TEXAS A&M AgriLIFE
Teaching • Research • Extension • Service

Agriculture is Life!

TR-336
2008

Ponding Test Results
Seepage Losses
Laterals 8E and 2A-C

Maverick County Water Control and Improvement District No. 1

By:

Eric Leigh, Extension Associate, Biological and Agricultural Engineering

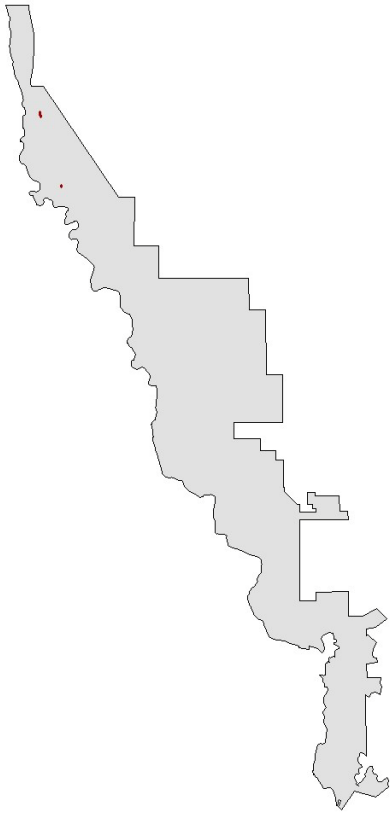
Guy Fipps, Professor and Extension Agricultural Engineer, Biological and Agricultural Engineering

Texas Water Resources Institute Technical Report
November 2008

Texas Water Resources Institute
make every drop count

PONDING TEST RESULTS
SEEPAGE LOSSES
LATERALS 8E AND 2A-C

MAVERICK COUNTY WATER CONTROL AND IMPROVEMENT DISTRICT NO. 1



Report Prepared by:

Eric Leigh and Guy Fipps,[1] P.E.

March 30, 2004

IRRIGATION TECHNOLOGY CENTER

Texas Cooperative Extension - Texas Agricultural Experiment Station,
Texas A&M University System

[1] Extension Associate, and Professor and Extension Agricultural Engineer, respectively, Department of Biological and Agricultural Engineering, 2117 TAMU, College Station, TX 77843-2117.

CONTENTS

Ponding Test Results, Seepage Losses: Laterals 8E and 2A-c
Maverick County Water Control and Improvement District No.1

SUMMARY

This report summarizes the results of ponding tests conducted in Maverick County Water Control and Improvement District No.1 on August 26-27, 2003. Tests were conducted on one unlined canal (Figure 1) and one lined canal (Figure 2). The segments are located on the northern area of the district (see Figure 3) as follows:

- Test segment MA3 (unlined): east of US Hwy 277 and immediately north of FM1908
- Test segment MA4 (lined): east of US Hwy 277 and 0.3 miles north of Willory Farm Rd.

Ponding test results are summarized in Tables 1 and 2 and were high for both types of canals. Test Segment MA3 (lined) had been dredged and cleaned two weeks prior to testing which is likely to have contributed the relative have seepage loss rate of 13.85 gal/ft2/day. The lining of MA4 was in poor shape as shown in (Fig. 7 – 8), resulting in a loss rate of 8.82 gal/ft^2/day.

Table 1. Summary of ponding test results of the canals Lat 8E and Lat 2Ac.

Test ID	District Segment ID	Length (ft)	Avg. Top Width (ft)	Test Type	Loss rate Gal/ft^2/day	Total Loss in Canal (ac-ft/mile) per day	per year
MA3	Lat 8E	481	20.7	seepage	13.85	4.63	1690.1
MA4	Lat 2Ac	1610	11.3	seepage	8.82	1.35	493.5

Table 2. Test results for canals Lat 8E, and Lat 2Ac in terms of change in water level.

Test ID	ft/hr	ft/day	in/hr	in/day
MA3	0.12	2.77	1.39	33.29
MA4	0.08	1.81	0.91	21.73

Figure 1. Test MA3, a segment of the unlined canal Lat. 8E.

Figure 2. Test MA4, a segment of the lined canal Lat. 2Ac.

