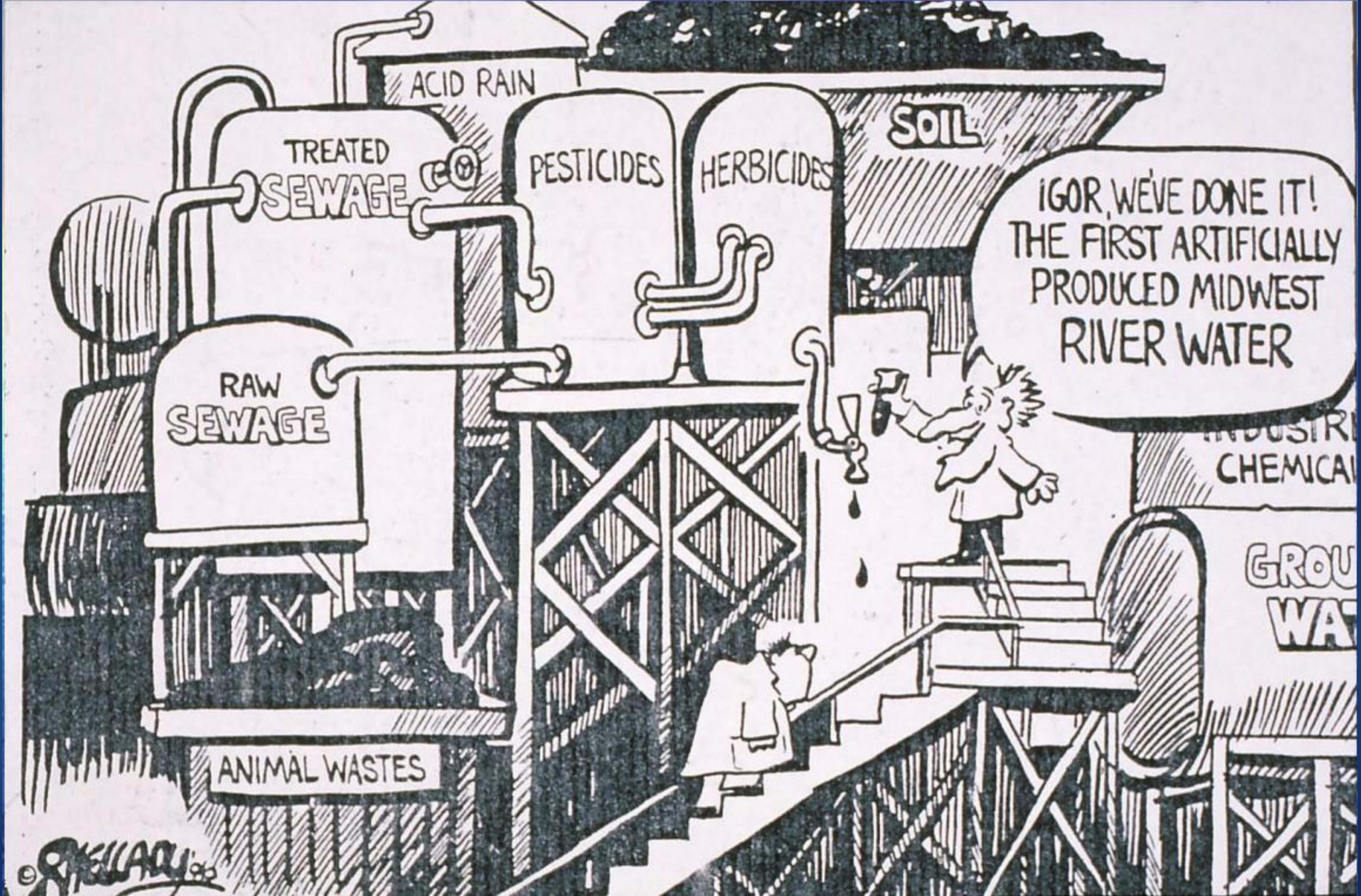
Source Water Protection in Iowa

Chad Fields, Geologist with the Iowa Department of Natural Resources

History of Source Water Protection: Before 1985

- Growing understanding of how human activities can impact drinking water and groundwater
  - John Snow first linked a London cholera outbreak (killing over 600 people) to drinking sewage from a well in 1855
  - In Iowa there was state-led water sampling, water system reviews, and drinking water protection efforts since early 1900s
  - By late 1970s many city wells in the old center of town, next to old businesses, and are also old
  - Federal Safe Drinking Water Act of 1974 established national drinking water standards for 23 contaminants (radium-226, nitrate, total coliform, etc.), with routine sampling


