of the State Auditor's Office, under direction of the legislative audit committee, to conduct audits and investigations in connection with any and all state funds received pursuant to this CONTRACT. The CONTRACTOR shall comply with and cooperate in any such investigation or audit. The CONTRACTOR agrees to provide the State Auditor with

access to any information the State Auditor considers relevant to the investigation or audit. The CONTRACTOR also agrees to include a provision in any subcontract related to this CONTRACT that requires the subcontractor to submit to audits and investigation by the State Auditor's Office in connection with any and all state funds received pursuant to the subcontract.

I. The CONTRACTOR will provide information to an entity or person who is independent of the CONTRACTOR and who is selected by the REGIONAL WATER PLANNING GROUP sufficient to allow that person or entity to routinely provide reports of expenses and use of planning funds to the REGIONAL WATER PLANNING GROUP. The person to whom the information is provided may be a member of the REGIONAL WATER PLANNING GROUP. The CONTRACTOR shall allow such person or entity full access to all records relating to the study, including all financial records.

J. The CONTRACTOR will submit to the BOARD a copy of their annual audit report within sixty (60) days from the date of publication.

K. Within thirty (30) days after the execution of this CONTRACT and upon written request from the CONTRACTOR, the EXECUTIVE ADMINISTRATOR will advance to the CONTRACTOR twenty percent of the COMMITTED FUNDS, unless the CONTRACTOR requests and the EXECUTIVE ADMINISTRATOR approves advances of less than twenty percent.

L. All advanced funds received must be deposited into an interest bearing account by the CONTRACTOR.

M. When CONTRACTOR has paid expenses equal to the previous advance, the CONTRACTOR will submit a written request to the EXECUTIVE ADMINISTRATOR for another twenty percent advance of the BOARD'S SHARE OF THE TOTAL STUDIES COSTS (or less if requested and approved pursuant to Paragraph B of this Article). Any payments of expenses which the CONTRACTOR withholds from a subcontractor for the purposes of retainage, equal to or less than five percent of the payment due, shall be considered to have been paid by the CONTRACTOR for purposes of determining expenses paid under the previous sentence. The CONTRACTOR will attach to the request a written progress report described in Article III, Paragraph C of this Section, a listing of actual expenses incurred and documents showing payment of such expenses (including those for force labor activities valued at rates consistent with those ordinarily paid for similar work in service provider's organization), and statements or documents showing any interest earned on the previous advance. Any interest earned by the CONTRACTOR shall be considered as part of the Board's payment of COMMITTED FUNDS and used only as a portion of TOTAL STUDIES COSTS.

N. The written progress report required by Article III, Paragraph C of this Section, and the following documentation which documents the TOTAL STUDIES COSTS shall be submitted by the CONTRACTOR to the EXECUTIVE ADMINISTRATOR in support of its requests for advances:

(1) Summary of total expenses incurred and amounts paid, including the following information:
   (a) Contractor's Vendor Identification Number;
   (b) TWDB Contract Number;
   (c) The billing period: beginning (date) through ending (date);
   (d) Total STUDIES COSTS for the billing period broken down by Region Specific Study and budget categories contained in Exhibit D; and
   (e) Certification, signed by the CONTRACTOR'S authorized representative, that the expenses submitted for the billing period are a true and correct representation of amounts paid for work performed directly related to this CONTRACT;

(2) For direct expenses paid by the CONTRACTOR and by outside subcontractors -- copies of invoices to the CONTRACTOR showing the tasks that were performed; the percent and cost of each task completed; a total cost figure for each direct expense category contained in Exhibit D; and the total dollar amount paid to and due to the subcontractors; and

(3) For CONTRACTOR expenses (not subcontractors) - a statement showing the tasks that were performed, the percent and cost of each task completed, and a total cost figure for each direct expense category contained in Exhibit D.

(4) For travel and subsistence expenses of the CONTRACTOR and subcontractors:
   (a) names, dates, work locations, time periods at work locations, itemization of subsistence expenses of each employee, limited, however, to travel expenses authorized for state employees by the General Appropriations Act, Tex. Leg. Regular Session, 2005, Article IX, Part 5, as amended or superseded;
   (b) other transportation costs -- copies of invoices or receipts covering tickets for transportation or, if not available, names, dates, and points of travel of individuals; and
   (c) all other allowable expenses -- invoices or receipts to evidence the amount paid.
   (d) Voting Member travels expenses are reimbursable in accordance with Texas Administrative Code §355.93 (b) (5) (c) (1). Voting member travel is limited to twenty-five percent of the total budget amount per fiscal year.

O. Within thirty (30) days of approving the request, the EXECUTIVE ADMINISTRATOR will advance another twenty percent of the BOARD'S SHARE OF THE TOTAL STUDIES COSTS (or less if requested and approved pursuant to Paragraph B of this Article) less any unapproved expenses and earned interest and less a five percent retainage. The five percent retainage will be calculated as five percent of the eligible expenses paid by the CONTRACTOR of COMMITTED FUNDS. The five percent retainage will be held on all Region Specific Study budgets until the CONTRACTOR submits all Region Specific Studies, as described in Article III, Paragraphs D and E of this CONTRACT.

P. The five percent retainage is to encourage completion of the FINAL STUDY REPORTS. In lieu of the five percent retainage, the BOARD will accept a performance bond or letter of credit with the BOARD as the beneficiary if the EXECUTIVE ADMINISTRATOR determines that such action would accomplish the same purpose as holding retainage.

Q. At the time of submission of all FINAL STUDY REPORTS, the CONTRACTOR will provide a final reconciliation of expended amounts under the CONTRACT. Within sixty (60) days of the EXECUTIVE ADMINISTRATOR's final accounting of the amounts expended by the CONTRACTOR and the amounts advanced by the BOARD to the CONTRACTOR, the CONTRACTOR will refund to the BOARD any advances not used for expenses approved by the EXECUTIVE ADMINISTRATOR, and any interest earned but not expended on such approved expenses. If the amounts expended by the CONTRACTOR exceed the amounts advanced by the BOARD, the EXECUTIVE ADMINISTRATOR will provide such differences to the CONTRACTOR, if not in excess of COMMITTED FUNDS and within the TOTAL STUDIES COSTS.