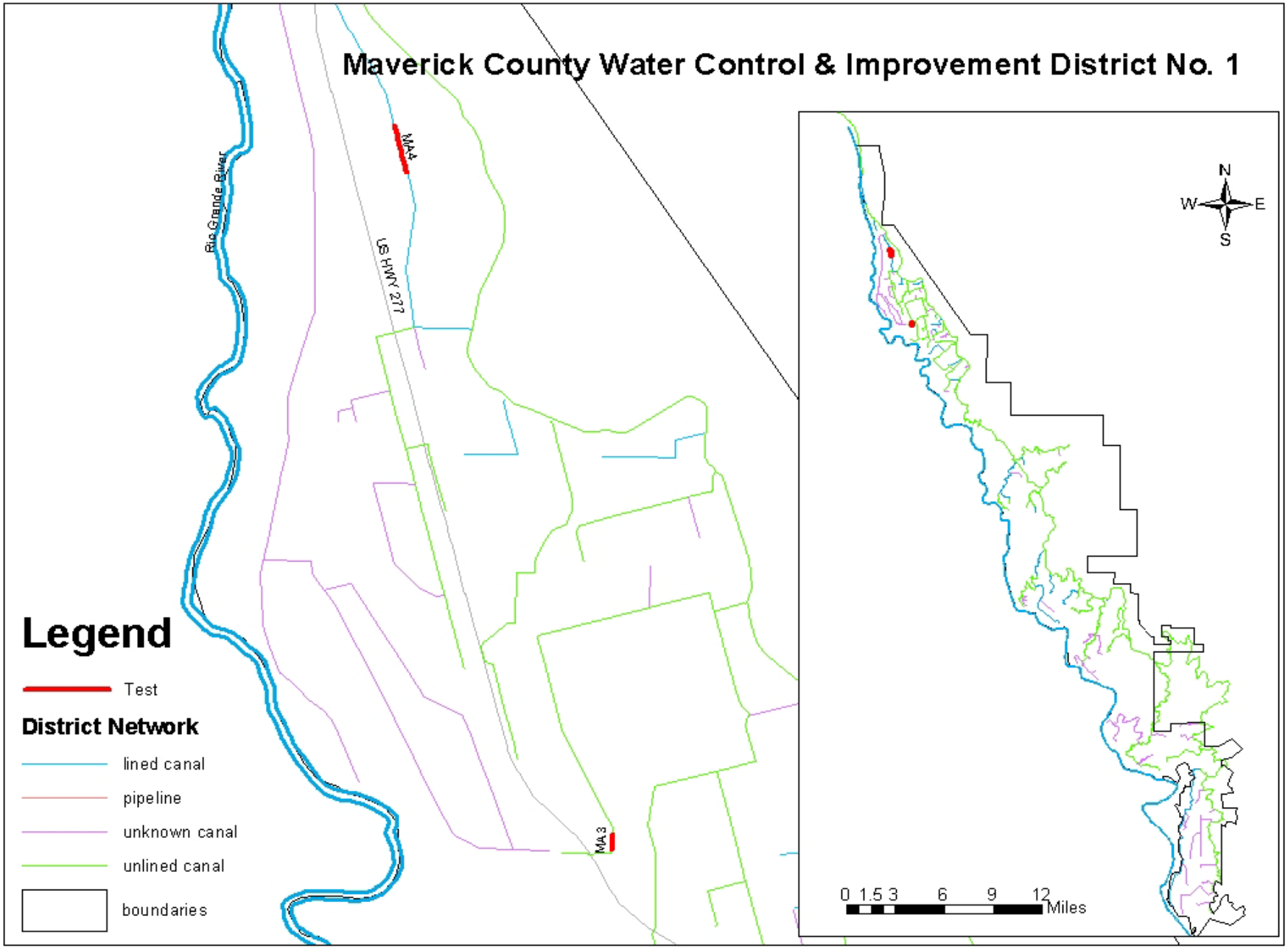


Figure 3. District Map and locations of test segments.

MATERIALS AND METHODS

Seepage loss rates were measured using the ponding method. In this method, the two ends of a canal segment are closed or sealed with earthen dams as shown in Figure 4 and 5. As can been seen in Figure 5, the dam was built on the upstream side of the check gate allowing for better containment and to reduce fill needed for the dam.

Figure 4.Downstream dam of Test Segment MA3.

Figure 5.Upstream dam of Test Segment MA4.

