

Texas Water Development Board



Agricultural Water Conservation Grant Final Report

Contract # 1313581609

by
Tom McLemore
Harlingen Irrigation District Cameron County #1

Johanna Arendt
Karen Ford
Tabish Khan
WaterPR

August 26, 2016

This project was funded by the Texas Water Development Board, with additional funding and services from the Harlingen Irrigation District.

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List of abbreviations

Ac	Acre
AF	Acre feet
AFY	Acre Feet per year
BOR	U.S. Bureau of Reclamation
Cfs	Cubic feet per second
Ft	Foot
Gpm	Gallons per minute
HID	Harlingen Irrigation District
PS	Pump Station
PVC	Polyvinyl chloride
SCADA	Supervisory Control and Data Acquisition
TWDB	Texas Water Development Board

1. Executive summary

Increasing the efficiency of irrigation water conveyance is of utmost importance to agriculture in the lower Rio Grande Valley. This \$200,000 grant from TWDB's Agricultural Water Conservation program has allowed the Harlingen Irrigation District to improve the efficiency of their conveyance system, saving both water and money.

The District replaced an aging lateral pipeline off McLeod-Hood Reservoir, which was found to be leaking approximately 377 acre-feet per year. They installed 9,400 feet of new pipe that was not only larger in diameter, but also more durable, made with PVC rather than the corrugated concrete used in the old pipeline. This allowed the District to improve its water-conveyance efficiency in that area by 17 percent in the first year. It also reduced both the amount of energy used and the amount of stress put on the pumping equipment, saving the District money in the long run. Customer service also improved, as water began reaching farmers faster once the pipeline was operating more efficiently.

In addition to installing a new pipeline, the District made several improvements to the conveyance system flowing from McLeod-Hood. District staff raised a pumping station well by 8 feet in order to prevent overflow from the reservoir, thereby increasing the reservoir's holding capacity. The District also installed a Siemens transit time water meter, which they had previously evaluated at the TWDB-funded Rio Grande Center for Ag Water Efficiency, and moved existing meters to improve their water-delivery accounting. The meters are connected to the District's solar-powered SCADA system, which was also installed with TWDB funding, resulting in increased efficiency.

These are the kinds of improvements recommended in both the State Water Plan and the Rio Grande Regional Water Plan (Region M). Water which previously leaked from the McLeod-Hood laterals can now remain in the Amistad and Falcon reservoirs to be allocated for municipal and irrigation district use within the Rio Grande Valley. It is a kind of "painless" form of water conservation, as no user group has to do without. And the newly installed equipment will continue to provide both water and budget savings for decades to come.

2. History and purpose

Harlingen Irrigation District identified the pipeline replacement as a high priority in 2011. The District undertook a Bureau of Reclamation (BOR) WaterSMART System Optimization Review, evaluating the efficiency of the District's entire water-conveyance system. The Review found considerable water-loss from the laterals running from the District's McLeod-Hood Reservoir to Pump Stations 54 and 55.

HID was aware there were problems with the laterals—District staff had reported difficulty irrigating farmland in the area, particularly downstream of Pump Station 55 (PS 55). And while doing repairs over time, the District discovered the decades-old corrugated concrete piping was deteriorating. However, it was one of several items on a list of future needed repairs in the District until the WaterSMART System Optimization Review helped HID identify it as a priority.

2.1 Measuring water loss

In order to determine the amount of water being lost, District staff filled the lateral from the McLeod-Hood Reservoir and closed all the outlets. They then closed the reservoir valve and measured how much the water declined at each pump station well. The lateral section to Pump Station 54 (PS 54) had a loss of 50 gallons per minute (gpm), and the lateral section to PS 55 had a loss of 655 gpm. The total water loss was 705 gpm or approximately 377 acre-feet per year (AFY).

In addition to wasting a valuable resource, the leakage lowered the efficiency of the pumping system and put extra stress on the equipment. The District utilized WaterCAD, a water distribution modeling and analysis software tool, to identify inefficiencies in the system. The District found the 24-inch lateral from McLeod-Hood Reservoir to PS 55 had significant head loss of 23-feet with all pumps on and all outlets closed. The decreased head meant the District could not maintain the proper water depth at the PS 55 pump house, causing the pump to cavitate, essentially sucking air instead of water. This led to premature wear on the impeller and lowered the pressure in the pipelines leading from PS 55 to the farms, increasing the amount of time it took to irrigate fields and lowering the overall efficiency of the system.

