# Demonstration of the Rapid Assessment Tool:

# Analysis of Water Supply Conditions

# in the Harlingen Irrigation District[1]

January 7, 2003

A Report Prepared by:

Eric Leigh and Guy Fipps, P.E.[2]

[1]A portion of this study was funded by Texas Cooperative Extension through 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.

[2] Extension Associate, and Professor and Extension Agricultural Engineer, respectively, Biological and Agricultural Engineering Department, Texas A&M University, College Station, Texas 77843-2117.

**Demonstration of the Rapid Assessment Tool (RAT):**
**Analysis of Water Supply Conditions in the Harlingen Irrigation District**

## Summary

RAT (Rapid Assessment Tool), currently under development, is a combination of surveys, data collection, mapping and limited direct measurement designed to provide a quick and cost-effective analysis of the conditions of the water distribution network of irrigation districts.

The ***Water Supply (Head) Conditions c***omponent of RAT is designed to determine the extent of the area affected from less than optimal water supply, to identify associated canal and pipeline segments, and to define the major causes of the problem. This report summarizes the application of this RAT component in the Harlingen Irrigation District.

Less than optimal water supply conditions were found to affect approximately 21,000 acres within the district. This means there is either insufficient flow (volume) or pressure to meet demand at the farm turnout. On an area basis, 6% of the affected area has minor problems, 59% moderate and 35% severe. This report includes tables and 7 charts which detail the types, extent, and causes of the head problem.

## RAT

RAT is a combination of methodologies designed to provide a quick and cost-effective analysis of conditions within an irrigation district. The main objective is to define the extent and seriousness of problems contributing to poor conveyance efficiency and low on-farm water use efficiency. RAT methodologies include surveys, rating of infrastructure, flow measurement, seepage loss tests, and GIS-based mapping and analysis, among other activities.

### Water Supply Conditions

This report demonstrates the ***Water Supply Conditions*** component of RAT. This component identifies the canal/pipeline segments and areas of the district which have ***insufficient head***. *Insufficient head* is defined as inadequate water supply or pressure at the farm turnout to meet demand or to provide sufficient water for efficient furrow irrigation.

The procedures used are as follows:

(1) District personnel (primarily the canal riders) and DMS Team rate the head conditions of canal segments and pump stations within the district. Segments are evaluated by the criteria show in Table 1. A copy of the rating form provided to district personnel is attached to this report.

(2) The DMS Team instructs district personnel on how to complete the form and definition of terms. This includes traveling to the field and joint rating of segments.

(3) The DMS Team complies and analyzes all data and produces maps that interpret the data similar to those provided in this report.

Table 1. Water Supply (Head) Condition Rating Criteria.

**A) Frequency of Head Problem**

1) Occasional during peak periods
2) Often during peak periods
3) Occasional during non-peak periods
4) Often during non-peak periods
5) Always during peak period
6) Never

**B) Cause of Head Problem**

1) Heavy demand on the total irrigation district.
2) Heavy demand on a certain sections or areas.
3) Engineering problems.
    a) Structural problems
    b) Canal size or capacity
    c) Slope or elevation
    d) Fluctuating Canal Levels
4) Other (i.e. farmer management problems)

**C) Severity of Head Problem**

1. Minor
2. Moderate
3. Severe

**Results**

Table 2 gives the numerical results for each canal/pipeline segment and pump station identified during the rating procedure. Head problems affect appromixately 21,000 acres in the district. On an area basis, the head problem is classified as follows:

- ***severity***: 6% minor, 59% moderate, 35% severe
- ***frequency***: 6% occurs always (non-peak periods) and 94% during peak demand
- ***frequency during peak demand***: 7% occasional, 26% often and 67% always

Six (6) of the affected areas have flow rates (in gallons per minute) measured at a few farm turnouts during a single irrigation; these are also given in Table 2. Poor head causes large variations in flow rate during a single irrigation event which greatly lowers the efficiency of surface irrigation.

Causes

The two primary reasons head problems are occurring in the district are:

1) ***Heavy demand in a certain area*** - poor head in 39% of the affected area is caused by mismanagement of the system by either the water supplier or the water users on that system; or

2) ***Engineering Problems (capacity)*** - poor head in 61% of the affected area is due to:
   a) expansion of irrigated acres (10% of problem), and
   b) changes in crop mix to a larger portion of crops with higher water consumption, such as sugarcane (90% of the problem).

Charts

Seven (7) charts are included in this report. Chart 1 shows the affected areas and locations of most pump stations serving these areas. In addition, two (2) sets of charts are provided for each of the rating criterion:

1) Severity of Head Problem
   (minor, moderate or severe)

2) Frequency of Head Problem
   (peak or non-peak demand periods)

3) Causes of Head Problem
   (demand in specific area or engineering/lack of capacity of system)

The first chart for each criterion highlights the canal segment and pump station with the head problem; the second chart highlights the areas (i.e., fields) affected by the head problem.

