Irrigation District Engineering and Assistance

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Task 1 and 3 Extension Engineering
Task 1: Irrigation District Studies

- Provide technical assistance, applied research and educational programs to improve water management and promote water conservation and modernization.

Task 3: Institutional Incentives

- Evaluate irrigation district infrastructure needs and develop strategies to efficiently deliver water for agricultural use, and to facilitate the adoption of efficient irrigation technologies.
Highlights 2009-2010

- Newsletter
- Website Hosting
- Canal Lining Evaluations
- Automation/Telemetry Demonstrations
- Canal Riders Training Development
- Spill Loss Research Update
- WebGIS – Brownsville
GIS Classes
Scheduled
August 2010

- **Beginners GIS Course** – 1 day intro class using ArcGIS 9.x. Students will learn basic mapping skills.

- **Intermediate GIS Course** – 1 day advanced class learning spatial analysis operations, create personal geodatabases, and a demonstration on Online GIS applications.

- **GPS Course** – ½ day class will provide hands-on instruction using simple hand-held units to a more complex survey-grade unit.
GIS Classes

Scheduled
August 2010

- Contact Eric Leigh or Martin Barroso for more information
- [http://idea.tamu.edu](http://idea.tamu.edu)
- Classes in El Paso depending on interest
GIS Classes
Significance?

- To educate about software updates and functionality
- Improve knowledge and skills
- Provide awareness of technology

Available to:
- District Managers
- Farmers
- Board of Directors
- Local & State Officials
- Extension & Research Personnel
A NEW IDEA

News Letter

November 2009

- Projects: Ongoing, Updates, and Results
- Recent Publications
- Educational Opportunities
Lining Evaluation Project

Protective barrier were PVC and polyester. Liners installed without a protective barrier are susceptible to damage from the sun, animals, intentional and unintentional vandalism, and normal district operational activities. An example of unintentional vandalism is children swimming in the canals.

Four types of liners have been used without a protective barrier: polypropylene, PVC, EPR, and polyurethane. Many of the rubber lined sections showed serious deterioration. The PVC has a hardener of the liners and is more resistant to vandalism and animal damage. The other two liners did well in remote canals.

Proper installation of liners was found to be critical. For example, liners that were not stretched properly during installation left no sagging or excess material that seem to be a natural draw for damage. Pains and loose material are easily grabbed, pulled, and torn.

The IDEA Team recommends that districts institute a regular inspection and repair program. Once a tear or cut happens, it will tend to expand and be susceptible to further damage until it is repaired. When planning a lining project, a district should evaluate the location and consider the potential for damage. Liners in high traffic areas will experience more damage. A more durable liner such as the PVC or even better, a liner with a protective barrier should be considered.

Additional details and results of our analysis are provided in the report “Assessment of Canals Lining Projects in the Lower Rio Grande Valley of Texas,” which may be viewed or downloaded from the IDEA website (http://idea.tamu.edu).

Office Computer Screen Display

United Irrigation District of Hidalgo County

Online Screen Display

Weekday: Monday, August 6, 2009

Avg. Daily Water Use: 93.5 a.c.f.
Total Drawdown: 99.0 a.c.f.

Activity in the Past 24 Hours (O.F.D.)

Activity in the Past 10 Days

Recent Publications

B-6218 Measuring Seepage Losses from Canals Using the Ponding Test

Measuring seepage loss rates is one of the best ways to prioritize canals for maintenance and rehabilitation and to ensure that canal improvements qualify for grant funding. The methodology considered here is to measure the loss rates from irrigation standard of comparison (ISOC) data collected from two ends of a canal, usually with earth dams. The change in water level is measured from 24 to 48 hours and used to calculate the seepage losses from data collected. There is a sample ponding test data form available in the online edition for use on this method. It includes sections on preparing for the test, collecting and analyzing data, and calculating seepage losses.

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News Letter Provides

- To communicate, education, and make aware of program activities
  - District Managers
  - Board of Directors
  - Local & State Officials
  - Extension & Research Personnel

- Presents opportunities for involvement
Website Hosting

- Bayview ID
- Brownsville ID
- CCID2
- United
- HCID16

http://districts.tamu.edu
Welcome to the Bayview Irrigation District No.11 Website!