ARTICLE V. OWNERSHIP AND PUBLICATION

A. The BOARD shall have unlimited rights to technical or other data resulting directly from the performance of services under this CONTRACT. It is agreed that all reports, drafts of reports, or other material, data, drawings, computer programs and codes associated with this CONTRACT and developed by the CONTRACTOR or its subcontractors pursuant to this CONTRACT shall become the joint property of the REGIONAL WATER PLANNING GROUP, CONTRACTOR, Subcontractors, and BOARD. These materials shall not be copyrighted or patented by the CONTRACTOR or by any subcontractors involved in this CONTRACT, unless the EXECUTIVE ADMINISTRATOR approves in writing the right to establish copyright or patent; provided, however, that copyrighting or patenting by the CONTRACTOR or its subcontractors will in no way limit the REGIONAL WATER PLANNING GROUP's or the BOARD's access to or right to request and receive or distribute data and information obtained or developed pursuant to this CONTRACT. Any material subject to a BOARD copyright and produced by the CONTRACTOR or BOARD pursuant to this CONTRACT may be printed by the CONTRACTOR or the BOARD at their own cost and distributed by either at their discretion. The CONTRACTOR may otherwise utilize such material provided under this CONTRACT as it deems necessary and appropriate, including the right to publish and distribute the materials or any parts thereof under its own name, provided that any BOARD copyright is appropriately noted on the printed materials.

B. The CONTRACTOR agrees to acknowledge the BOARD in any news releases or other publications relating to the work performed under this CONTRACT.

ARTICLE VI. AMENDMENT, TERMINATION, AND STOP ORDERS

A. This CONTRACT may be altered or amended by mutual written consent or terminated by the EXECUTIVE ADMINISTRATOR at any time by written notice to the CONTRACTOR. The EXECUTIVE ADMINISTRATOR may terminate this CONTRACT, if the REGIONAL WATER PLANNING GROUP withdraws its designation of the CONTRACTOR as the CONTRACT representative of the REGIONAL WATER PLANNING GROUP. Upon receipt of such termination notice, the CONTRACTOR shall, unless the notice directs otherwise, immediately discontinue all work in connection with the performance of this CONTRACT and shall proceed to cancel promptly all existing orders insofar as such orders are chargeable to this CONTRACT. The CONTRACTOR shall submit a statement showing in detail the work performed under this CONTRACT up to the date of termination. The BOARD, in its discretion, shall then pay the CONTRACTOR that proportion of the prescribed fee, which applies to the work, actually performed under this CONTRACT, less all payments that have been previously made and any approved by the EXECUTIVE ADMINISTRATOR to conclude the contract. Thereupon, copies of all work accomplished under this CONTRACT shall be delivered promptly to the BOARD.

B. The EXECUTIVE ADMINISTRATOR may issue a Stop Work Order to the CONTRACTOR at any time. Upon receipt of such order, the CONTRACTOR shall discontinue all work under this CONTRACT and cancel all orders pursuant to this CONTRACT, unless the Stop Work Order directs otherwise. If the EXECUTIVE ADMINISTRATOR does not issue a Restart Order within 60 days after receipt by the CONTRACTOR of the Stop Work Order, the CONTRACTOR shall regard this CONTRACT terminated in accordance with the foregoing provisions.

ARTICLE VII. NO DEBT AGAINST THE STATE

This CONTRACT and Agreement shall not be construed as creating any debt by or on behalf of the State of Texas and the BOARD, and all obligations of the State of Texas are subject to the availability of funds.

ARTICLE VIII. LICENSES, PERMIT, AND INSURANCE

A. For the purpose of this CONTRACT, the CONTRACTOR will be considered an independent contractor and therefore solely responsible for liability resulting from negligent acts or omissions.

B. The CONTRACTOR shall be solely and entirely responsible for procuring all appropriate licenses and permits, which may be required by any competent authority for the CONTRACTOR to perform the subject work.

ARTICLE IX. SEVERANCE PROVISION

Should any one or more provisions of this CONTRACT be held to be null, void, voidable, or for any reason whatsoever of no force and effect, such provision(s) shall be construed as severable from the remainder of this CONTRACT and shall not affect the validity of all other provisions of this CONTRACT, which shall remain of full force and effect.

Exhibit C
Scope of Work

RIO GRANDE REGION M SCOPE OF WORK

Study 1 - Evaluation of Alternative Water Supply Management Strategies Regarding the Use and Classification of Existing Water Rights on the Lower and Middle Rio Grande

A. Acquire and Review Latest Version of Rio Grande WAM (Run 3)

B. Identify Potential Changes to Rio Grande Operating Rules Regarding Amistad-Falcon Water Rights for Possible Inclusion as Potentially Feasible Water Management Strategies including:
   a. Alternatives to existing conversion rates for converting existing irrigation/mining water rights to municipal use;
   b. Changes to the operating reserve with respect to its amount and how it is established;
   c. Changes to the domestic-municipal-industrial reserve with respect to its amount and how it is established;
   d. Changes to current procedures for allocating storage in Amistad and Falcon Reservoirs to irrigation/mining accounts;
   e. Changes to current procedures for accounting for reservoir and river delivery system losses; and
   f. Other Changes as approved by the Planning Group and the TWDB.

C. Modify Existing WAM to Incorporate Simplified Water Rights Representations and Other Procedures to Facilitate More Efficient Modeling and Evaluation of Potentially Feasible Water Management Strategies, including:
   a. Combining all Lower Rio Grande domestic-municipal-industrial water rights into a single right;
   b. Combining all Middle Rio Grande domestic-municipal-industrial water rights into a single right;
   c. Combining all Lower Rio Grande Class A irrigation/mining water rights into a single right;
   d. Combining all Middle Rio Grande Class A irrigation/mining water rights into a single right;
   e. Combining all Lower Rio Grande Class B irrigation/mining water rights into a single right;
   f. Combining all Middle Rio Grande Class B irrigation/mining water rights into a single right; and
   g. Other WAM modeling procedures as may be appropriate and necessary to facilitate evaluation of potentially feasible water management strategies.

D. Modify WAM developed in Task C to Incorporate Up to Four Potentially Feasible Water Supply Management Strategies Identified in Task B.

E. Evaluate Potentially Feasible Water Supply Management Strategies Identified Task B using Modified WAM from Task D to Simulate Water Supply Reliabilities, River Flows, and Reservoir Storage

F. Review Results of Task E with Planning Group and other Water Users and Identify Any Desired Modifications to the Potentially Feasible Water Management Strategies Considered in the Evaluation Performed in Task E.

G. Evaluate Up to Two Additional Potentially Feasible Water Management Strategies Identified in Task F and Rerun WAM Simulations Using the Modified WAM from Task C

H. Discuss Results With Region M Representatives and Water Users

I. Summarize Results and Prepare Draft Final and Final Report, including:
   a. Delivery of 20 copies of Draft Final Report, and;
   b. Delivery of 30 copies of Final Report

Deliverables

Draft and final reports will be prepared including the following sections: executive summary, purpose of study including how the study supports regional water planning, methodology, results, and recommendations. Draft report will be submitted to the planning group and the TWDB for review and comment. All comments will be addressed in the final report.