Table 2. Head problem ratings results and, where available, flow rates measured at the farm turnouts during individual irrigation events (note: the larger the variation in flow, the more serious the head problem).

| **Affected Areas** | **Acreage** | **Measured Gallons/Minute** | **Rating Results (Table 1)** | | |
|---|---|---|---|---|---|
| | | | **A** | **B** | **C** |
| Not Reported | 15876 | | | | |
| Bouldin Lateral | 200 | | 5 | 3b | 3 |
| Bowman Canal | 1375 | | 5 | 3b | 2 |
| Canal 1 | 4624 | | 5 | 3b | 3 |
| Pipeline 48 | 820 | | 4 | 3b | 3 |
| Pipeline 49 | 417 | 400-1300 | 4 | 3b | 3 |
| Pump Station 15 | 889 | | 2 | 2 | 2 |
| Pump Station 18 | 791 | 1000-3000 | 2 | 2 | 2 |
| Pump Station 23 | 741 | 2000-2400 | 2 | 2 | 2 |
| Pump Station 26 | 659 | 1200-1600 | 2 | 2 | 2 |
| Pump Station 27 | 657 | | 2 | 2 | 2 |
| Pump Station 29 | 883 | | 2 | 2 | 2 |
| Pump Station 31 | 519 | | 5 | 3b | 2 |
| Pump Station 33 | 1525 | | 5 | 3b | 2 |
| Pump Station 50 | 836 | | 5 | 3b | 3 |
| Pump Station 53 | 3612 | 900-1500 | 5 | 2 | 2 |
| Pump Station 61 | 472 | | 5 | 3b | 3 |
| Pump Station 64 | 572 | | 2 | 3b | 2 |
| Pump Station 31 & 33 | 202 | 1000-3100 | 5 | 3b | 2 |
| Weber Canal | 1344 | | 1 | 1 | 1 |

**DMS (District Management System) Team**

Dr. Guy Fipps, Extension Agricultural Engineer
Eric Leigh, Extension Associate
Martin Barroso, Extension Agricultural Technician
Noemi Perez, Extension Agricultural Technician
Dr. Yanbo Huang, Extension Associate
Daniel Wishard, Student Worker
Brock Faulkner, Student Worker

**Chart Descriptions**

## Chart 1

This map shows the areas that are affected by head problems. Fields (affected acreage) are color-coded based on the canal, pipeline, or pump station providing water to that area.

## Chart 2a

This map shows distribution network components (canals, pipeline, and pump stations) affected by head problems, color-coded by the severity (minor, moderate, or severe) of the head problem.

## Chart 2b

This map shows the areas are affected by head problems, color-coded by the severity of the head problem (minor, moderate, or severe).

## Chart 3a

This map shows the distribution network components (canals, pipeline, and pump stations) affected by head problems, color-coded according to when head problems occur.

## Chart 3b

This map shows fields which are affected by head problems, color-coded according to when the head problems occur.