ACID RAIN
SOIL
TREATED SEWAGE
PESTICIDES
HERBICIDES
IGOR, WE'VE DONE IT! THE FIRST ARTIFICIALLY PRODUCED MIDWEST RIVER WATER
RAW SEWAGE
CHEMICAL
ANIMAL WASTES
©

History of Source Water Protection 1985-1996

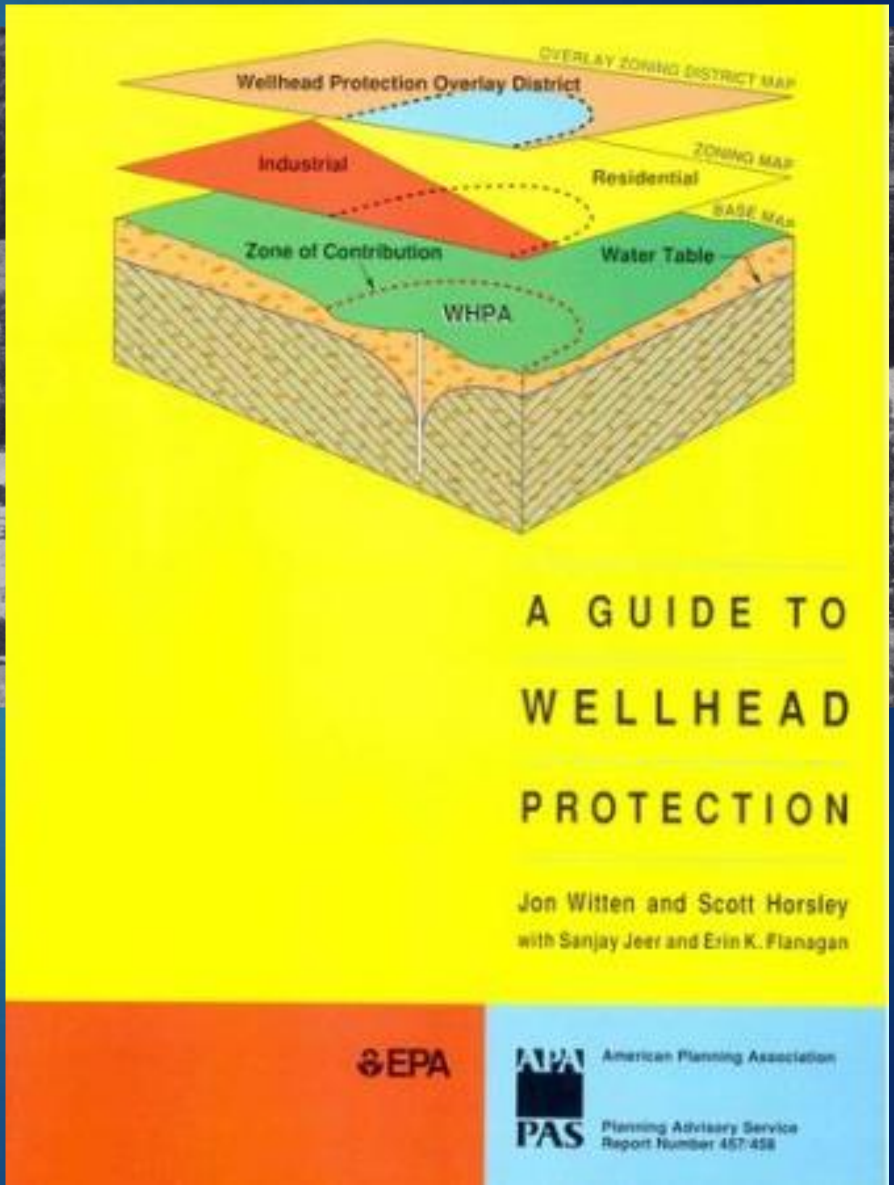
State level:

- 1987 Iowa Groundwater Protection Act
  - Prevent contamination of groundwater from point and nonpoint source pollution, to the maximum extent practical
  - Established funding for management and creation of many state groundwater and pollution programs:
    - Center for Health Effects of Environmental Contamination (CHEEC) (UI)
    - Iowa Waste Reduction Center (UNI)
    - Leopold Center for Sustainable Agriculture (ISU)
    - Etc.