General Manager
Amy Gonzales

Office Location: Map
110 S. San Roman Rd.
Bayview, Texas 78566

Telephone Numbers:
(956) 233-5800 office
(956) 233-4343 fax

Hours of Operation:
Monday - Friday
8 am - 5 pm

Email Address: bayviewirrigation@yahoo.com
About Us

Our History

Cameron County Water Improvement District Number 11 was organized as a water control and improvement district in 1932 under the provisions of Chapter 51, Texas Water Code. The Cameron County Water Improvement District Number 11 was renamed Bayview Irrigation District No. 11 on November 29, 1982.

The District’s primary operation is to provide irrigation water to an area approximately 6,850 acres but only about 4,506 are strictly under agricultural production. The District obtains water from the Rio Grande River under a contract with the Republic Electric Power Company who in turn contracts to the City of Brownsville. The contract is for 100 CFS. Water is stored in the Lower Rio Grande Valley Reservoir and eventually through the irrigation system and evapotranspiration to the crops.
Website Addresses

- Bayview Irrigation District No.11
  http://bayviewid11.tamu.edu
- Brownsville Irrigation District
  http://brownsvilleid.tamu.edu
- Cameron County Irrigation District No.2
  http://ccid2.tamu.edu
- Hidalgo County Irrigation District No.16
  http://hcid16.tamu.edu
- United Irrigation District
  http://united.tamu.edu
Significance?

- To help communication information via internet to farmers, water users, and communities.

- Publicizes the districts’ involvement in the community, and provides a forum in which to interact with the district.
TASK 1: Irrigation District Studies

Updates:
- Canal Lining Evaluations
- Automation/Telemetry Demonstrations
Canal Lining Evaluation Program

- Annual evaluations and ratings to determine durability and long-term viability of canal lining.
Purpose of Lining Evaluations

- Ensure continued water savings
- Help districts select durable canal lining material
- Develop guidelines for maintaining performance
  - vandalism
  - material installation
  - maintenance/repair
<table>
<thead>
<tr>
<th>Material</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Polyester with protective barrier</td>
<td>A geocomposite consisting of two layers (top and bottom) of 8 oz/yd² nonwoven polyester bonded to an olefinic copolymer geomembrane, 20 mil thick. The protective barrier consists of 2-3 inches of shotcrete.</td>
</tr>
<tr>
<td>PVC with protective barrier</td>
<td>Non-reinforced Poly Vinyl Chloride (PVC). The protective barrier consists of a wire mesh with 2.5 inches of shotcrete.</td>
</tr>
<tr>
<td>Polypropylene</td>
<td>A reinforced polyester scrim 16 oz/yd² between polypropylene layers, 24 mil thick.</td>
</tr>
<tr>
<td>PVC Alloy</td>
<td>A polyvinylchloride blend, reinforced with a polyester scrim, 40 mil thick.</td>
</tr>
<tr>
<td>EPDM Rubber</td>
<td>A non-reinforced EPDM (ethylene propylene diene monomer), 45 mil thick.</td>
</tr>
<tr>
<td>Polyurethane</td>
<td>Two layers of 3-oz/yd², heat-bonded, non-woven geotextile saturated with liquid polyurethane, 40 mil thick.</td>
</tr>
</tbody>
</table>
Canal Lining Evaluation Report
June 29, 2009

EVALUATION OF CANAL LINING PROJECTS IN THE LOWER RIO GRANDE VALLEY OF TEXAS

Rio Grande Basin Initiative
Irrigation Technology Center
Texas AgriLife Extension Service
Significant Water Savings

- Water losses were reduced after lining by 94%

**before**
- 1.98 gal/ft²/day
- 227.14 ac-ft/mi/yr

**after**
- 1.17 gal/ft²/day
- 11.20 ac-ft/mi/yr
Results

- EPDM and Polyurethane liners ranged from good performance to having serious problems.
- The PVC alloy is the toughest of the 4 liners installed without a protective barrier.
- Without question, the best lining system is a synthetic liner with a protective barrier of shotcrete.
Updates?