In addition to replacing the deteriorating pipeline, this project included other water-conveyance improvements. The District raised up the receiving well at PS 55 to improve reservoir storage, and they installed a new transit time flow meter at PS 54 to improve water-delivery accounting. More information on the entire project can be found in the Section 4 of this report.

2.2 Importance of water conservation

By halting substantial leakage from aging pipes (~377 AFY), the District has freed up a volume of water that can remain in the Amistad and Falcon reservoirs and be allocated by the Rio Grande Watermaster for municipal and irrigation district use within the Rio Grande Valley.

Water is in high demand in the Rio Grande Valley. In recent years, farmers have seen cuts in allocations due to prolonged drought, a lack of water released into the Rio Grande from Mexico, and growing demand from non-agricultural users. Water conservation is a major part of regional and statewide water plans.

One of the five main goals of the 2011 Rio Grande Regional Water Plan, which was the current plan at the start of this project, was to “minimize irrigation shortages through the implementation of agricultural water conservation measures.” In summarizing potential water management strategies, the report says, “It is apparent that the most cost-effective strategy with the greatest yield is irrigation conveyance system improvements.”

This emphasis on improving the efficiency of irrigation district operations continued in the 2011 Rio Grande Regional Water Plan. Chapter 5: Water Management Strategies says, “Irrigation District improvements represent some of the best Water Management Strategies for Region M by both decreasing losses and improving service to customers.

Irrigation District Conservation Strategies include:

1. Canal lining (new linings and replacement of damaged linings)
2. Installation or replacement of pipeline
3. General repairs and improvements including new metering installation

Demand projections in the 2017 State Water Plan are dependent on increasingly efficient irrigation systems. The Plan states, “Irrigation demand is expected to decline as a result of more efficient irrigation systems, reduced groundwater supplies, the economic difficulty of pumping water from increasingly greater depths, and the transfer of water rights from agricultural to municipal uses.” Further adding, “The vast majority of unmet needs are within the irrigation water use category.” This highlights the importance of irrigation conservation strategies in the 2017 State Water Plan which estimates “about 639,000 acre-feet per year in irrigation conservation strategies is recommended in 2020, and 1.3 million acre-feet per year is recommended in 2070.”

The District’s installation of 9,400 feet of new pipeline and transit time flow meters, made possible by this TWDB grant, are the kind of cost-effective water conservation strategies supported by the Region M water plan and the 2017 State Water Plan. This infrastructure

upgrade, together with the many water conservation projects completed by the District in past years (many with TWDB funding), will reduce water loss and help close the gap between agriculture irrigation needs and the available water supply in the Rio Grande Valley.

Below are other TWDB-funded projects undertaken by the District in years past that have contributed to the goal of agriculture water conservation and irrigation efficiencies:

1. TWDB Ag Grant contract #0503580013: Texas Project for Ag Water Efficiency

Project website: <http://www.texasawe.org>

Annual report: <http://www.twdb.texas.gov/conservation/agriculture/demonstration/lower-rio-grande-valley.asp>

2. TWDB Ag Grant contract #0903580882: Innovative Technologies for Agricultural Water Management and Flow Measurement

Final Report:

http://www.twdb.texas.gov/publications/reports/contracted_reports/doc/0903580882_harlingen.pdf

3. Project location

McLeod-Hood Reservoir, located in the northeast portion of the Harlingen Irrigation District, has a capacity of 288 acre-feet (AF) and supplies water to 2,500 acres of land. In total, the District covers 56,114 acres in Cameron County and provides drainage, flood control, and water supply services to 88.3 square miles.

The District's water supply comes entirely from the Rio Grande—the main pumping plant diverts water from the river near the town of Los Indios. HID operates three reservoirs including the HID Main Reservoir, located in the south end of the District, and the McLeod-Hood Reservoir and Bogus Lake in the north end. The reservoirs serve as buffers to absorb changes in daily producer use, as well as to mitigate the four-day travel time of water from Falcon Reservoir.

Figure 3-1 below provides a close-up of the project site and Figure 3-2 on the following page shows the project location within the District.



Figure 3-1. Map of project site. Red lines indicate the newly installed pipeline.