## Chart 4a

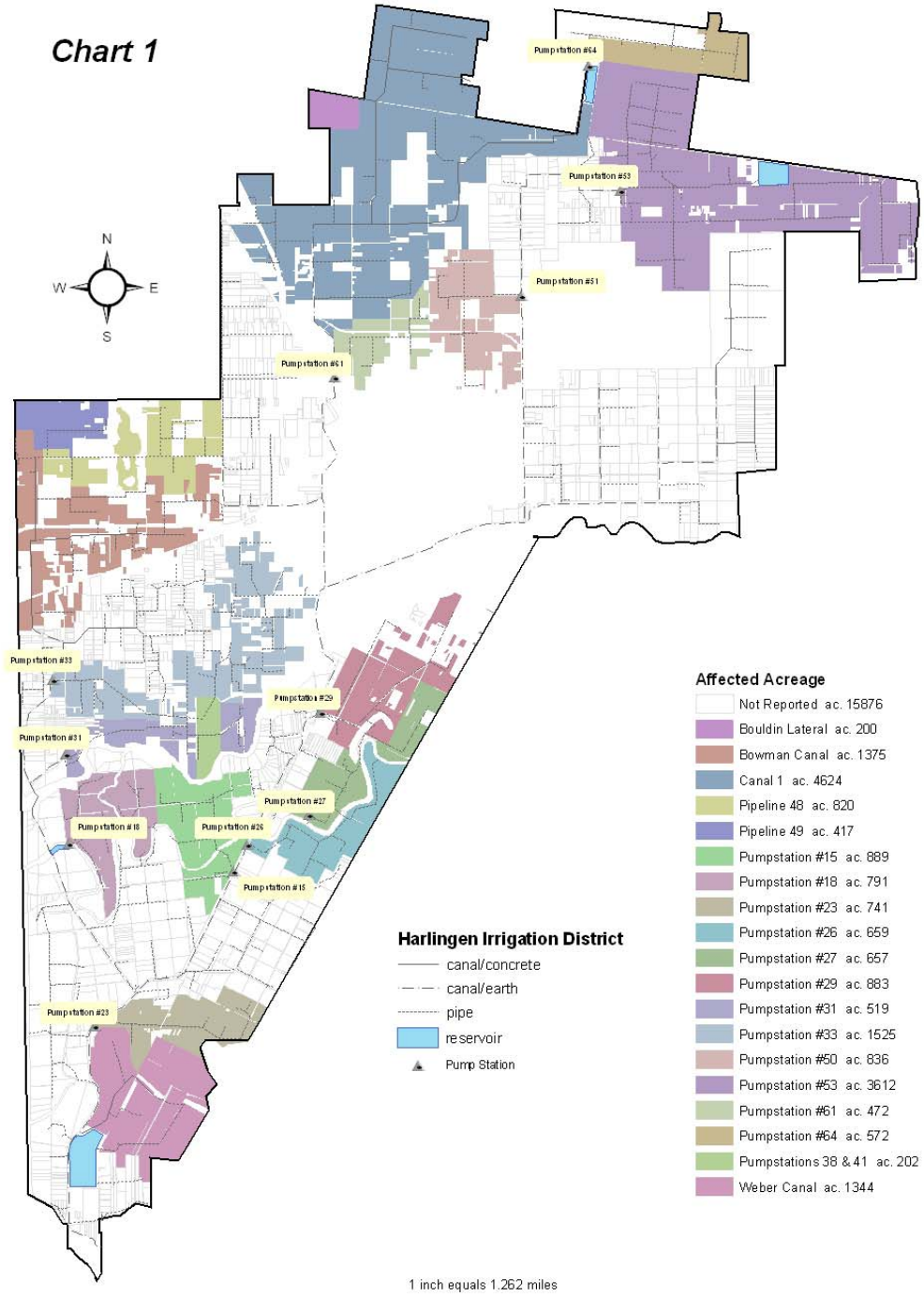
This map shows the distribution network components (canals, pipeline, and pump stations) affected by head problems, color-coded according to reasons that the head problems occur.

## Chart 4b

This map shows fields are affected by head problems, color-coded according to reasons that the head problems occur.