Once sealed, water elevations are usually taken for approximately 48 hours. However, due to the rapid drops in water levels in both segments, the tests were stopped after 24.5 hours in MA3 and 0.5 hours in MA4. Two to three staff gauges (Figure 6) were placed in each test segment, and stage levels were recorded manually. Canal dimensions and water spans were also surveyed during the test.

Figure 6.Staff gauge use to manual measure water levels.

The tests are classified as follows:

- Test segment MA3 did not contain valves or gates within the canal; thus, the seepage rate was measured.
- Test segment MA4 did not contain valves or gates within the canal; thus, the seepage rate was measured. High loss rates can be attributed to the canal lining condition shown in Figures 7 and 8.

Tables 3 and 4 provide details on the test segments; data collected and recorded changes in water depths during the tests. The canal cross-sections at each of the staff gauges are illustrated in Figures 9 - 10 for test MA3, and Figures 11 - 13 for test MA4. Also shown on these charts are the water depths at the beginning of the test.

Figure 7. Horizontal cracks in the sidewall of MA4.

Figure 8. Large break in the sidewall of MA4.

TEST RESULTS

Test MA3: Lateral 8E

Table 3. Data for Test MA3: Lateral 8E.				
District: Maverick County Water Control and Improvement District No. 1			**Test ID:** MA3	
Canal: Lateral 8E			**Lining Type:** Unlined	
Starting Water Span Widths: **A:** 18.35 feet, **B:** 19.25 feet			**Date:** Aug. 26-27, 2004	
Test Segment Length: 481 feet			**Start Time:** 1:19 pm **Finish Time:** 1:49 pm	
Test Starting Depths: **A:** 3.06 feet, **B:** 4.50 feet				
Staff Gage Readings				
Date	**A**		**B**	
	Time	**Feet**	**Time**	**Feet**
Aug. 26	13:19	3.98	13:22	5.43
	14:16	3.78	14:13	5.24
	15:20	3.56	15:19	5.01
	16:16	3.40	16:15	4.85
Aug. 27	10:10	1.46	10:15	2.92
	13:45	1.14	13:49	2.62
True depth adjustment factor (ft)		-0.92		-0.93

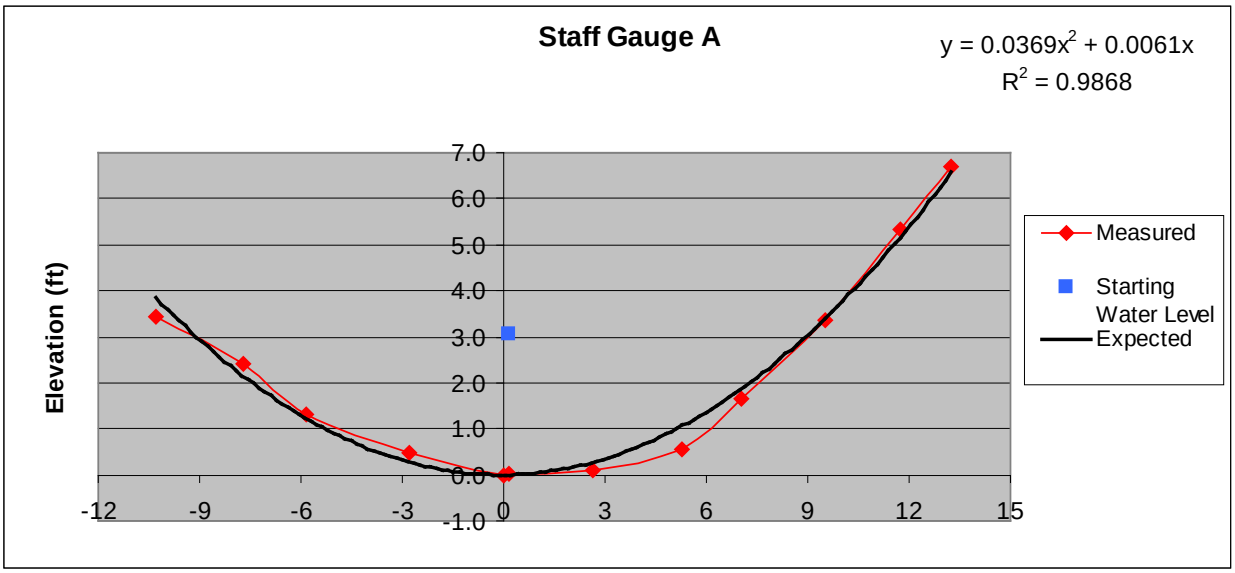


Figure 9. Cross-section at Staff Gauge A, MA3.