History of Source Water Protection 1985-1996

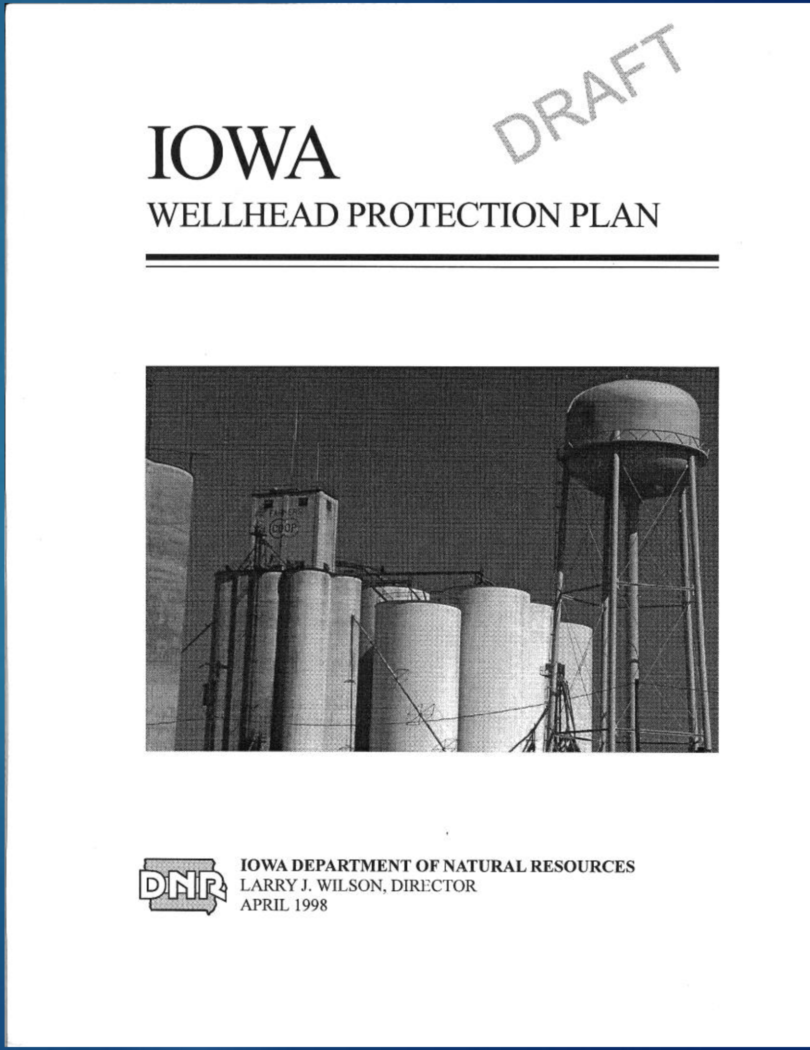
Federal level (EPA):

- 1986 SDWA started EPA's "Wellhead protection" program
  - Prevention of drinking water contamination is the primary goal
- An exclusively community (locally)-led program. EPA funded, developed and provided access to resources uch as guidebooks and seminars to help communities begin wellhead protection.
- Beginnings of terms such as WHPA, Capture Zones, delineation, implementation, and 5-Step Planning Process
- Not much federal $$ for implementation of program
- Nationwide, only 600 water systems had started wellhead protection by 1993