- Performed 2009-2010 inspections of old and new lining projects.
- 33 project sites, including 6 new projects
  - EPDM material in Maverick ID
  - 3 in overlaid shotcrete on existing lined section in HCID No.6
Impacts?

- 3 different EPDM materials in Adams Garden ID in collaboration with Firestone
Impacts?

- United Irrigation District followed our recommendations and installed new project.
Automation and Telemetry Demonstrations

- Hidalgo County Irrigation District No.6 (HCID6)
- Cameron County Irrigation District No.6 (CCID6)
- United Irrigation District
Purpose?

- Create in-house capacity in canal operation and control concepts, and automation applications
- Demonstrate cost-effective and alternative technologies for SCADA
Purpose?

- Assist districts in designing and implementing projects which have a water conservation/management purpose.
- Evaluate and advise districts on equipment/software options and other technical issues.
Obstacles

- Implementation Process
  - Lack of knowledge about existing technology
  - Lack of willingness to learn/use technology based control system

Our Approach:

- Provided detailed explanations on equipment and design during the process
- Developed “easy to understand” manuals
- Provided training on control interface
- Constant reinforcement of project activities and goals
Activities

- Maintenance
- Hardware problems & replacement
- Programming changes
- Testing
- Communication systems
- Internet
United ID

Examples:

- Continued testing due to hysteresis during radial gate operation at United

- Continued flow measurement for varying flow conditions at United

- Improvement on programming code to control the gate and monitor flow rates

- On-line access (password protected) to control and monitor SCADA projects.
Accurate gate calibration is pivotal for flow calculations. The gate is used for flow control and measurement purposes (United).
Radial Gate: **Past 20 min Averages**

Last Record: 5/13/2010 12:00:00 PM

- **Flow Rate**: 53.6 CFS
- **Downstream Water Level**: 4.9 ft
- **Gate Opening**: 1%
- **Upstream Water Level**: 7.4 ft
District and Online Displays

Flow (CFS) and Water Levels (ft): Past 12 Hours
Flow (CFS): Past 7 Days
Significance?

- Accurate gate calibration is pivotal for flow calculations
- Gate is used for flow control and measurement purposes (United)
- Online & computer displays help the districts to control, operate, and make decisions
Mission 6

Examples:

- Replacement of faulty parts in actuator
- Improvement on communication system; both radio and direct connection.
- Water level sensor and control (PLC) replacement due to lighting events in HCID No.6
Walker Lake
Significance?

- Performed operation and maintenance because district personnel lacks of knowledge and skill to do so

- Provided further guidance to HCID6 how to expand existing SCADA projects (Eagle Automation)
Control Type: Manual
Current Water Level: 131.7 feet
Remote Control: 0
Communication Status: Healthy, Multidrop

Emergency Level: 132.20 feet
Gate Status: 100

Water Level Graph:
- Overrange

Date: 17 Mar 2010
Trace Type: District.Current Water Level
Ruler Value: Current
## Emergency Gate

<table>
<thead>
<tr>
<th>Control Type</th>
<th>Current Water Level</th>
<th>Emergency Level</th>
<th>Communication Status</th>
<th>Gate Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>Normal State</td>
<td>132.0 feet</td>
<td>132.40 feet</td>
<td>Healthy, Multidrop</td>
<td>Gate Closed</td>
</tr>
</tbody>
</table>

### Water Level

![Water Level Graph](image)

<table>
<thead>
<tr>
<th>Trace</th>
<th>Type</th>
<th>Ruler Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Emergency.Current Water Level</td>
<td>Current</td>
<td>-</td>
</tr>
<tr>
<td>Emergency.Current Water Level</td>
<td>Raw Historic</td>
<td>-</td>
</tr>
</tbody>
</table>
Significance of Automation?