# Areas Affected by Head Problems

*Chart 1*

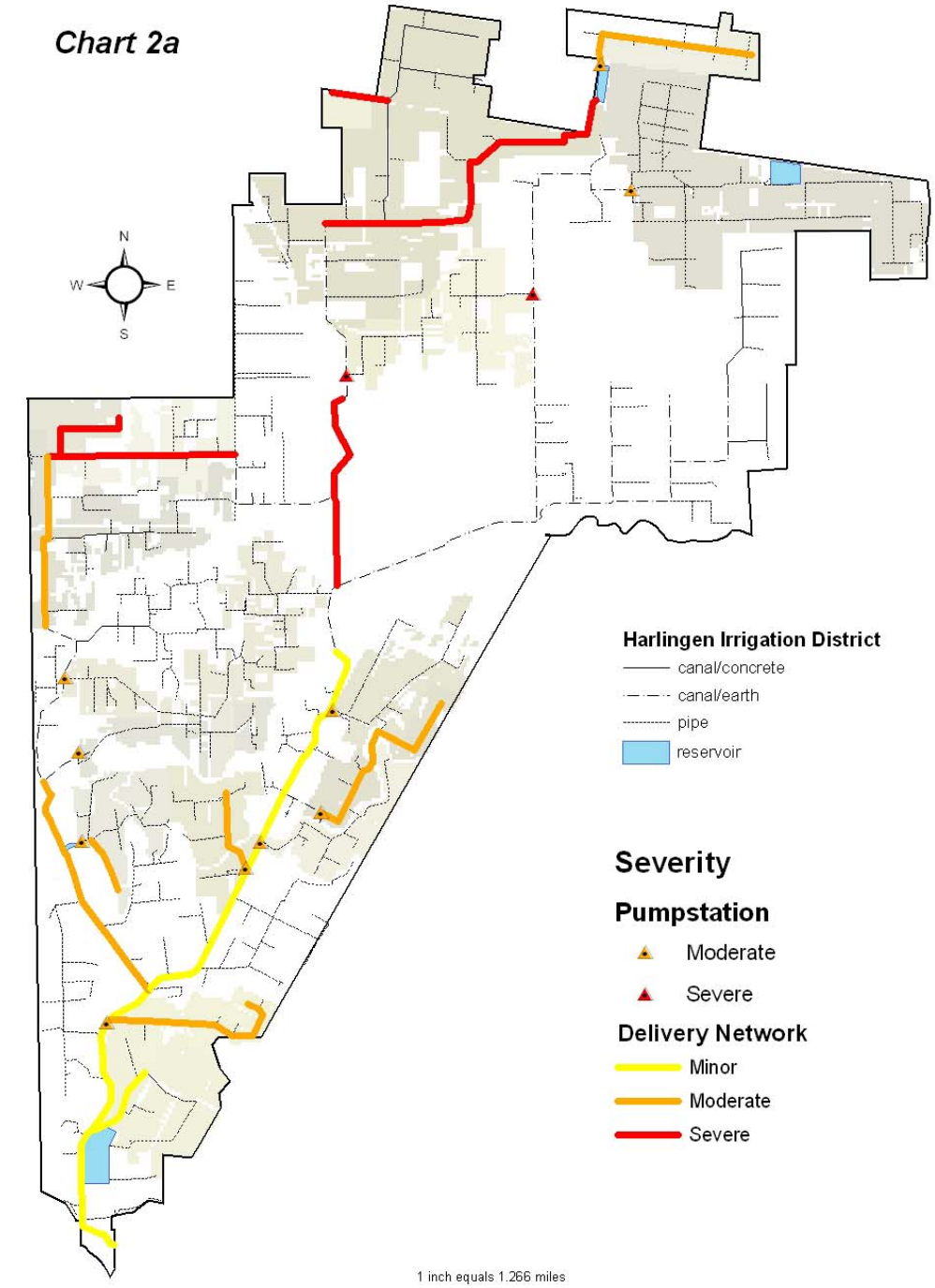



Harlingen Irrigation District
Head Problem Survey

Agricultural Engineering, Texas Cooperative Extension
Texas A&M University System