The report will show the results of the studies, including information on how water right conversions from irrigation to municipal uses might be undertaken, and what overall water supply management strategies might be considered by the Planning Group for implementation in order to more effectively use and enhance the available future supply of water from Amistad and Falcon Reservoirs.

The report will be submitted per TWDB requirements and results from this study will be included in the 2011 Rio Grande Regional Water Plan. The development, analysis, and reporting of results will follow methodologies and guidance according to Exhibit B, and agency rules.

Budget – The budget for this study is$41,838.00.

Study 2 - Classify Individual Irrigation Districts as Water User Groups

A. Development of maps showing service areas of Irrigation Districts. Acquire existing maps that show irrigation district boundaries, existing canals, and pipelines maps, and overlay them with existing aerial maps to create a "master map" of all irrigation districts in the region. Overlay the boundaries of cities. Pinpoint major delivery points for each irrigation district, including municipal and steam electric users. The resulting master map showing irrigation district boundaries, conveyance systems, and major delivery points will allow for a region wide understanding of irrigation, livestock, municipal, and steam electric water deliveries and how these deliveries intertwine between irrigation districts.

B. Quantify and qualify urbanization and its effects through the use of census data and maps.
   1. Analyze the existing conveyance system to determine delivery mechanisms of each Irrigation District. Acquire and analyze census data. Analyze population increases of cities whose boundaries overlap with irrigation district boundaries to determine historic and projected growth. Acquire historical aerial maps to visually determining the location of urban growth. Obtain historical information pertaining to irrigation district land exclusions and inclusions from each individual irrigation district. The result of this task will be a quantitative understanding of urbanization affects on individual irrigation districts in the region. This will be used as a tool to plan for the change in water demands from conversion from irrigation to municipal use.

   2. Revise and update water demands based on the changed condition of classifying individual Irrigation Districts as Water User Groups as opposed to the method of classifying irrigation demands on a county-wide basis as was done in the previous plan.

C. Analyze the existing conveyance system to determine delivery mechanisms of each Irrigation District. Acquire information pertaining to district-wide conveyance system efficiencies from individual irrigation districts, along with identification of problem areas (both historical and potential) throughout the district. This will help the region establish cost data for improvement with greater accuracy and identify needs by district.

D. Revise and update water demands based on the changed condition of classifying individual Irrigation Districts as Water User Groups or Wholesale Water Providers as opposed to the method of classifying irrigation demands on a county-wide basis as was done in the previous plan. Acquire information pertaining to individual irrigation district water rights, historical allocations, and historical raw water deliveries. Acquire historical rainfall data and Amistad/Falcon levels. Determine individual irrigation district supplies and demands. Develop projections of irrigation water usage using information obtained from the urbanization analysis. To avoid "double counting" the water, this task will only entail irrigation supply and demand, but will identify customers for information purposes.

Deliverables

Draft and final reports will be prepared including the following sections: executive summary, purpose of study including how the study supports regional water planning, methodology,

results, and recommendations. Draft report will be submitted to the planning group and the TWDB for review and comment. All comments will be addressed in the final report. The report will include maps and analyses and findings from the four tasks.

The report will be submitted per TWDB requirements and results from this study will be included in the 2011 Rio Grande Regional Water Plan. The development, analysis, and reporting of results will follow methodologies and guidance according to Exhibit B, and agency rules.

Budget – The budget for this study is$45,150.00.

Study 3 - Analyze Results of Demonstration Projects

A. Analyze results from the Harlingen Irrigation District on-farm conservation demonstration project. Based on the information obtained from the Harlingen Irrigation District on-farm conservation demonstration project, a thorough analysis will be performed with the goal of developing an on-farm incentive for implementation of such strategies.

B. Analyze results from the Public Utility Board of the City of Brownsville Seawater Reverse Osmosis Pilot Study. Results of the seawater desalination pilot study will be analyzed and incorporated into the regional water plan to gain a better understanding as to the applicability of seawater desalination as a regional water management strategy.

Deliverables

Draft and final reports will be prepared including the following sections: executive summary, purpose of study including how the study supports regional water planning, methodology, results, and recommendations. Draft report will be submitted to the planning group and the TWDB for review and comment. All comments will be addressed in the final report.

The report will summarize the results of each study in the context of the Regional Water Plan. In addition, recommendations will be developed by the Regional Water Planning Group regarding: 1) the development of an on-farm incentive program to increase implementation of such strategies throughout the region; and 2) the feasibility of Seawater Desalination as a Region-wide Water Management Strategy.

The report will be submitted per TWDB requirements and results from this study will be included in the 2011 Rio Grande Regional Water Plan. The development, analysis, and reporting of results will follow methodologies and guidance according to Exhibit B, and agency rules.

Budget – The budget for this study is$28,040.00.

Exhibit D
Region M Regional Water Planning Group
Task Expense Budget

Task Budget

Study No.	Task Description	Total
1	**Surface water right management evaluation**	
	a) Acquire and review latest version of Rio Grande WAM	$1,682.50
	b) Identify potential changes to Rio Grande operating rules regarding Amistad-Falcon water rights for possible inclusion as potentially feasible Water Management Strategies	7,065.50
	c) Modify existing WAM to reflect simplified water rights representations	2,822.50
	d) Modify WAM developed in Task C to incorporate up to four potentially feasible water supply Management Strategies identified in Task B	7,742.50
	e) Evaluate potentially feasible water supply Management Strategies identified in Task B using modified WAM from Task D to simulate water supply reliabilities, river flows, and reservoir storage	7,825.50
	f) Review results of Task E with Planning Group and other water users and identify any desired modifications to the potentially feasible Water Management Strategies considered in the evaluation performed in Task E	4,082.50
	g) Evaluate up to two additional potentially feasible Water Management Strategies identified in Task F and rerun WAM simulations using modified WAM from Task C	3,596.50
	h) Discuss results with Region M representatives	4,520.50
	i) Summarize results and prepare draft final and final report	2,500.00
		$41,838.00
2)	**Classify Irrigation Districts as WUGs or WWPs**	
	a) Development of maps showing service areas of Irrigation Districts	$10,000.00
	b) Quantify and qualify urbanization and its effects	20,000.00
	c) Analysis of existing conveyance system	5,760.00
	d) Revise water supply and demand data	9,390.00
	e) Evaluate water savings due to the construction of conveyance system interconnects, joint water conservation projects, and raw water deliveries	0
	f) Analyze effectiveness of completed conservation projects	0
	g) Evaluate WMSs for individual Irrigation Districts	0
	h) Evaluate impacts of municipal WMSs on Irrigation Districts	0
		$45,150.00

3)	**Analyze Results of Completed Demonstration Projects**	
	a) Discuss/analyze results from the Harlingen Irrigation District on-farm projects	$4,680.00
	i) Development of an on-farm incentive for implementation of strategies	12,600.00
	b) Discuss/analyze results from the Brownsville PUB Seawater RO Pilot Study	10,760.00
		$28,040.00
	Administrative and Public Participation	
	a) Administrative	$12,270.00
	b) Scope of Work	12,240.00
	c) Public Participation	34,860.00
		$59,370.00
	TOTALS:	**$174,398.00**
Notes		
[1]	The original amount for Task 2, subtask D was$10,260.00. Due to the funding amount authorized by the TWDB, this task can only be funded for$9,390.00 which is 91.5% of the required amount to fully complete this task.	