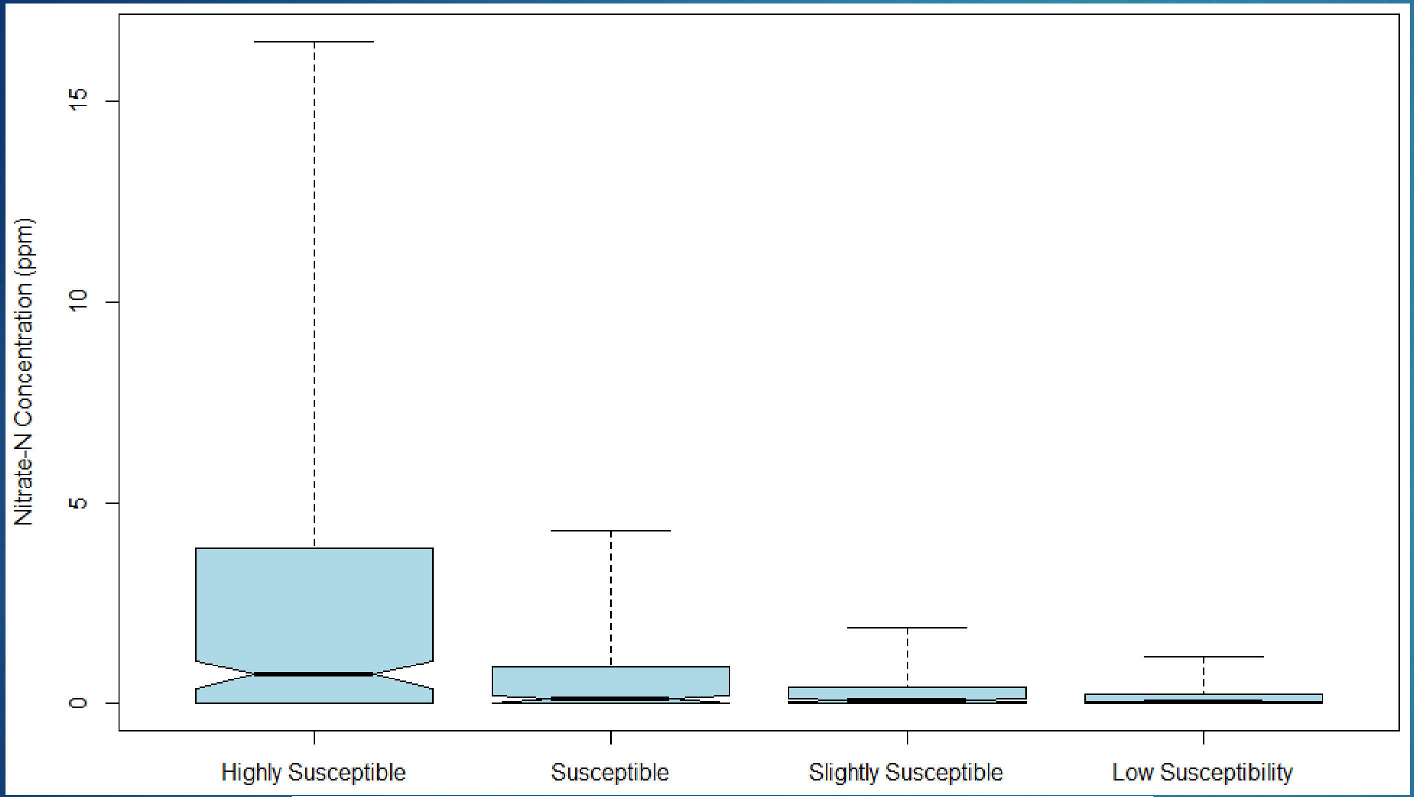


History of Source Water Protection 1996-2003

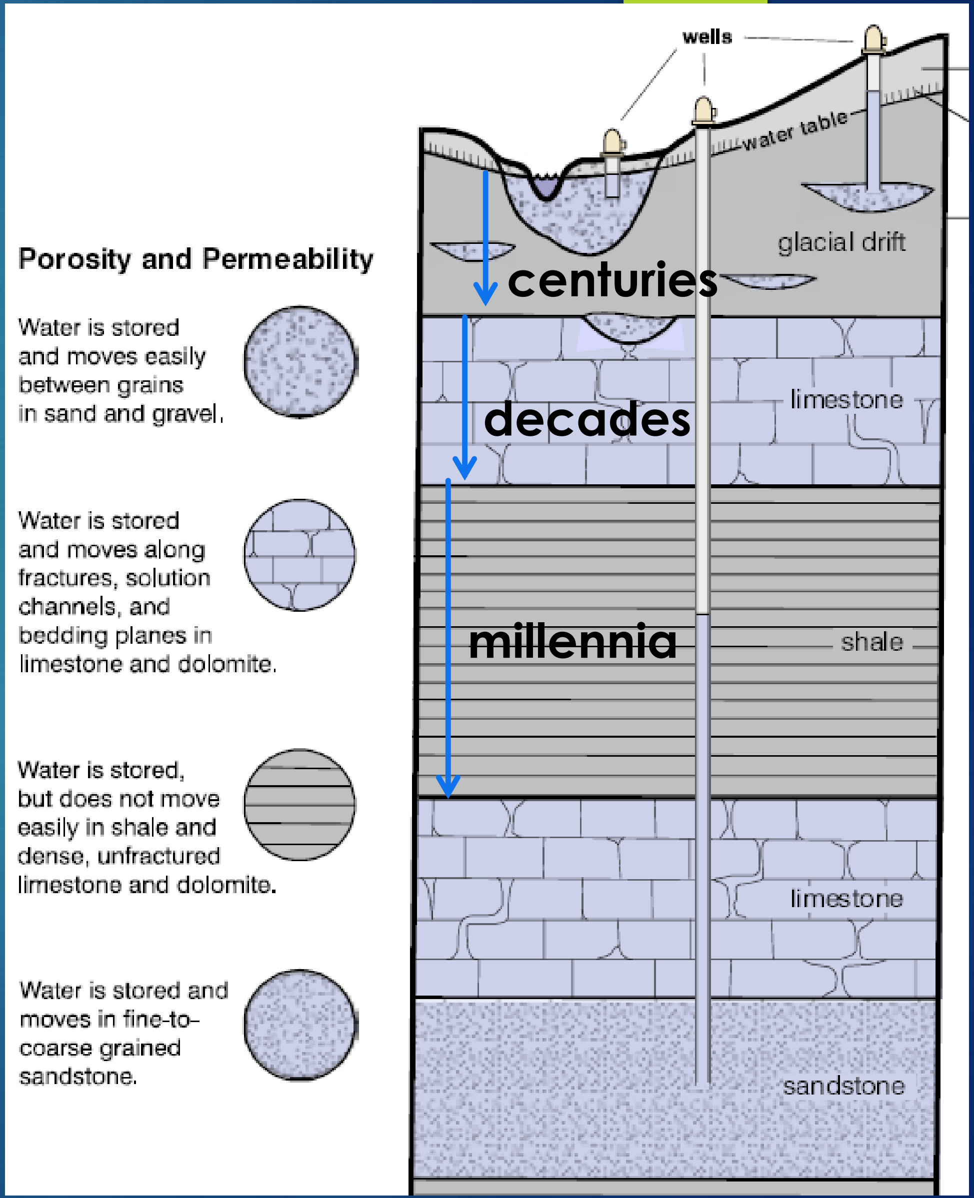
- 1996 Amendments to SDWA
  - Provided funding to states through the Drinking Water SRF program (15% of state set asides)
  - Changed name to Source Water Protection Program (more inclusive, though some states still use "wellhead" term for groundwater program)
  - Comprehensive State Source Water Program "Plans" provided by each state for EPA approval by 1998 (Iowa's was approved in 1999). Concepts in Iowa:
    - **Voluntary** Program
    - **7-Step** Planning Process
    - Source Water **Assessments** provided by state
    - Geologically defined **Susceptibility**