DMS Team - Jan 2003
http://dms.tamu.edu

# Severity
# Canals with Head Problems

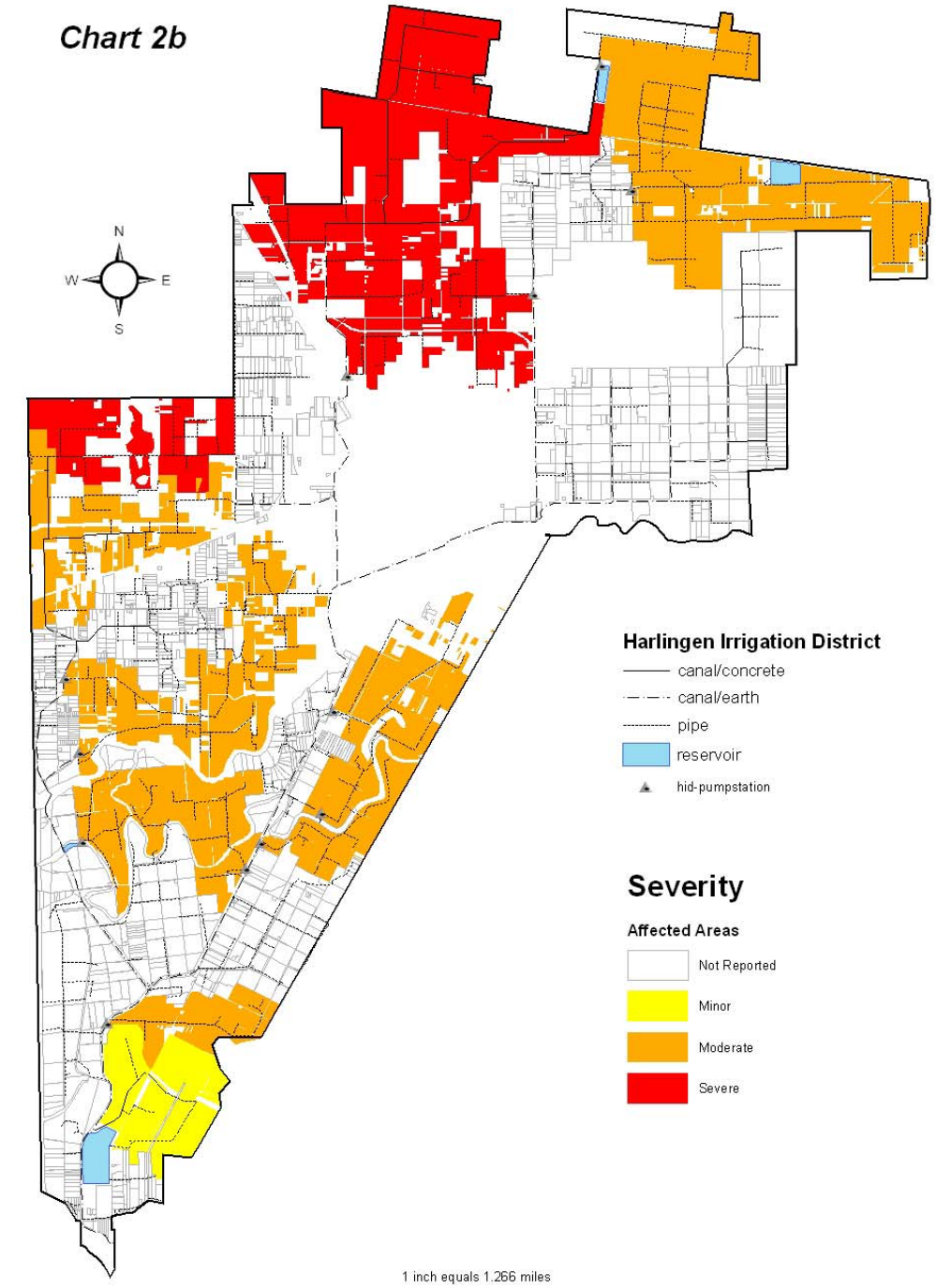



Harlingen Irrigation District
Head Problem Survey

Agricultural Engineering, Texas Cooperative Extension
Texas A&M University System