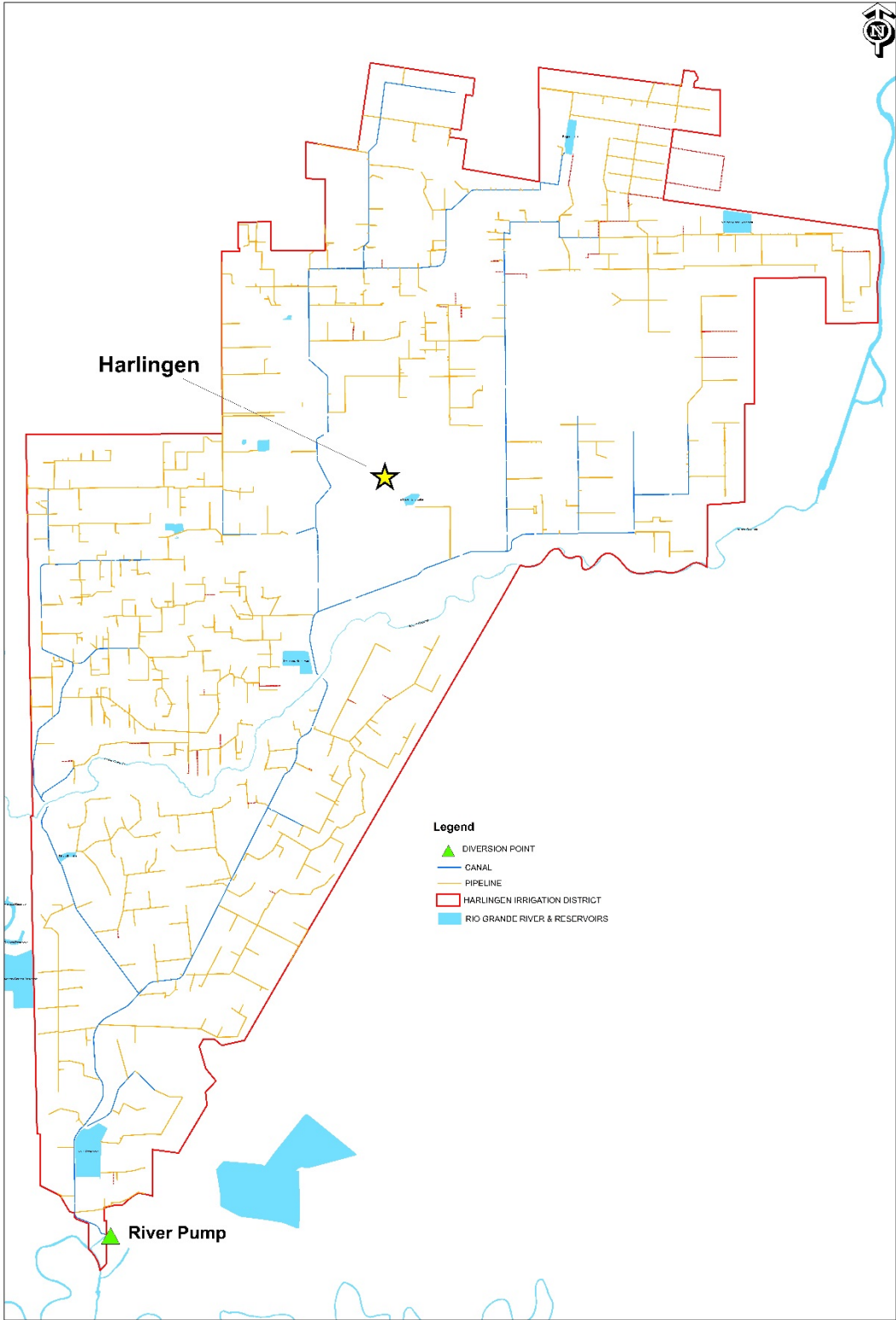


Figure 3-2. Map of Harlingen Irrigation District

4. Project description

Harlingen Irrigation District installed 9,400 feet of 30-inch and 36-inch PVC (CORR-21) pipe to replace the deteriorating 12- to 24-inch corrugated concrete laterals running from the McLeod-Hood Reservoir to Pump Stations 54 and 55. The existing laterals, which were found to be leaking about 377 AFY, were built in the 1930s and 1940s. HID took them over from Cameron County Irrigation District #15 about 25 years ago.

The project's engineering firm was Ferris, Flinn and Medina LCC of Harlingen. They sized the new pipeline to provide water to one-third of the McLeod-Hood system at a time—or 36 cubic-feet per second (cfs). The pipeline, as designed, met the District's goal of having one outlet per every 40 acres that was capable of delivering a 0.6-foot watering depth with a minimum head of water no less than 4 cfs. This met the District's grower needs and expectations.

In the original design, the pipeline was to be installed on the north side of McCloud Road. The District decided instead to install the pipeline on the south side, leaving the old system in operation during construction, and allowing them to avoid disturbing 24 driveways.