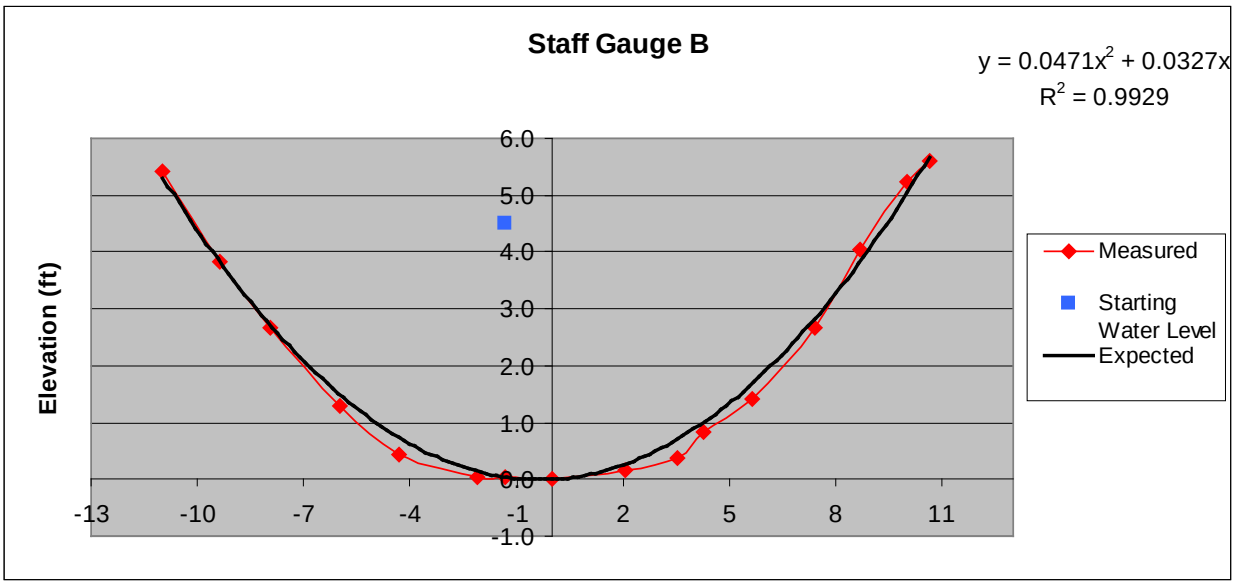


Figure 10. Cross-section at Staff Gauge B, MA3.

Test MA4: Lateral 2A-c

Table 4. Data for Test MA4: Lateral 2A-c.						
District: Maverick County Water Control and Improvement District No. 1					**Test ID:** MA4	
Canal: Lateral 2A-c					**Lining Type:** Lined	
Starting Water Span Widths (feet): **A:** 7.11, **B**: 7.27, **C**: 8.63					**Date:** Aug. 26-27, 2003	
Test Segment Length: 1610 feet					**Start Time:** 1:56 pm **Finish Time:** 10:35 pm	
Test Starting Depths (feet): A: 1.71, **B**: 2.24, **C**: 2.33						
Staff Gage Readings						
Date	**A**		**B**		**C**	
	Time	**Feet**	**Time**	**Feet**	**Time**	**Feet**
Aug.26	13:56	3.67	14:00	3.93	14:03	0.92
	15:10	3.52	15:08	3.78	15:06	0.78
	16:05	3.4	16:04	3.67	16:03	0.68
	16:57	3.3	16:56	3.58	16:55	0.58
Aug.27	10:30	2.13	10:32	2.38	10:35	-0.64
True depth adjustment factor (ft)		-1.963		-1.685		-1.412