- Reduces losses due to spillage
- Improves conveyance efficiency
- Improved water delivery to farm turnout which contributes to better on-farm efficiency
- Real time data at a central location for improved operation of system
- And the ability to quickly respond to changing situations
TASK 3: Institutional Incentives

- Canal Riders Training Development
- Spill Loss Research Update
- WebGIS – Brownsville
GIS as a real time decision support system in Brownsville Irrigation District

PURPOSE

 Improving pumps and water account data daily management

 Enabling growers/landowners to access personal data via Internet
ACTIVITIES

- Recommendations to improve pump flow and water sales data management
- Training and Demonstration Activity for district personnel and contractors
  - Meetings: database improvement and transfer set up
  - Demonstrations: ArcGIS Server, WebGIS pilot project
  - GIS classes to district personnel
- WebGIS Pilot Project
  - Output files format, elaboration, and transfer
  - Network communication
  - Web applications to access historic and real time data
WebGIS Pilot Project

Grower/Landowner

Brownsville Irrigation District - Grower/Landowner Map

Map Contents:
- Layer
  - Feltenbach
  - Mol
  - Unit
  - Background
  - Owner Maps
  - Annotation
  - Boundaries < 22600
  - Fields 2003 Flat rate clerk
  - Fields 2003 Flat rate
  - Roads < 22500
  - Roads > 22500
  - Water Bodies
  - NE_Mexico
  - Aerial photograph

Results

Print

The page at http://watergis.tamu.edu says:

Please enter your password:

[Enter]  [OK]  [Cancel]

Unit #9 - Meter #2

FLOW (GPM)

Time  | GPM  | ACFT
--- | --- | ---
Monday 3/8/2010 8:30 | 0 | 26

TOTAL VOLUME (ACFT)

FLOW (GPM)

2/19  | 2/24  | 3/1
--- | --- | ---
25 | 20 | 30
15 | 10 | 25
5 | 0 | 15
0 | 0 | 0

GPM  | ACFT
--- | ---
0 | 26
Water GIS - BROWNSVILLE IRRIGATION DISTRICT

DATABASE DOWNLOAD

Ticketes:
2009
2009
2009

Pump Units:
2009: 3, 4, 5, 6, 7, 8, 9, 10, 11, 12

Pump Units (Landowner Units):
2009: [Fehrenbach], [Jones], [Pavilion], [Malo]
Authorized the WaterGIS website http://watergis.tamu.edu/

AgriLIFE Extension is developing Online GIS demonstrations in collaboration with some water entities. Data is accessible in different ways as, for example, interactive maps, dynamic charts, and spreadsheets, in such a way to help water entities to advance in their current water management and conservation efforts.

Brownsville Irrigation District

Project Description

Brownsville Irrigation District in their current water management and conservation efforts, are collaborating with Texas Agrilife Extension to facilitate the integration of pump flow, metering data, and water account database information into an online GIS application.

Objectives

The main objective is to improve the availability and access to real-time and historical flow data and water use information, in such a way to:

- Provide a higher level of analyses for planning of irrigation scheduling and management of daily operations.
- Benefit the farmers/water-users by providing more timely and efficient irrigation scheduling, and have account information more readily available for on-farm management.

Components

1) Displaying status of pumps and real-time and historic water flow data.
2) Allow water account access through an interactive GIS interface.
DISCUSSION

- Initial interest after demonstrations is promising, an evaluation from the Brownsville Irrigation District personnel is needed after a period of testing.
- Design and maintenance of district databases should be done to allow easy updating of the system.
WebGIS Pilot Project

Significance?

Saving water & time through:

- Improving pump and water account data daily management
  - Daily up-to-dated maps to improve water order planning and delivery
  - Provides better access for evaluation and analysis of historically data for improved efficiency
- Enabling growers/landowners to access personal data via Internet
  - Online irrigation (meter) readings
  - Updated water account information
Technical Assistance: GIS

PURPOSE
- Assist the District in their efforts in updating their GIS
- Interactions with consultants
- Create a standardized GIS database structure for irrigation districts
Hidalgo County Irrigation District #6
Database/GIS Integration