		STUDY 1	STUDY 2	STUDY 3	ADMIN
Category	**Total Amount**	**Total Amount**	**Total Amount**	**Total Amount**	**Total Amount**
Salaries and Wages	$47,130.00	$0	$0	$0	$47,130.00
Fringe	0	0	0	0	0
Travel	0	0	0	0	0
Other Expenses	0	0	0	0	0
Subcontract Services	$127,268.00	$41,838.00	$45,150.00	$28,040.00	$12,240.00
Voting Planning Member Travel	0	0	0	0	0
Overhead		0	0	0	0
Profit	0	0	0	0	0
TOTAL	**$174,398**	**$41,838**	**$45,150**	**$28,040**	**$59,370**

[1] Salaries and Wages is defined as the cost of salaries of engineers, draftsmen, stenographers, surveymen, clerks, laborers, etc., for time directly chargeable to this contract.
[2] Fringe is defined as the cost of social security contributions, unemployment, excise, and payroll taxes, employment compensation insurance, retirement benefits, medical and insurance benefits, sick leave, vacation, and holiday pay applicable thereto.
[3] Other Expenses is defined to include expendable supplies, communications, reproduction, postage, and costs of public meetings.
[4] Voting Planning Member Travel Expenses is defined as eligible travel expenses incurred by regional water planning members that cannot be reimbursed by any other entity, political subdivision, etc.

[5] Overhead is defined as the costs incurred in maintaining a place of business and performing professional services similar to those specified in this contract. These costs shall include the following:

- Indirect salaries, including that portion of the salary of principals and executives that is allocable to general supervision;
- Indirect salary fringe benefits;
- Accounting and legal services related to normal management and business operations;
- Travel costs incurred in the normal course of overall administration of the business;
- Equipment rental;
- Depreciation of furniture, fixtures, equipment, and vehicles;
- Dues, subscriptions, and fees associated with trade, business, technical, and professional organizations;
- Other insurance;
- Rent and utilities; and
- Repairs and maintenance of furniture, fixtures, and equipment.