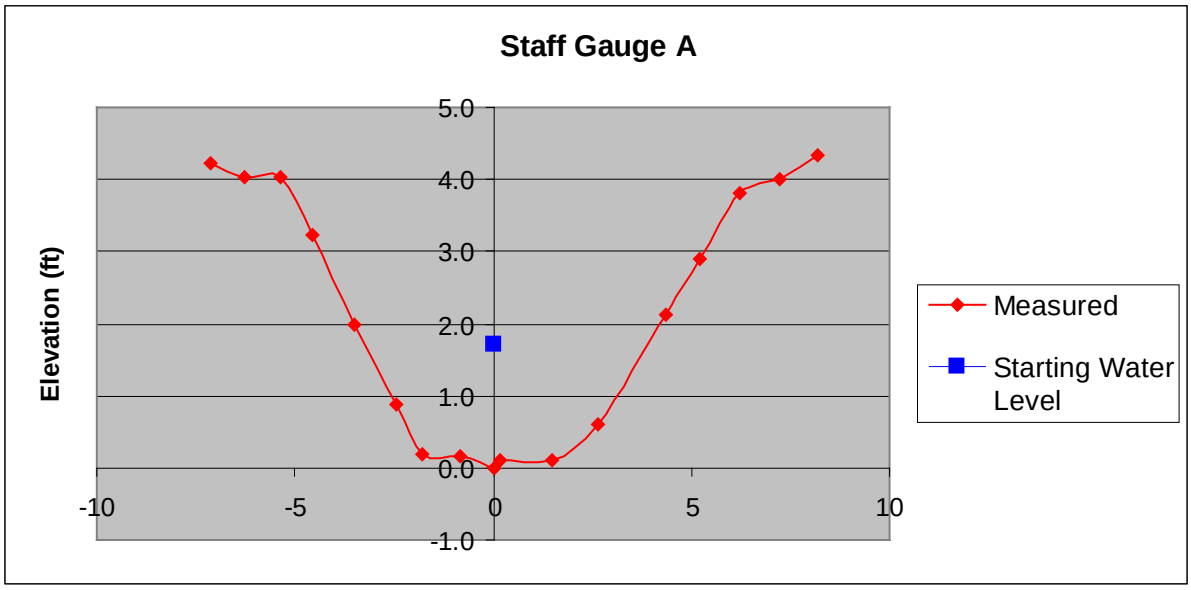


Figure 11. Cross-section of Staff Gauge A, MA4.

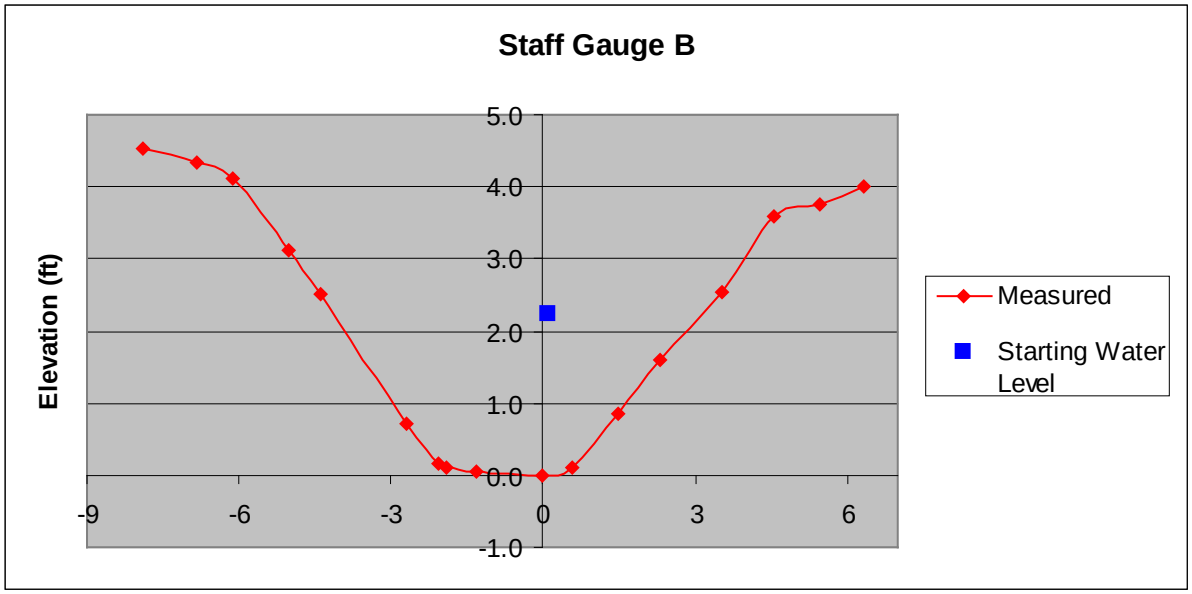


Figure 12. Cross-section of Staff Gauge B, MA4.

