Rapid Intervention Program (RIP) to Improve Operational Management and Efficiencies in Irrigation Districts

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Rapid Intervention Program (RIP)

- Is based on ten-year experience at the Texas A&M Extension Service
- Is a structured and systematic approach for:
  - Analyzing the distribution network and on-farm irrigation of irrigation schemes
  - Developing recommendations on improved management strategies
Rapid Intervention Program (RIP) is designed as:

- A low-cost, user-friendly and versatile approach …
- … that takes advantage of the knowledge and experience of the scheme operators and managers
RIP Components Include

1. Inventory of basic data needed to estimate water supply, flows and on-farm irrigation needs
2. Hydraulic Head Survey and Analysis Tool
3. Distribution Network Condition Rating Tool
4. On-farm Survey and Analysis Tool and Water delivery Schedule Calculation Procedure
5. Spreadsheets and GIS map for data analysis
6. Training curriculums for persons implementing the RIP (flow measurement, spreadsheets, GIS)
Case Studies

- Design of RIP procedure (Central and South Iraq, 2012)
  1. Al Shehhamiyah Water User Association
  2. Thraima Project

- Prioritization of canals for lining (Texas, 2013):
  3. Gulf Coast Irrigation Division of the Lower Colorado River Authority (LCRA)
Al Shehamiyah Water User Association and Thraima Project, Iraq
Al Shehamiyah Water User Association
15,000 ha
13 m³/s (4 pumps)

Thraima Project
21,000 ha
14 m³/s (gravity)
Pumping Station
(Al Shehamiyyah)
Inlet (Thraima)
End of Main Canal

Main Drain
Secondary canal
Irrigated field (Border)
Obtain map of the distribution network and irrigated areas
- Working with the operators, complete and modify survey forms
- Encourage operators to conduct ground truth, and carry out measurements of actual flow rates for canals and at on-farm turnouts
- Enter data into spreadsheet
- Analyze data and create maps showing results (include data quality control, link spreadsheets to GIS, review of results with operators)
- Create reports (include tables of results, GIS maps with results)
RIP Manual

A manual was developed within the Iraqi project, to serve as both a training program and a reference guide to all the steps required in order to successfully apply the RIP.

The manual also includes four Appendixes:
- Survey forms (English and Arabic)
- Training curriculums
- Case study results (Al Shehamilyah and Thraima Projects)
Head Survey

Purpose:
- Identification of canals and areas that currently have continuous or intermittent water supply problems
- Identification of the potential causes of these problems
Two components:

1. Head Survey
   - Canals
   - Affected areas

2. Drainage survey
   - Areas with drainage problems
Head Survey
(Al Shehamiyah)

Frequency of head problem during peak period
Head Survey (Al Shehamiyah)

Severity of head problem
Head Survey
(Al Shehamiyah)

Cause of drainage problem
Head Survey (Thraima)

Severity of head problem
Head Survey
(Thraima)

Cause of head problem
Canal/Gate Evaluation

Purpose:

- Assess general condition of the irrigation distribution network through a visual rating system to identify segments which need rehabilitation

General description: Segment ID*, Current Canal Operating Depth, Freeboard*, Year of installation*, Use frequency*, How often does the district perform cleaning*, Vandalism*

Field rating (concrete, earthen, gates): General conditions*, Vertical and Horizontal Cracks (Hairline, Pencil-size, Large), Noticeable amounts of maintenance & repair*, Buckles and Erosion behind concrete lining, Vegetation*, Concrete erosion, Evidence of seepage*, Major damages*
Canal Evaluation
(Al Shehamiyah)

General conditions
(concrete canal)
Canal Evaluation
(Al Shehhamiyah)

Evidence of seepage
Canal Evaluation (Thraima)

Major damages, #/km
(concrete canal)
Damage on canal liner
On-Farm Survey

Purpose:

- Information needed to determine if the current flow at the farm turn-out is sufficient to allow for efficient on-farm irrigation
- For a representative field in each command area during peak irrigation