Iowa Source Water Protection Susceptibility Explained

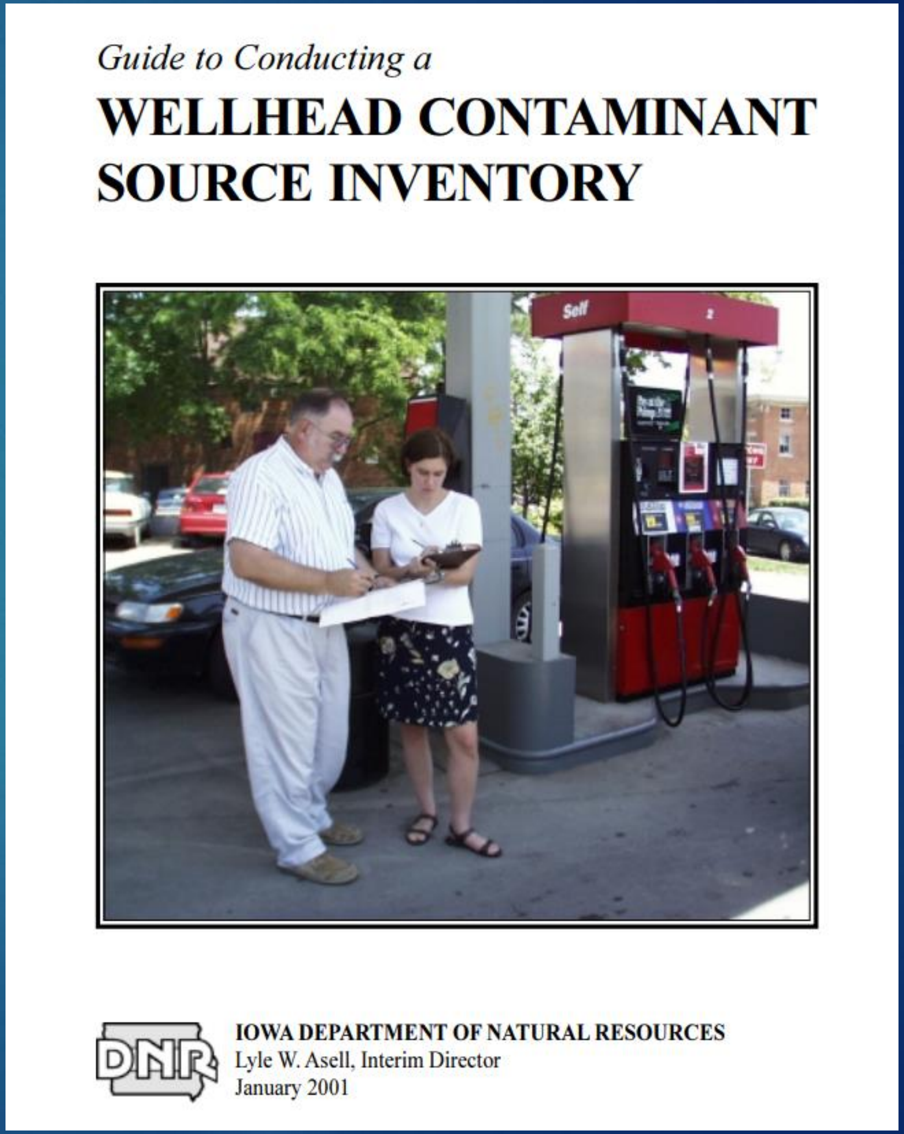


Confining layer thickness	Susceptibility designation
<25 feet	Highly susceptible
25 to 50 feet	Susceptible
50 to 100 feet	Slightly susceptible
>100 feet	Low susceptibility