Construction of the pipeline began in October 2013. The District's original plan to construct the pipeline in phases to avoid disrupting operations during irrigation season, was no longer necessary. In addition to having the old pipeline operational during construction, winter rainfall actually negated the need for water deliveries in the early part of the 2014 growing season. The District was able to work on the pipeline with minimal interruption, finishing construction ahead of schedule in May 2014.

Using the same method that identified leaks in the old pipeline, the District tested the new pipes to ensure they were leak-free.

The project also included raising the receiving well at PS 55 by 8 feet to improve the storage capacity of McLeod-Hood reservoir. The top of the well was previously six feet below the high water level of the reservoir, and overflows had occasionally occurred.

A new Siemens transit time flow meter was installed on the supply side of PS 54, and the flow meter that was already at PS 54 was moved to the reservoir outlet. These meters, in conjunction with the existing transit time flow meter for PS 55, allow the District to more accurately measure water deliveries, leading to better overall system management.

4.1 Funding

This project was funded through TWDB's Agricultural Water Conservation grant program. The total cost of the PVC pipeline, flow meter and pump station modifications was \$893,368. In addition to the \$200,000 granted by TWDB through the Agricultural Water Conservation

Program, the District provided the remaining approximately 78 percent of the cost through District funds and in-kind labor.

The District was able to begin work on the improvements to the McLeod-Hood laterals quickly once the grant was executed in 2013. Preliminary designs for the project had already been completed through BOR's WaterSMART System Optimization Review prior to applying for the grant.

4.2 Construction photos



Pipe staging area.



Pouring a junction box.



30-inch pipeline going south.



Preparing for dry bore.



Dry bore in progress.



Completed dry bore with 30-inch pipe installed



Working around a municipal water line.



Keeping things level with a laser.



Tying into Pumping Station 55.



Hole for a turnout.



The images above show the outlet control structure from McLeod Hood Reservoir. The District replaced the gate and cut the concrete box down to allow for more flow from the reservoir.

4.3 Administration, Monitoring, Reporting, and Outreach

As part of the Texas Project for Ag Water Efficiency, the Harlingen Irrigation District held a number of workshops and training programs for both growers/producers and irrigation district managers/personnel. These workshops covered the findings from on-farm demonstrations using new irrigation practices or tools, and included an emphasis on automation and upgrading district infrastructure to increase efficiency and conserve water. Further, workshops designed for irrigation districts, highlighted work done with Federal and State Grants to improve on district efficiency and conserve water

Annual water savings reporting will follow project completion for a period of 5 years, as follows:

- March 15, 2016
- March 15, 2017
- March 15, 2018
- March 15, 2019
- March 15, 2020

5. Project benefits

This grant enabled system improvements and increased the efficiency of the District’s operations, reduced water loss, and provided a model to other irrigation districts looking to optimize their operations.

In the year one following the pipeline project completion, the District conserved 264.42 AF that would otherwise have been lost to leakage—a 17 percent improvement in efficiency, as shown in the table below. More than 120 landowners and 5 farmers have benefitted from the irrigation pipeline upgrade.

Table 5-1. Water conserved as a result of improvements.

Year	Acres Irrigated	Average volume	Total volume after improvements	Total volume before improvement	Estimated savings ac/ft	Percent improvement
2014	2203.5	0.6	1322.1	1586.52	264.42	17%
2015	601.26	0.6	360.756	396.8316	36.0756	9%

The pipeline replacement also saves energy because the District will no longer be pumping the extra approximately 377 AFY. HID estimates that pumping the water up 44 feet required about 23,590 kilowatt hours, saving an estimated \$3,304 in energy costs over the course of a year.

This project also benefitted from the TWDB-funded Rio Grande Center for Ag Water Efficiency. As part of the District’s work at the Center, staff evaluated different types of transit time flow meters and found the Siemens meters to be the most reliable, and so chose to purchase and install those meters for this improvement project.

All three meters along the McLeod-Hood laterals—at PS 54, PS 55 and at the reservoir—will be connected to the District’s solar-powered SCADA system, which was also installed with TWDB funding. TWDB has allowed HID to greatly improve the efficiency of their operations, saving water and showcasing easy-to-implement system improvements. We look forward to continuing this productive partnership.