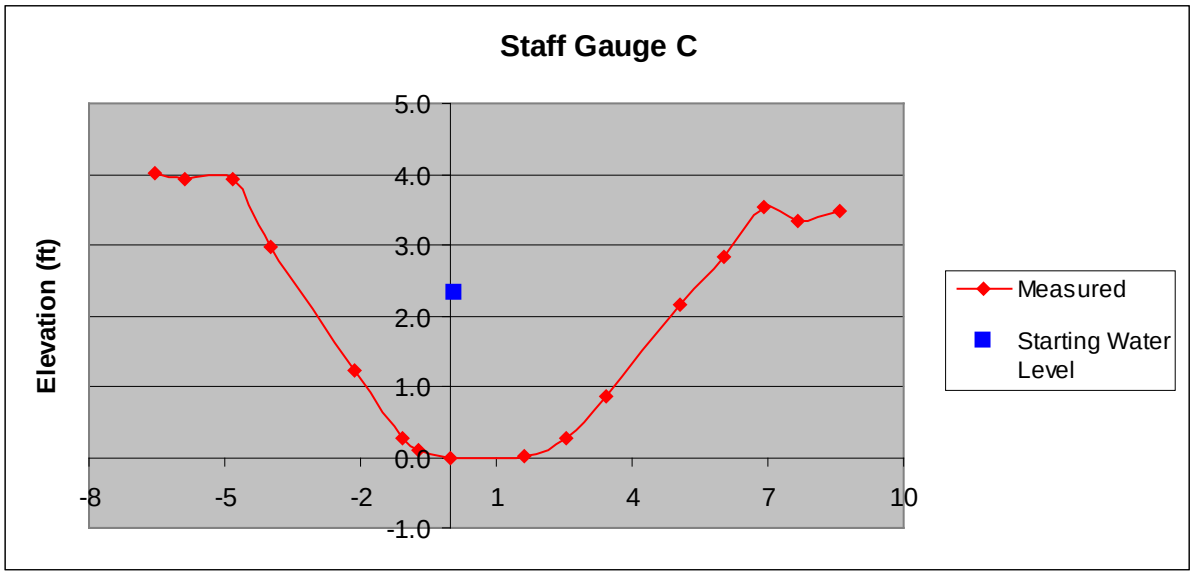


Figure 13. Cross-section of Staff Gauge C, MA4.

OTHER TEST RESULTS

Texas Cooperative Extension has conducted approximately 50 total loss tests and seepage loss tests in the Lower Rio Grande River Basin since 1998. The results are summarized in Tables 5 – 7. Table 8 gives seepage rates versus lining type as reported in the scientific literature.

Table 5. Results of seepage loss tests conducted by Texas Cooperative Extension in the Lower Rio Grande River Basin.

Test ID	Year	Canal Width (ft)	Canal Depth (ft)	Class*	Loss Rate	
					gal/ft^2/day	ac-ft/mi/yr
Lined						
16HC2	03			M		
LF1	03	12	5	M	1.77	152.9
LF2	03	10	6	M	4.61	369.1
MA4	03	12	5	S	8.85	529.7
SJ4	00	15	4	M	1.17	111.2
SJ5	02	14	5	M	1.38	145.5
UN1	01	12	6	M	2.32	214.3
UN2	01	8	3	M	2.09	132.2
Unlined						
BR1	03	60	11	M	3.14	794.6
MA3	03	19	5	S	13.9	1690.1
RV1	03	38	4	M	0.15	23.0
SB4	02	16	4	S	0.64	68.3
SB5	02	18	3	S	1.67	188.3
SB6	02	20	5	S	1.44	189.0
SB7	02	16	4	S	0.42	47.4
SB8	02	20	5	S	0.83	104.0

*Classification of canal: M = main, S = secondary

Table 6. Results of total loss tests in lined canals (leaking gates and valves may have contributed to measured loss rates) conducted by Texas Cooperative Extension in the Lower Rio Grande River Basin.