General Description: Presence of gravel, Soil type*, Top soil depth, Hard pan/impermeable layer limiting roots growth, Water table depth*, Irrigation method*, Irrigation efficiency in surface irrigation*, Crop composition in peak month*

Current Irrigation Practices: Flow rate (maximum actual flow)*, Time to irrigate a typical border*, Time lost to move water*, Time assigned to each scheduling unit*, Irrigations interval*, Number of Water courses/scheduling units, farms/water course, borders/farm irrigated at the same time*, Number of inlets to irrigate one border*
On-Farm Survey (Al Shehamiyah)

Water Table depth
On-Farm Survey (Al Shehhamiyah)

Time to irrigate a border
Water Delivery Scheduling Calculation Procedure

Steps:

1. Organize collected data (including distribution network levels and command areas) for peak irrigation month and define a representative field for each scheduling unit (SU)

2. For each SU calculate: crop water requirement, net irrigation depth, interval between irrigations, irrigation stream per border and time of application, border irrigated at the same time and total stream per SU, net and gross crop irrigation requirement

3. Compare calculations to available data and identify structural problems
On-Farm Survey (Al Shehamiyah)

Scheduling Units (SU)
Water Delivery Scheduling Calculation Procedure (cont.)

Purpose:

- Provides recommendations for
  - Optimal flow at the farm turnout
  - Frequency and volume of irrigation at peak demand
  - Number of fields that can be irrigated at the same time
  - Maximum flow in each canal segment
- Not completed (flow measurements not available)
Al Shehhamiyah
Thraima
Baghdad Water Technical Meeting and certificates

27 June 2012
Gulf Coast Irrigation Division of the Lower Colorado River Authority (LCRA), Texas
Objectives

Develop and apply a methodology for prioritizing the lining of irrigation water delivery canals

Elements:

- In cooperation with LCRA staff apply the RIP and modify it as needed (emphasis on identification and quantification of seepage)
- Evaluate the methodology by conducting field reconnaissance and more detailed study of selected canal segments
- Update and verify the revised methodology
- Demonstrate the revised methodology by applying it to a portion of one irrigation divisions
Steps

1. **Surveys**
   - General Survey (information on general maintenance, operation, and suspected seepage issues)
   - Head Survey and Seepage Surveys
   - Field Seepage Survey to verify collected data

2. **GIS soil analysis**
Steps (cont.)

3. Seriousness of expected seepage losses: a 3-point ranking scale based on
   A. Canal use frequency
   B. Severity and cause of seepage
   C. Visual indicators of seepage
   D. Soil maps analysis
Example of survey form
(Field Seepage Survey)
Results
Steps to obtain Seriousness of expected seepage losses: a 3-point ranking scale
A) Canal use frequency

B) Severity and cause of seepage

C) Visual indicators of seepage
Examples of visual indicators of seepage
D) Soil maps analysis
Final map: Seriousness of expected seepage losses (a 3-point ranking scale)

Rating based on highest priority for detailed analysis

1 = 9 segments (10 miles)

2 = 5 segments (4 miles)

3 = 10 segments (9 miles)

Likely non-seepage losses = 5 segments (4 miles)
Non seepage problems

Legend
- Pumping Station
- Damage caused by cattle

Frequency of Head Problems
- Never
- Sometimes
- Often
- Always

64 miles

7,000 acres
Conclusions

- RIP is an organized structure of data that can be further developed in more complex analysis (e.g. water delivery scheduling)
- Priorities to be addressed to improve water delivery efficiency are identified (in the Al Shehhamiyah case studies several gates were replaced based on results)
- RIP is easily replicable using the same structure of data
Conclusions
(LCRA case study, Texas)

- We identified 27.4 miles of canals that are likely to have significant seepage losses and/or leaks. These canals were ranked by priority for further analysis.
- We also identified non-seepage conditions and problems:
  - Head problems, resulting in insufficient flow (7,000 acres)
  - Cattle damage widespread in the South West and South East Sections
- Based on the observations we recommended some types of lining materials/systems (composite i.e. synthetic overlaid with a protective concrete layer, PVC blend reinforced with a polyester scrim, reinforced geomembrane)
For more information:

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