ACTIVITIES
 Analysis of water account database
 Key missing data have been identified

legal parcels paying flat rate
recently irrigated parcels
25% of legal parcels have multiple and not identified water accounts
Delta Lake Irrigation District
GIS Update Project Assistance

ACTIVITIES

- Provided recommendations
  - Categories of information
    - DISTRICT BOUNDARY
    - STORAGE AREA
    - IRRIGATION SUBAREA
    - IRRIGATION FIELD
    - SEGMENT OF CONVEYANCE SYSTEM
    - NODES OF CONVEYANCE SYSTEM
    - CROSS SECTION AND SURVEY POINT
    - OTHER NODE
  - Detailed information and organization into shapes and tables (e.g. Nodes):
    - PUMP/RE LIFT STATION
    - SIPHON
    - WEIR/FLUME
    - DIVERSION GATE
    - STANDPIPE
    - VALVE
    - BEGINNING OF SEGMENT
    - END OF SEGMENT
PURPOSE

- Improve knowledge of district operation, understanding of basic concepts (maintenance, gates, priorities)
- Improvement in conserve water, timely irrigation, improve performances

Why?

- Low education levels and limited English skills
- High turnover rate due to limited to no in-district training
ACTIVITIES

- Set up of a Canal Rider Questionnaire
- Interviewed canal riders, supervisors and managers
- Training class set up
  - Overall goal: train the new canal rider and reinforce the knowledge of the experience canal rider
  - Outlines:
    - Section I.: General Description and Responsibilities of Canal Riders 1 Hour (lecture & Handouts)
    - Section II.: Basic Terminology
    - Section III.: Basic Hydrology (Visual Examples)
    - Section IV.: Basic Conveyance System and Structures
    - Section V.: Understanding the Importance of Canal Management
    - Section VI.: Common Practices and Issues
    - Section VII.: Basic Form Filling and Reporting Techniques
Spill Data Analysis in Hidalgo and Cameron County Irrigation District No.9 (In progress)

PURPOSE
- Development of a Rapid Assessment Tool (RAT) to identify major spill structures
- Development recommendations for operational parameters
ACTIVITIES

- Analysis of measured water level at 3 sites (6/2008 - 9/2009)
- Collection of new parameters as possible indicators of frequency and magnitude of water losses
  - Algae classification with University of Texas Pan American, Edinburg
  - Water sales
New possible indicators (water sales, algae classification):
Results of water level analysis:

**Graphs and Data**: 
- **Site #2**: Graph showing estimated above_in, estimated Q_cfs, and threshold. 
- **Temperature**: Line graphs for MaxTemp, MinTemp, and Rainfall. 
- **Cumulative Frequency**: Plot of inches vs. cumulative frequency (%) for different thresholds.
Correlation between water losses and irrigation:

\[ y = 0.6242x + 31.504 \]
\[ R^2 = 0.8408 \]
Identification of key water sales:
CONCLUSIONS

 Promising correlation between observed parameters
 Estimate water losses that occur from spill losses

SIGNIFICANCE

 Allow Districts to quickly to identify and correct operational problems based on spill loss indicators to reduce water losses
On-farm/Distribution Network Management/Integration (In progress)

PURPOSE

- Evaluate the CRITERIA crop model for water balance simulation
- Create maps of predicted water needs to help the canal rider plan the water distribution operations
ACTIVITIES

- Testing of the CRITERIA crop model
  - Comparison of predicted and observed soil moisture for individual fields
  - Prediction of water needs at district level

- Collection of additional field data
  - Collection of core soil samples
  - Laboratory analysis of soil hydraulic properties (K sat, water content at saturation, FC, and WP)
AgriLife Research, Weslaco, TX, Delta Lake I.D.

USDA-ARS laboratory, Bushland, TX
CONCLUSIONS

 Promising results for individual fields with detailed observed data
 District personnel expressed interest for soil moisture maps to help the daily water distribution operation, but there are some key data missing:
  › Local rainfall
  › Some crop management information (planting and harvesting date, exact irrigation timing)

SIGNIFICANCE

 Help Districts forecast on-farm irrigation needs and planning operational activities