Brownsville Irrigation District
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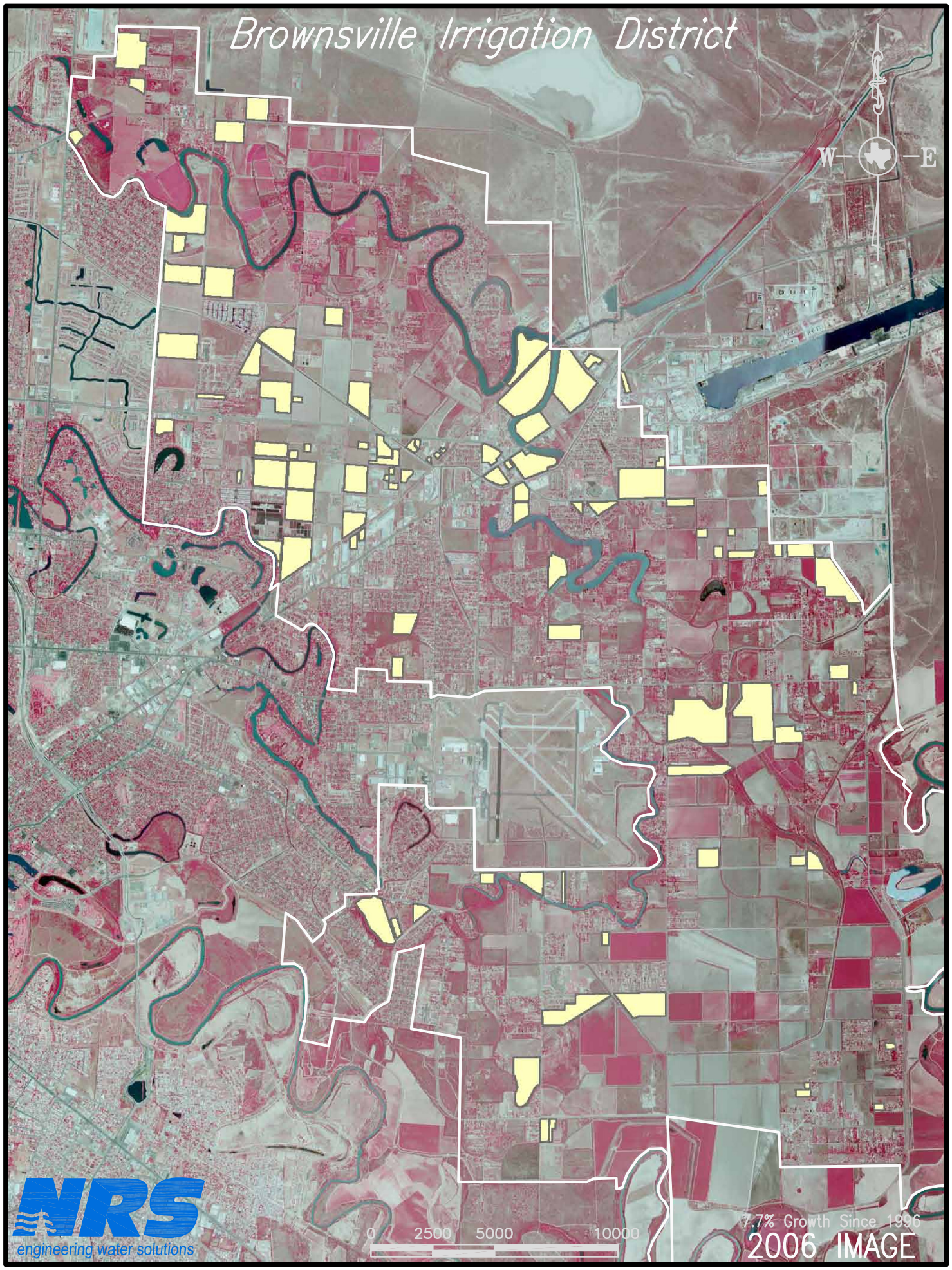
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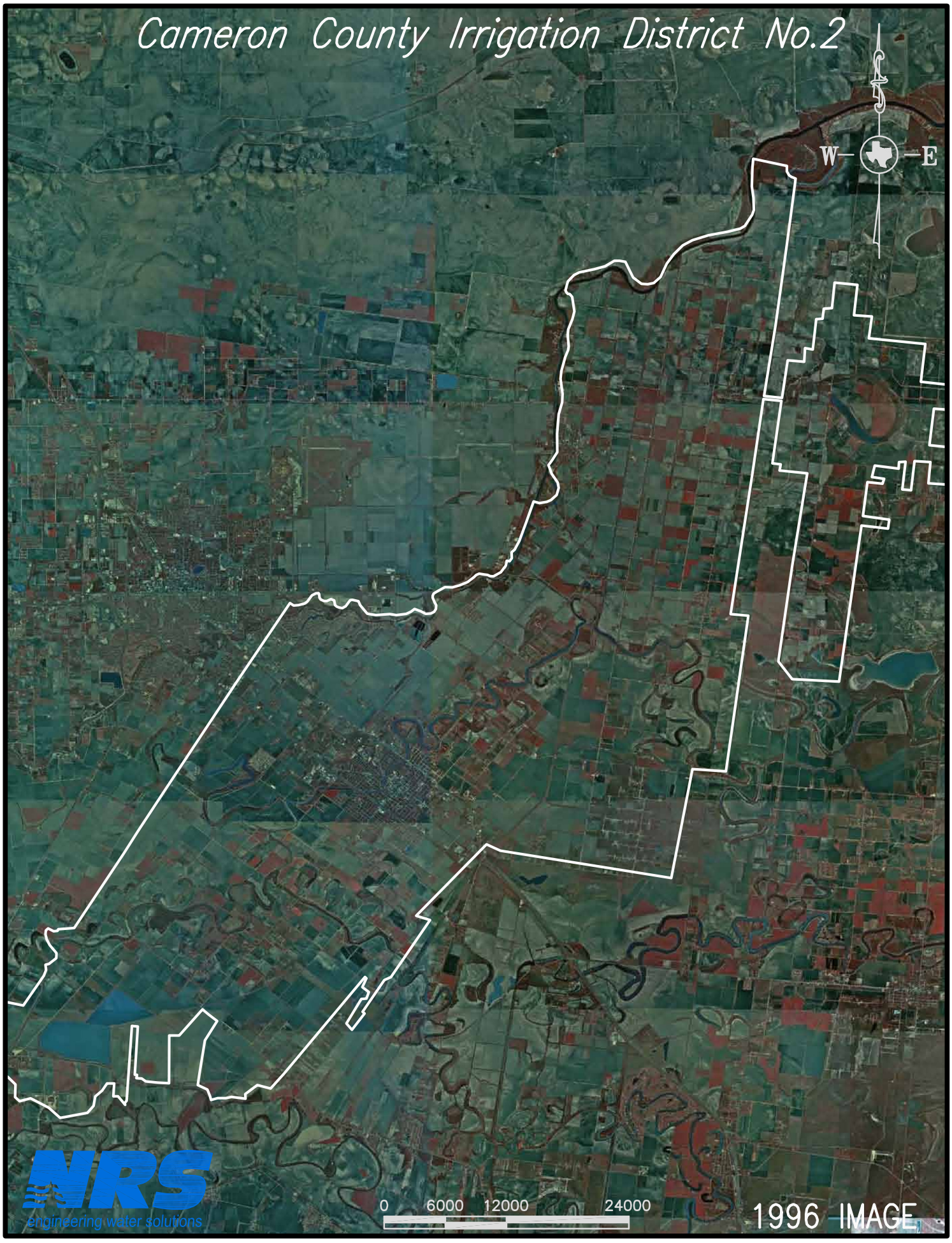
7.7% Growth Since 1996