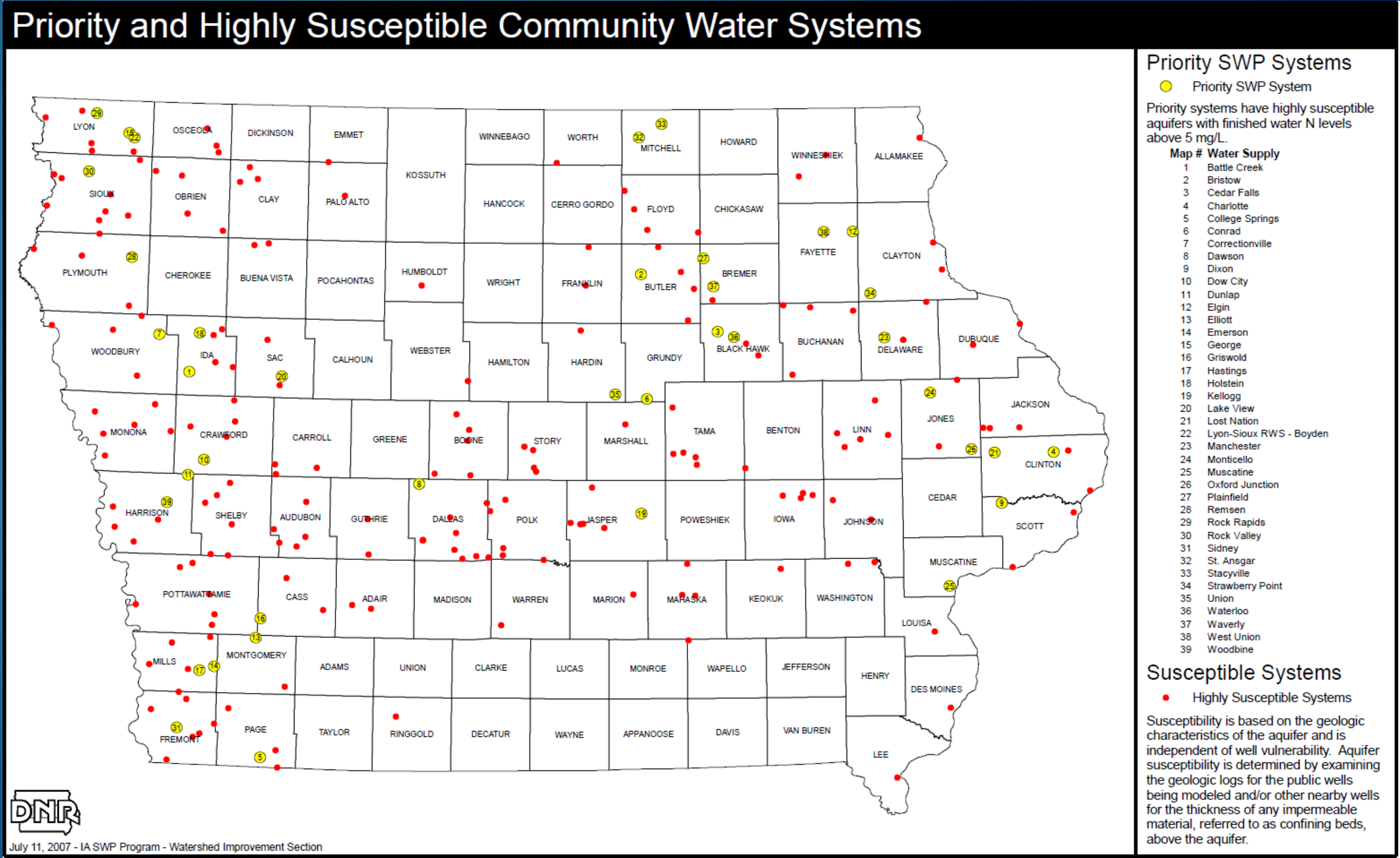


History of Source Water Protection 2004-2009

- Era of SWP "Phase 2" Plans
- In 2004, SWP "Phase 1" Assessments are "done"!!
  - Available online on ftp site as word documents
  - Not many communities picked up the SWP baton themselves without state outside help.
- ~2003 IDNR expanded constracts with outside agencies to assist community Phase 2 Plans:
  - Iowa Rural Water Association (IRWA)
  - Iowa Association of Municipal Utilities (IAMU)