Test ID	Year	Canal Width (ft)	Canal Depth (ft)	Class*	Loss Rate	
					gal/ft^2/day	ac-ft/mi/yr
Lined						
16HC1	03	14	5	M	1.89	192.4
BV1	99	10	5	M	7.97	510.5
BV2	99	9	4	M	8.53	451.5
DL1	00	20	6	M	0.16	18.8
DL2	00	7	4	S	4.12	236.2
DO1	03	5	3	S	1.68	65.2
DO2	03	6	4	S	2.18	121.5
DO3	03	6	3	S	2.71	107.2
ED1	00	6	4	S	34.32	1519.6
ED2	00	6	4	S	21.5	858.2
ED3	00	3	2	T	10.22	308.2
ED4	00	4	3	S	18.72	567.7
ED6	99	9	4	M	8.53	451.5
HA2	00	10	4	M	2.26	135.2
HA3	98	15	2	S	0.64	45.5
ME1	98	38	7	M	1.26	281.9
ME2	98		4	M	1.88	163.5
SJ1	99	12	5	M	2.58	126.8
SJ6	03	12	3	M	1.88	1.63
SJ7	03	19	4	M	1.98	227.1
UN3	02	12	6	M	2.02	169.7

*Classification of canal: M = main, S = secondary, T = tertiary

Table 7. Results of total loss tests in unlined canals (leaking gates and valves may have contributed to measured loss rates) conducted by Texas Cooperative Extension in the Lower Rio Grande River Basin.

Test ID	Year	Canal Width (ft)	Canal Depth (ft)	Class*	Loss Rate	
					gal/ft^2/day	ac-ft/mi/yr
BV3	99	55	8	M	0.15	53.4
ED5	02	105	7	M	2.39	1213.2
MA1	99	50	10	M	1.98	227.1
MA2	99	20	5	S	4.32	371.4
SB1	00	29	7	S	1.27	215.5
SJ2	00	23	6	M	2.74	293.2
SJ3	00	30	5	S	0.95	132.6

*Classification of canal: M = main, S = secondary

Table 8. Canal seepage rate reported in published studies.

Lining/soil type	Seepage rate (gal/ft^2/day)
Unlined[1]	2.21-26.4
Portland cement[2]	0.52
Compacted earth[2]	0.52
Brick masonry lined[3]	2.23
Earthen unlined[3]	11.34
Concrete[4]	0.74 - 4.0
Plactic[4]	0.08-3.74
Concrete[4]	0.06-3.22
Gunite[4]	0.06-0.94
Compacted earth[4]	0.07-0.6
Clay[4]	0.37-2.99
Loam[4]	4.49-7.48
Sand[4]	4.0-19.45

[1] DeMaggio (1990). Technical Memorandum: San Luis unit drainage program project files. US Bureau of Reclamation, Sacramento. [2] U.S. Bureau of Reclamation (1963). Lining for Irrigation Canals. [3] Nayak, et al. (1996). The influence of canal seepage on groundwater in Lugert Lake irrigation area. Oklahoma Water Resources Research Institute. [4] Nofziger (1979). Profit potential of lining watercourses in coastal commands of Orissa. Environment and Ecology 14(2):343-345.

ACKNOWLEDGEMENTS

A portion of this study was funded by Texas Cooperative Extension through the Irrigation Conservation in the Rio Grande Basin Initiative administered by the Texas Water Resources Institute of the Texas A&M University System with funds provided through a grant from Cooperative State Research, Education, and Extension Service, U.S. Department of Agriculture, under Agreement No. 2001-001-45049-01149.

The following persons contributed to this study:

Biological and Agricultural Engineering
2117 Texas A&M University
College Station 77843-2117
979-845-3977

Guy Fipps, Professor and Extension Agricultural Engineer

Texas A&M Research and Extension Center
2401 US Highway 83,
Weslaco 78596-8398
956-968-5581

Eric Leigh, Extension Associate
Noemi Perez, Ag Technician

Web Address: http://idea.tamu.edu

Maverick County Water Control and Improvement District No.1
Helpful planning and assistance in the canal ponding tests was provided by the District office personnel and canal riders.

THE IRRIGATION TECHNOLOGY CENTER
A center of the Texas Water Resources Institute
Texas Cooperative Extension - Texas Agricultural Experiment Station,
Texas A&M University System
http://itc.tamu.edu