2006 IMAGE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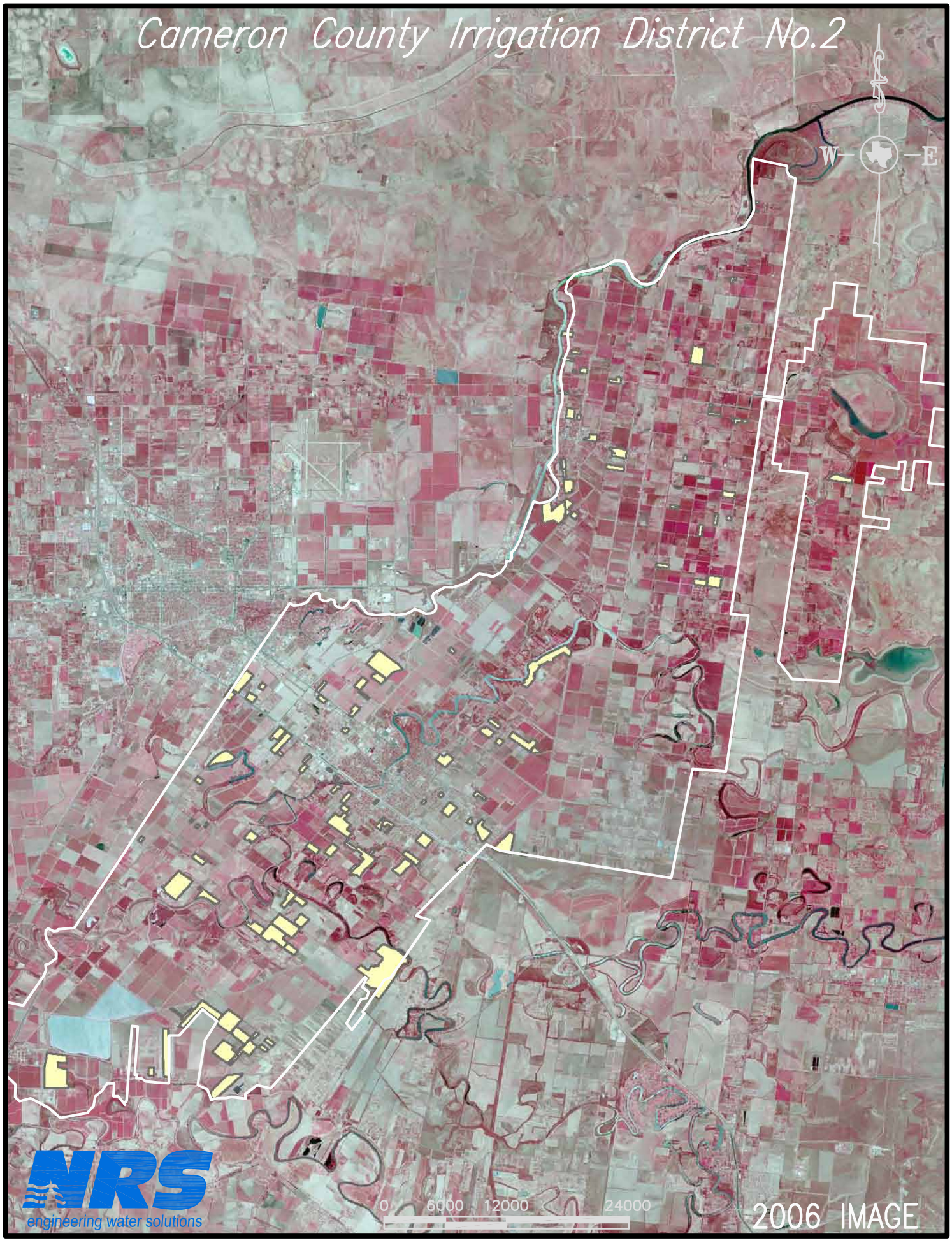
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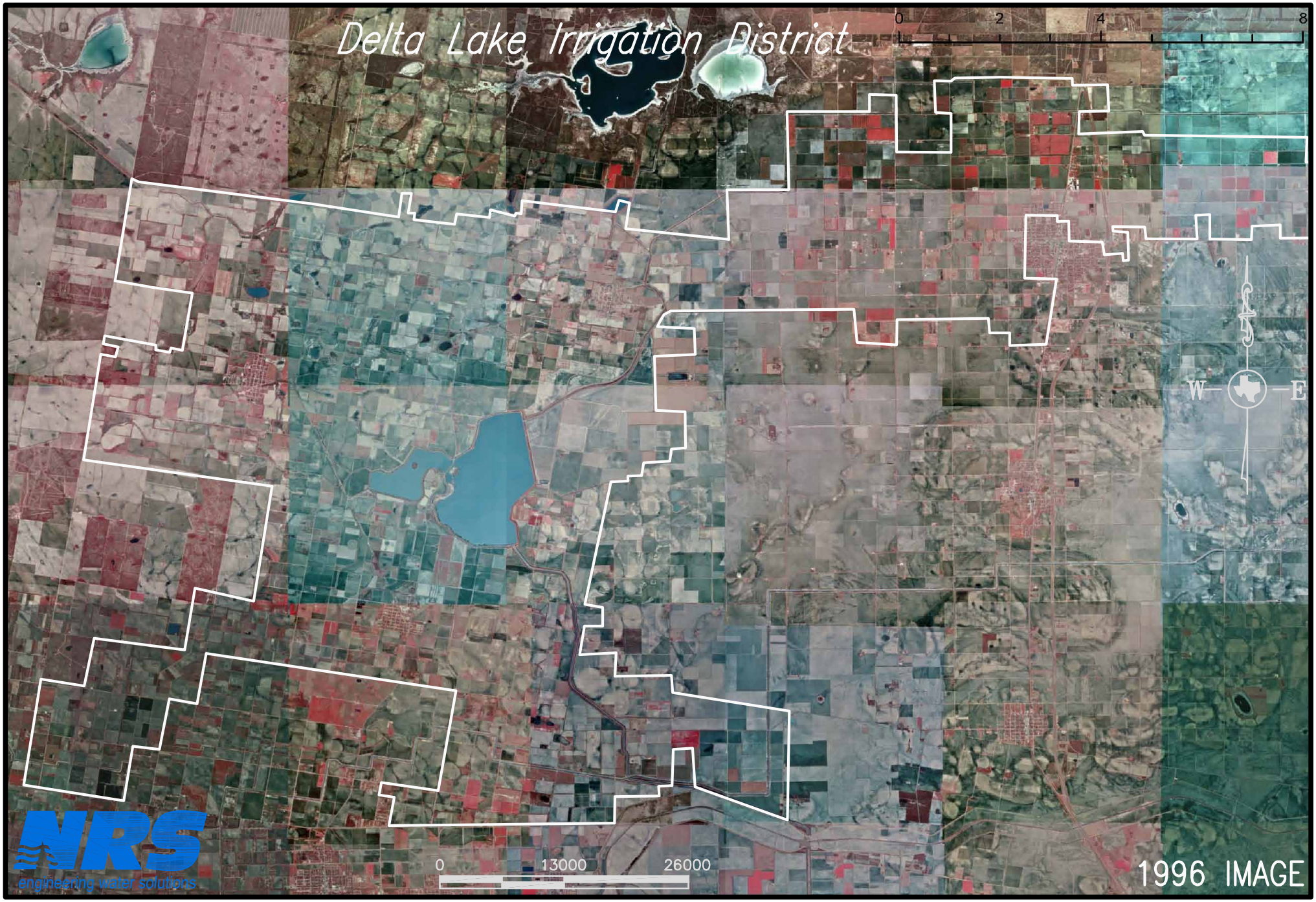
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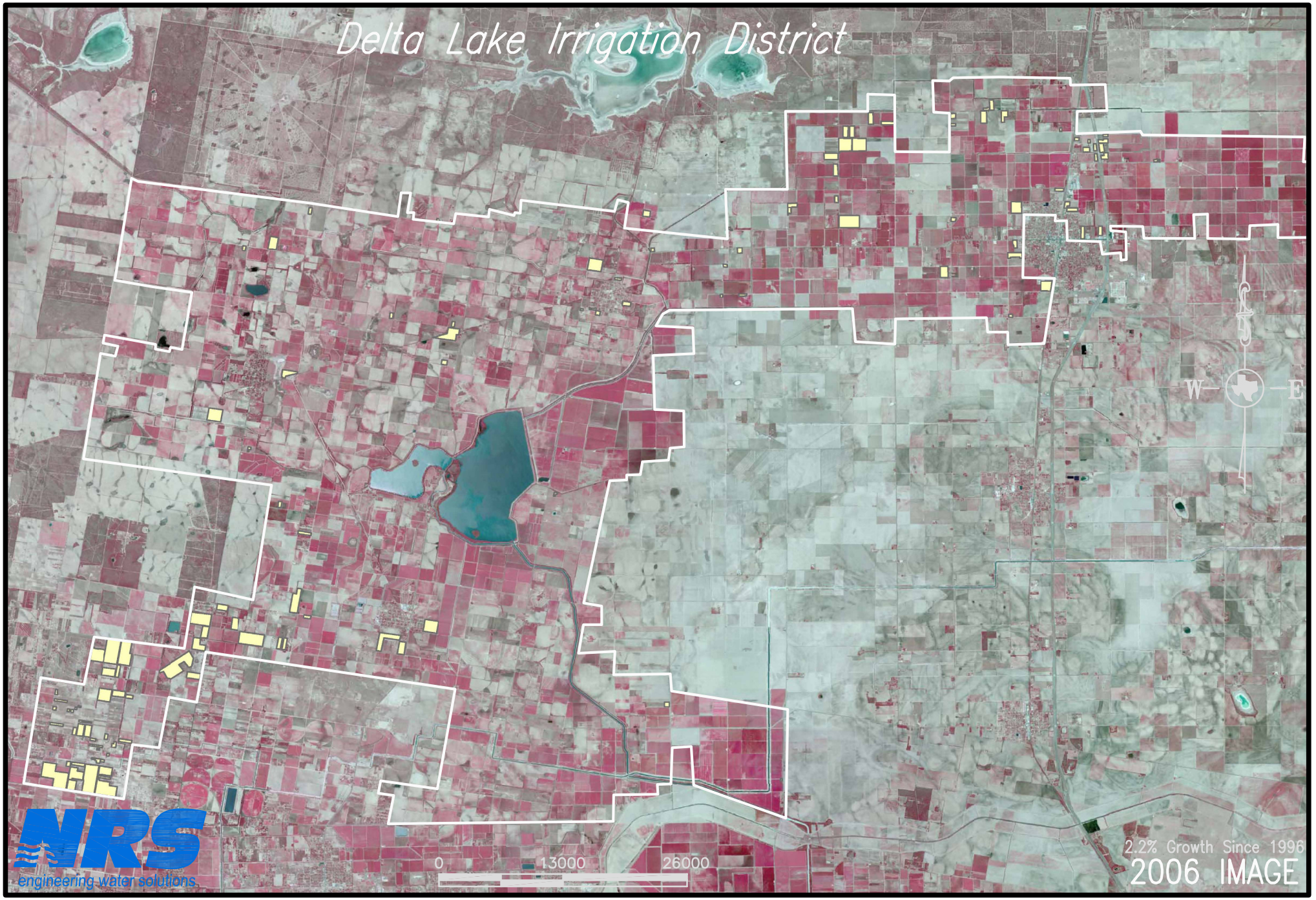
1996 IMAGE