DMS Team - Jan 2003
http://dms.tamu.edu

# Severity
# Areas (fields) Affected by Head Problems

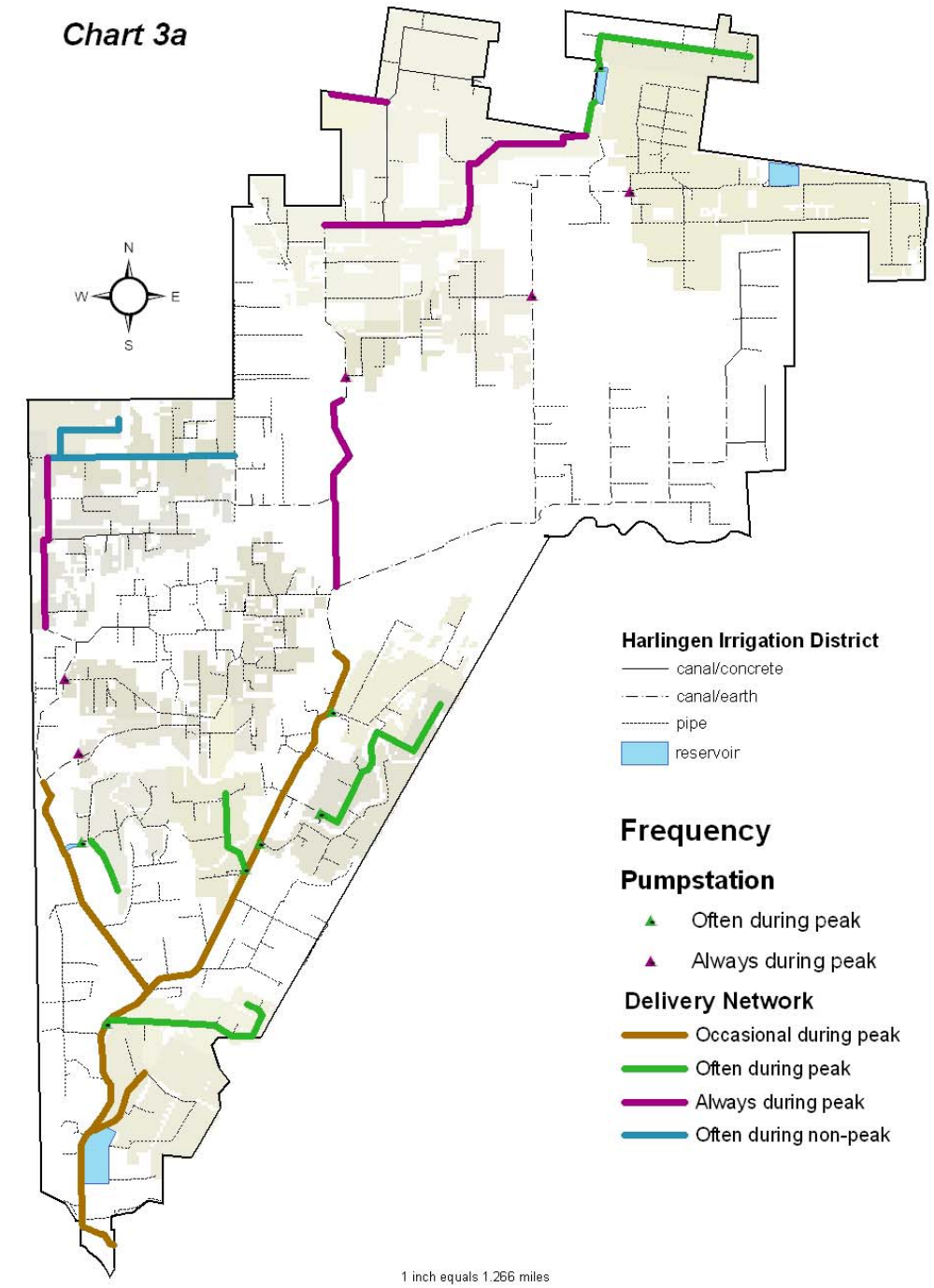



Harlingen Irrigation District
Head Problem Survey

Agricultural Engineering, Texas Cooperative Extension
Texas A&M University System

DMS Team - Jan 2003
http://dms.tamu.edu

# Frequency
# Canals with Head Problems

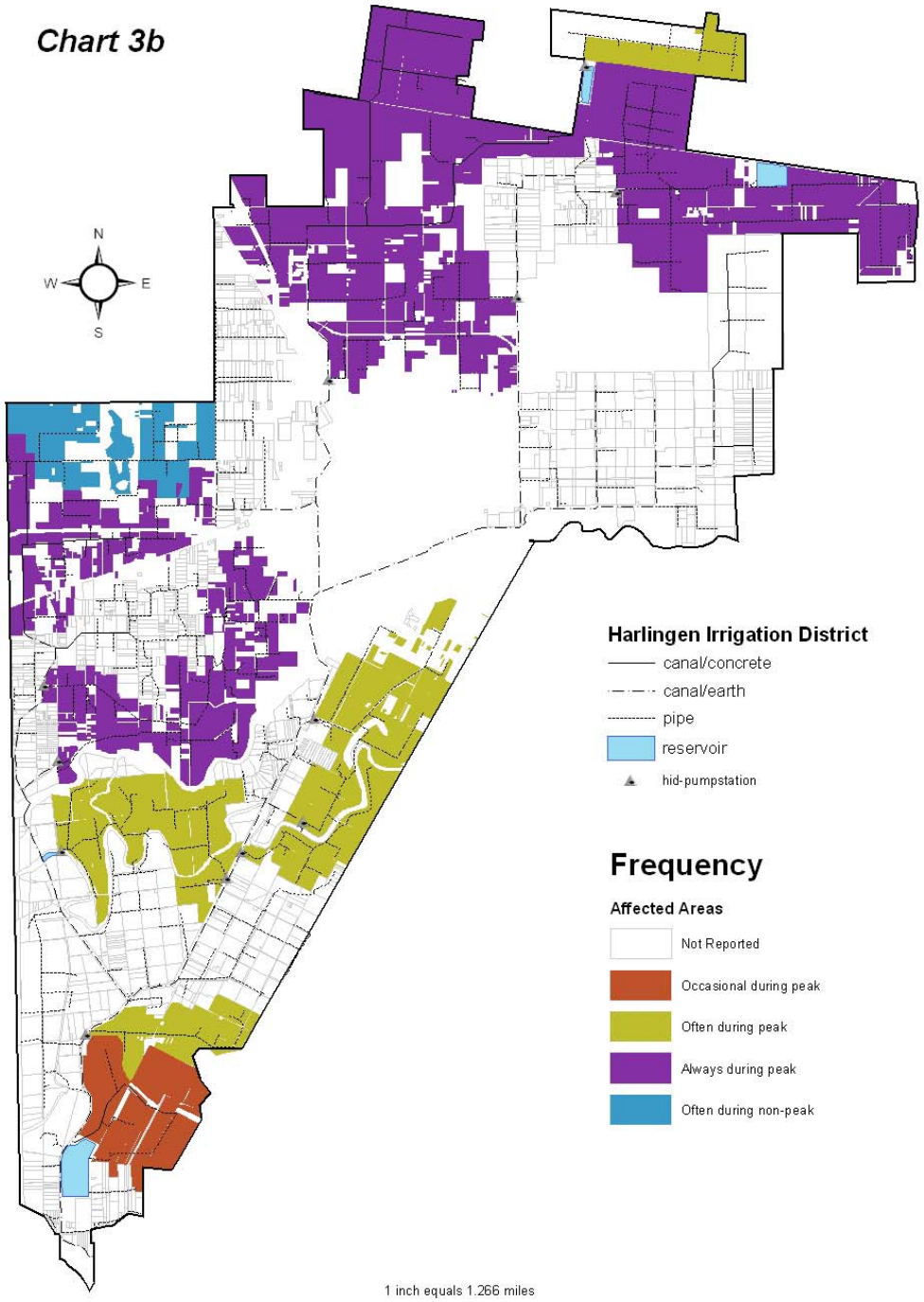



Harlingen Irrigation District
Head Problem Survey

Agricultural Engineering, Texas Cooperative Extension
Texas A&M University System