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Texas Water Development Board

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Austin, TX 78711-3231, www.twdb.texas.gov
Phone (512) 463-7847, Fax (512) 475-2053

June 27, 2016

Mr. Wayne Halbert
Harlingen Irrigation District Cameron County No. 1
301 E. Pierce
Harlingen, Texas 78550

email: tmclemore@hidcc1.org

Re: Texas Water Development Board's (TWDB) Agricultural Water Conservation Grant Fund Contract between the TWDB and the Harlingen Irrigation District, Cameron County No. 1 (Contractor), TWDB Contract No. 1313581609, Draft Report Comments on a Report Entitled "Efficiency improvements to the Harlingen Irrigation District's irrigation conveyance system, including replacement of concrete laterals with pipelines"

Dear Mr. Halbert:

Staff members of the TWDB have completed a review of the draft report prepared under the above-referenced contract. ATTACHMENT 1 provides the comments resulting from this review. As stated in the TWDB contract, the DISTRICT will consider revising the final report in response to comments from the Executive Administrator and other reviewers. In addition, the DISTRICT will include a copy of the Executive Administrator's draft report comments in the Final Report.

The TWDB looks forward to receiving one (1) electronic copy of the entire Final Report in Portable Document Format (PDF) and six (6) bound double-sided copies. **Please further note, that in compliance with Texas Administrative Code Chapters 206 and 213 (related to Accessibility and Usability of State Web Sites), the digital copy of the final report must comply with the requirements and standards specified in statute. For more information, visit <http://www.sos.state.tx.us/tac/index.shtml>.** If you have any questions on accessibility, please contact David Carter with the Contract Administration Division at (512) 936-6079 or david.carter@twdb.texas.gov.

The DISTRICT shall also submit one (1) electronic copy of any computer programs or models, and, if applicable, an operations manual developed under the terms of this Contract. If you have any questions concerning the contract, please contact Mr. Cameron Turner, the TWDB's designated contract manager for this project, at (512) 936-6090 or cameron.turner@twdb.texas.gov.

Sincerely,



Robert E. Mace, Ph.D., P.G.
Deputy Executive Administrator
Water Science and Conservation

Attachment

c: Cameron Turner, TWDB

Our Mission

To provide leadership, information, education, and support for planning, financial assistance, and outreach for the conservation and responsible development of water for Texas

Board Members

Bech Bruun, Chairman | Kathleen Jackson, Board Member | Peter Lake, Board Member

Jeff Walker, Executive Administrator

Attachment 1

Harlingen Irrigation District
TWDB Agricultural Water Conservation Grant Contract #1313581609
Draft Final Report dated May 10, 2016

Kudos for providing a very well written draft report, delivered ahead of schedule, A++!

Below are a few comments for your consideration in developing the final report.

General Comments:

- Please ensure that all paragraphs have similar tab stops/margins (e.g. third paragraph in Section 2. History and Purpose).
- Please consider revising the report to remove any instances of passive voice for improved clarity.
- Please include in the report a description of the education and outreach activities held as a part of the project, as mentioned in Task 5 in the scope of work.
- Consider including any available data on the number of producers or end users benefitting from this project.

Specific Comments:

Page 5

- Paragraph 3: Please define WaterCAD (e.g. “WaterCAD is a computer aided design program used for modeling and analysis of water distribution systems.”)

Page 6

- Consider including relevant references to the recently approved 2017 State Water Plan.
- Paragraph 2: Please correct the reference to the **Rio Grande Watermaster** in the following, “...*Amistad and Falcon reservoirs and be allocated by the ~~State Water Master~~ for...*”
- Paragraph 4: Please correct the reference to the **2011** Rio Grande Regional Water Plan.

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- Paragraph 1: Consider listing other TWDB funded HID projects and including links to their final reports and/or project websites, i.e.:
 - TWDB Ag Grant contract # 0503580013 – Texas Project for Ag Water Efficiency
 - <http://www.twdb.texas.gov/conservation/agriculture/demonstration/lower-rio-grande-valley.asp>
 - <http://www.texasawe.org/>
 - TWDB Ag Grant contract #0903580882 – Innovative Technologies for Agricultural Water Management and Flow Measurement
 - http://www.twdb.texas.gov/publications/reports/contracted_reports/doc/0903580882_harlingen.pdf

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- Paragraph 2: Please consider revising the following sentence, or providing additional information as necessary to explain the overall intent of the pipeline project, “*The pipeline was also designed to meet the District’s goal of having one outlet per every 40 acres, a 0.6-foot watering depth, and one head equaling 4 cfs.*”

- Paragraph 8: Please correct TWDB grant funding from \$250,000 to \$200,000.
- Paragraph 8: Please correct “72 percent of the cost” to 78 percent.