Delta Lake Irrigation District
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engineering water solutions
2.2% Growth Since 1996
2006 IMAGE


Hidalgo County Irrigation District No.2
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1996 IMAGE
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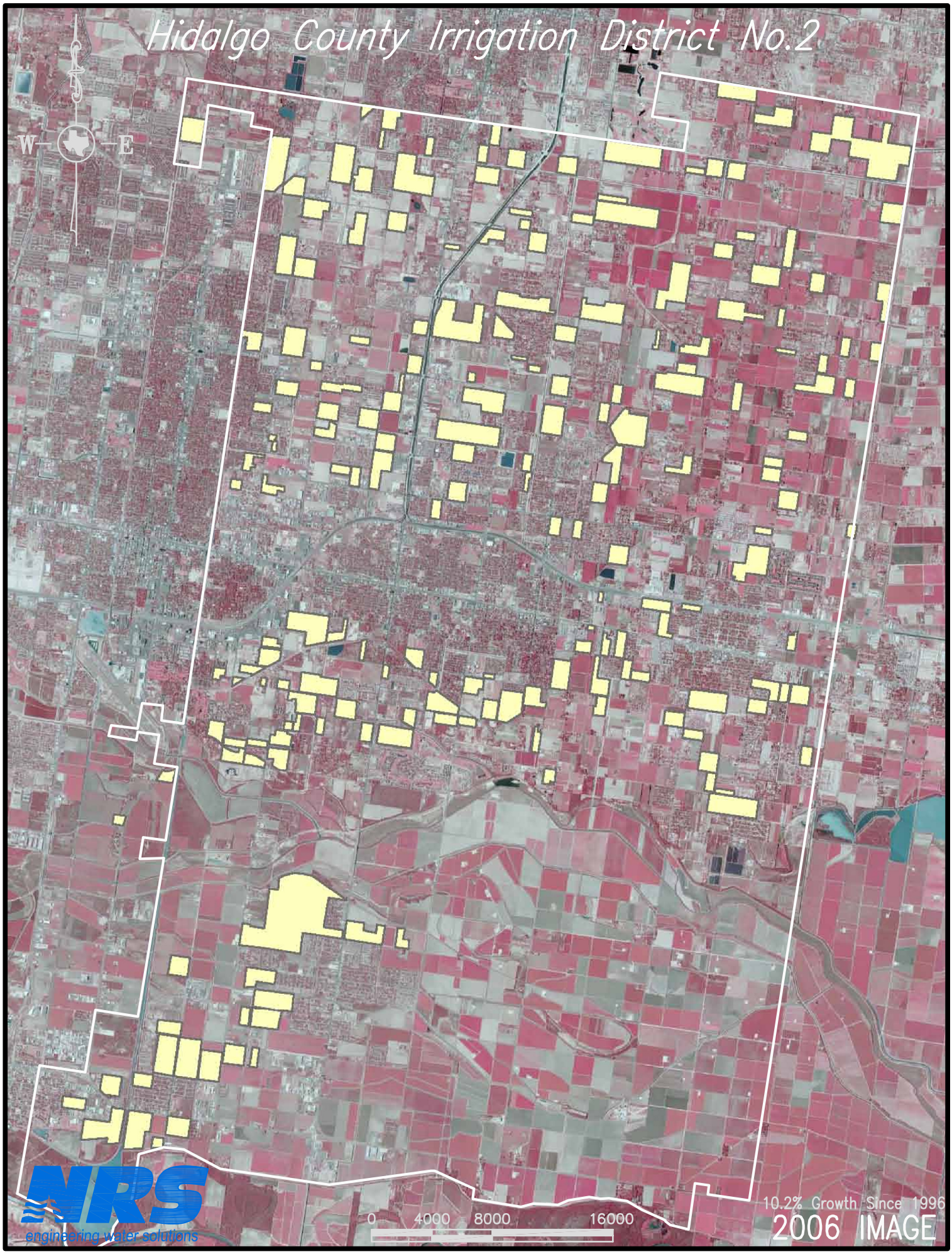
engineering water solutions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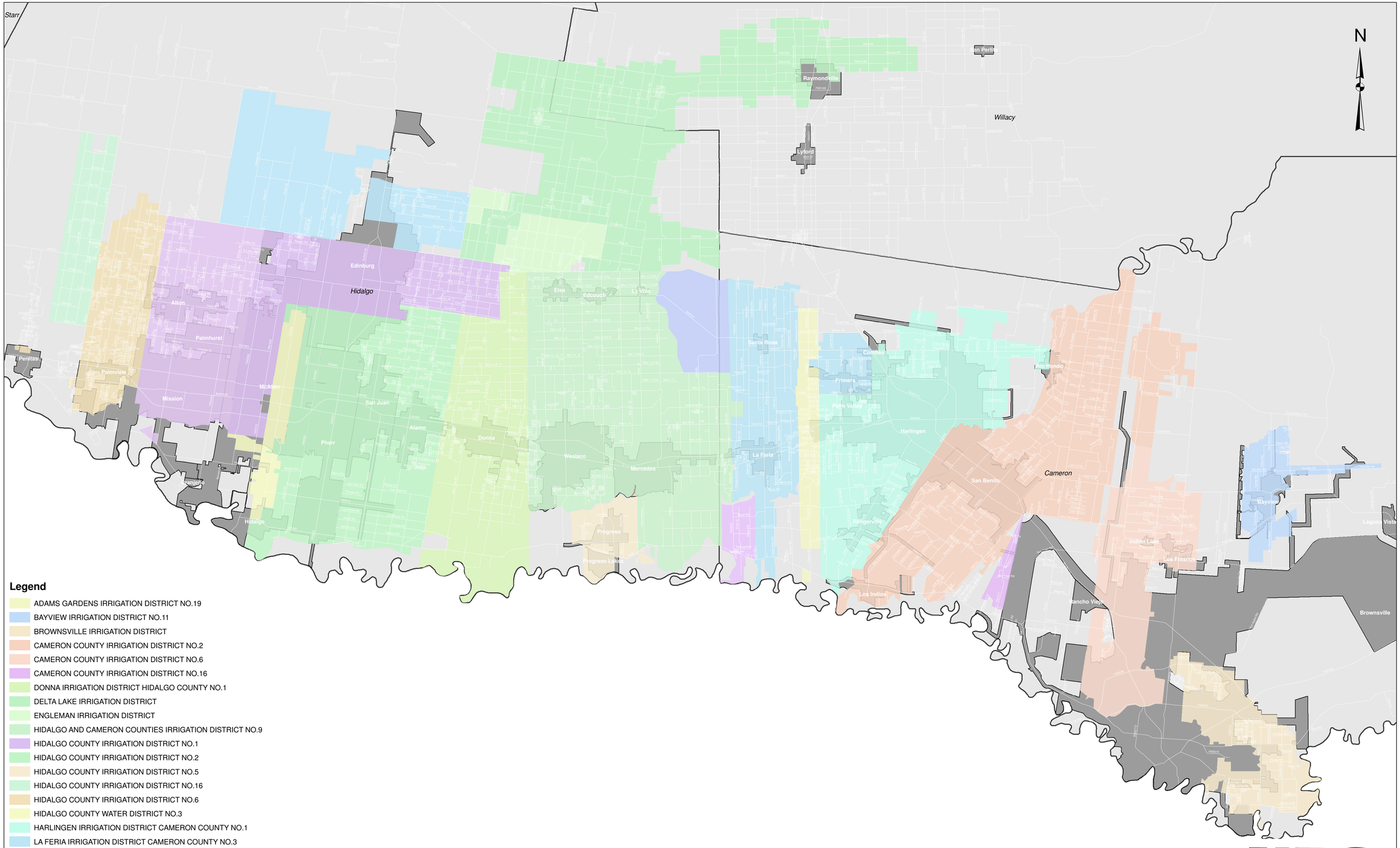
10.2% Growth Since 1996
2006 IMAGE