DMS Team - Jan 2003
http://dms.tamu.edu

# Frequency
# Areas (fields) Affected by Head Problems



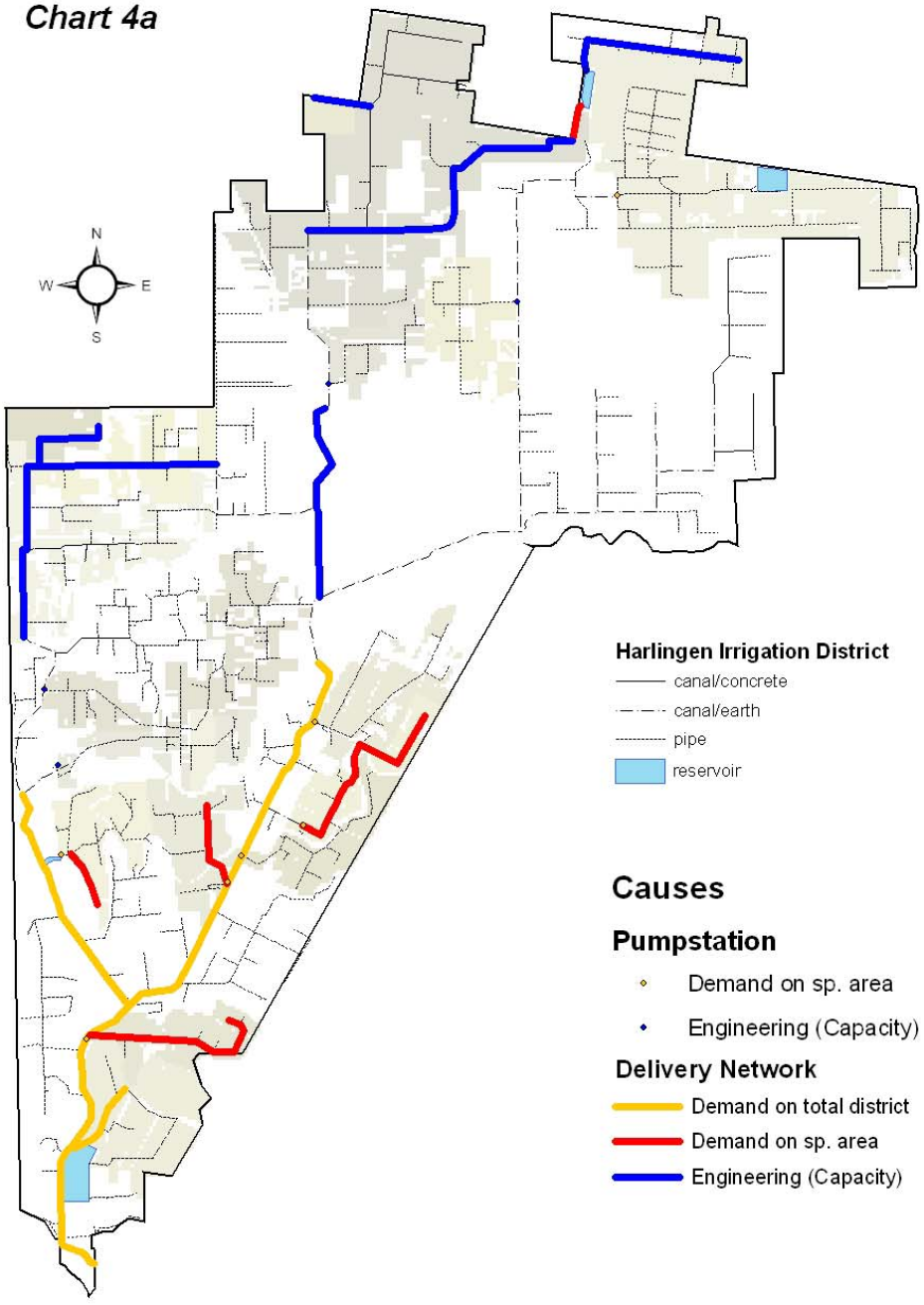

Harlingen Irrigation District
Head Problem Survey

Agricultural Engineering, Texas Cooperative Extension
Texas A&M University System

DMS Team - Jan 2003
http://dms.tamu.edu

# Causes
# Canals with Head Problems

*Chart 4a*



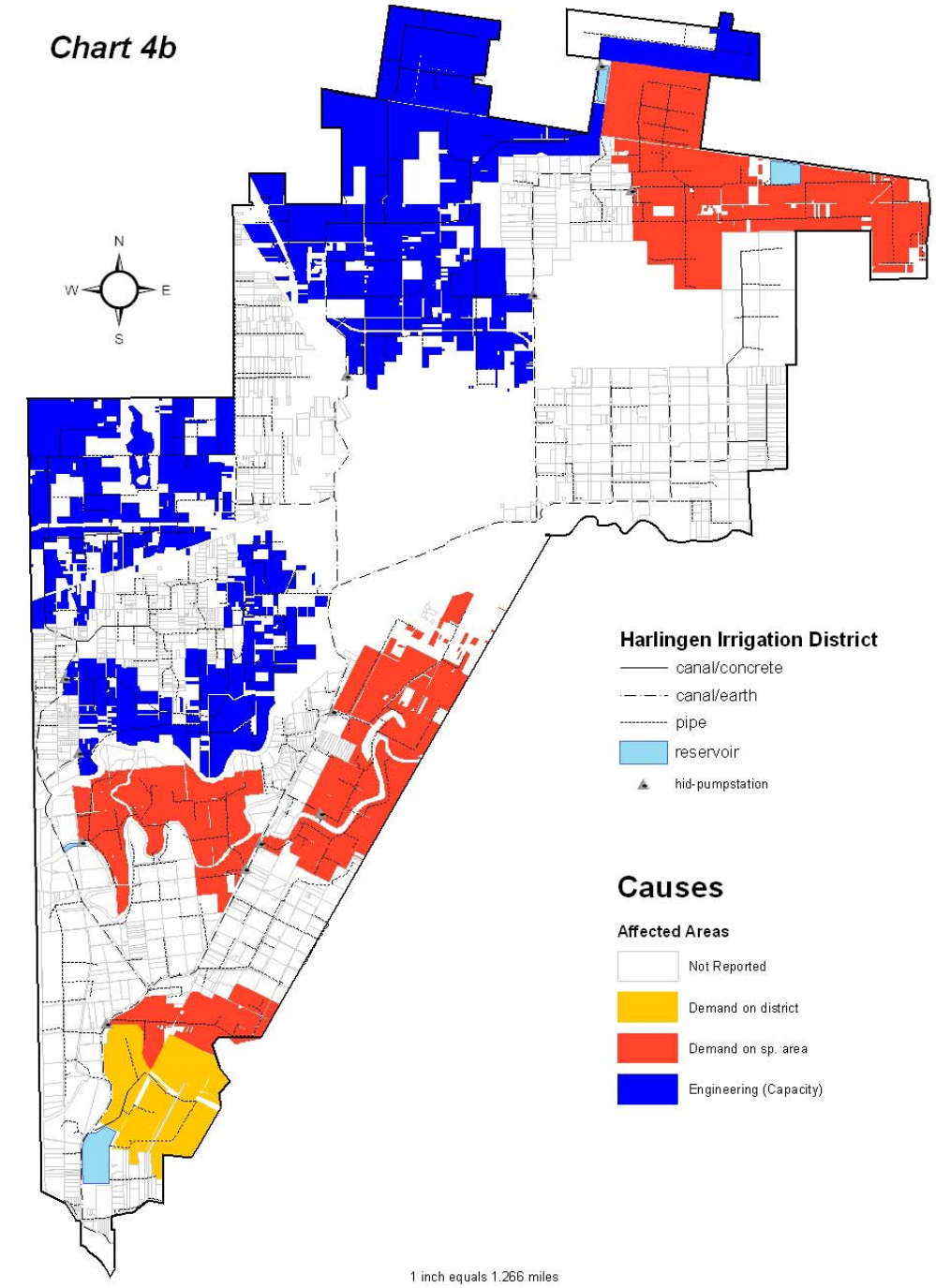

1 inch equals 1.329 miles

Harlingen Irrigation District
Head Problem Survey

Agricultural Engineering, Texas Cooperative Extension
Texas A&M University System

DMS Team - Jan 2003
http://dms.tamu.edu

# Causes
## Areas (fields) Affected by Head Problems




Harlingen Irrigation District
Head Problem Survey

Agricultural Engineering, Texas Cooperative Extension
Texas A&M University System

DMS Team - Jan 2003
http://dms.tamu.edu