Legend

- ADAMS GARDENS IRRIGATION DISTRICT NO.19
- BAYVIEW IRRIGATION DISTRICT NO.11
- BROWNSVILLE IRRIGATION DISTRICT
- CAMERON COUNTY IRRIGATION DISTRICT NO.2
- CAMERON COUNTY IRRIGATION DISTRICT NO.6
- CAMERON COUNTY IRRIGATION DISTRICT NO.16
- DONNA IRRIGATION DISTRICT HIDALGO COUNTY NO.1
- DELTA LAKE IRRIGATION DISTRICT
- ENGLEMAN IRRIGATION DISTRICT
- HIDALGO AND CAMERON COUNTIES IRRIGATION DISTRICT NO.9
- HIDALGO COUNTY IRRIGATION DISTRICT NO.1
- HIDALGO COUNTY IRRIGATION DISTRICT NO.2
- HIDALGO COUNTY IRRIGATION DISTRICT NO.5
- HIDALGO COUNTY IRRIGATION DISTRICT NO.16
- HIDALGO COUNTY IRRIGATION DISTRICT NO.6
- HIDALGO COUNTY WATER DISTRICT NO.3
- HARLINGEN IRRIGATION DISTRICT CAMERON COUNTY NO.1
- LA FERIA IRRIGATION DISTRICT CAMERON COUNTY NO.3
- SANTA CRUZ IRRIGATION DISTRICT NO.15
- SANTA MARIA IRRIGATION DISTRICT CAMERON COUNTY NO.4
- UNITED IRRIGATION DISTRICT OF HIDALGO COUNTY
- VALLEY ACRES WATER DISTRICT

OVERALL IRRIGATION DISTRICT MAP WITH CITY LIMITS

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1 ADAMS GARDENS IRRIGATION DISTRICT NO.19
2 BAYVIEW IRRIGATION DISTRICT NO.11
3 BROWNSVILLE IRRIGATION DISTRICT
4 CAMERON COUNTY IRRIGATION DISTRICT NO.2
5 CAMERON COUNTY IRRIGATION DISTRICT NO.6
6 CAMERON COUNTY IRRIGATION DISTRICT NO.16
7 DONNA IRRIGATION DISTRICT HIDALGO COUNTY NO.1
8 DELTA LAKE IRRIGATION DISTRICT
9 ENGLEMAN IRRIGATION DISTRICT
10 HIDALGO AND CAMERON COUNTIES IRRIGATION DISTRICT NO.9
11 HIDALGO COUNTY IRRIGATION DISTRICT NO.1
12 HIDALGO COUNTY IRRIGATION DISTRICT NO.2
13 HIDALGO COUNTY IRRIGATION DISTRICT NO.5
14 HIDALGO COUNTY IRRIGATION DISTRICT NO.16
15 HIDALGO COUNTY IRRIGATION DISTRICT NO.6
16 HIDALGO COUNTY WATER DISTRICT NO.3
17 HARLINGEN IRRIGATION DISTRICT CAMERON COUNTY NO.1
18 LA FERIA IRRIGATION DISTRICT CAMERON COUNTY NO.3
19 SANTA CRUZ IRRIGATION DISTRICT NO.15
20 SANTA MARIA IRRIGATION DISTRICT CAMERON COUNTY NO.4
21 UNITED IRRIGATION DISTRICT OF HIDALGO COUNTY
22 VALLEY ACRES WATER DISTRICT

OVERALL IRRIGATION DISTRICT BOUNDARIES WITH CONVEYANCES

SOURCE: IRRIGATION DISTRICT ENGINEERING AND ASSISTANCE PROGRAM (IDEA) http://idea.tamu.edu

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