History of Source Water Protection 2004-2009



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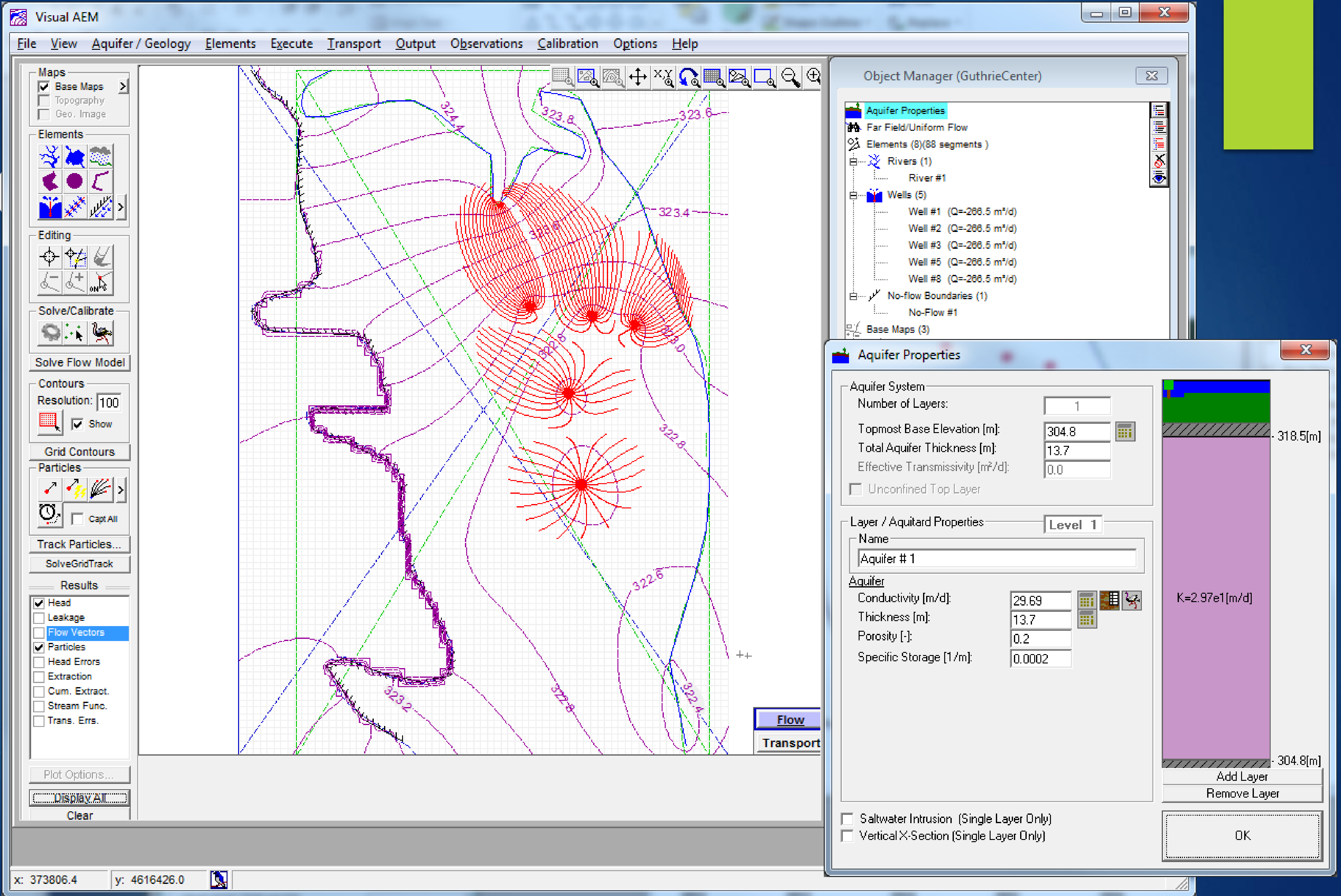
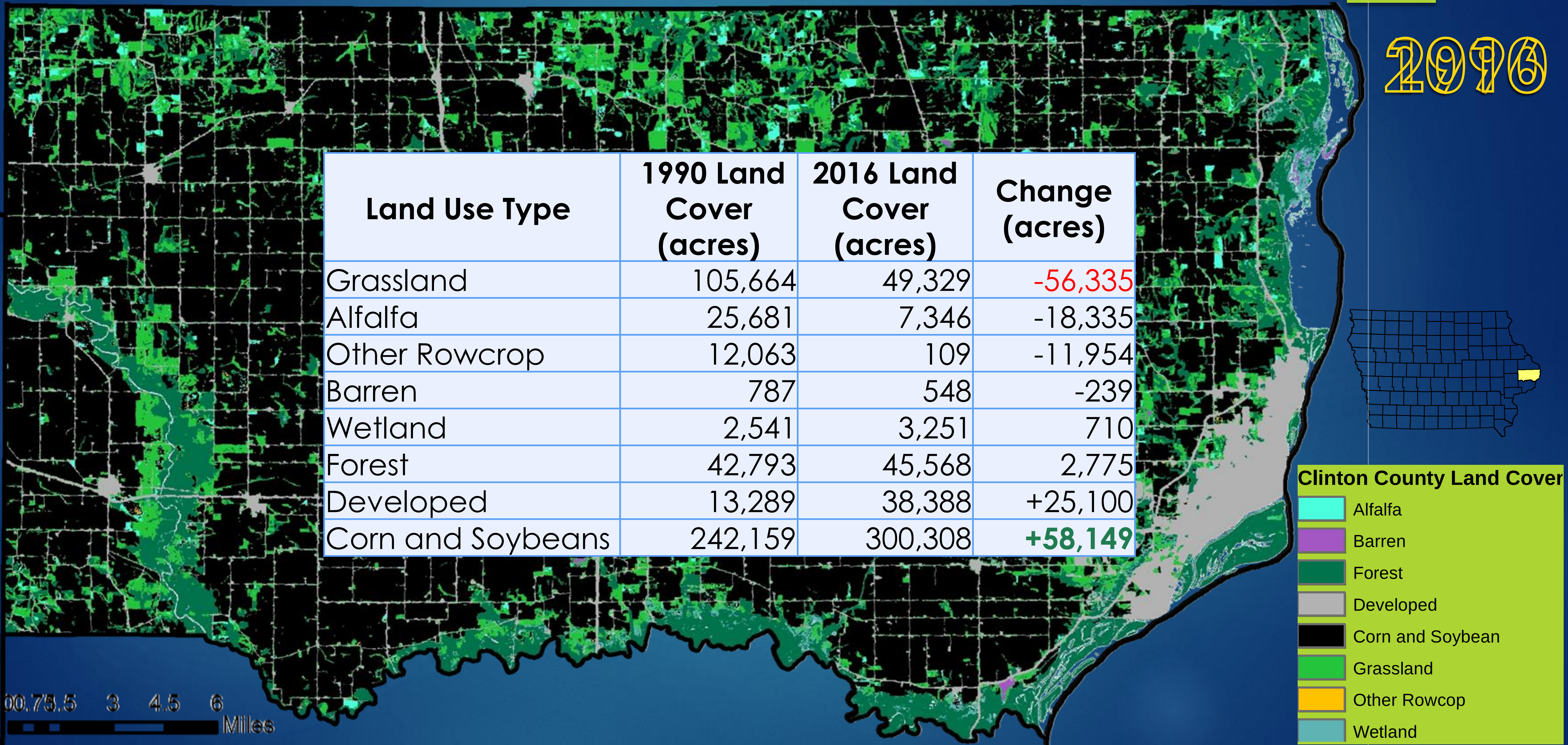


Visual AEM
File View Aquifer / Geology Elements Execute Transport Output Observations Calibration Options Help
Maps
Base Maps
Topography
Geo. Image
Elements
Editing
Solve/Calibrate
Solve Flow Model
Contours
Resolution: 100
Show
Grid Contours
Particles
Capt All
Track Particles...
SolveGridTrack
Results
Head
Leakage
Flow Vectors
Particles
Head Errors
Extraction
Cum. Extract.
Stream Func.
Trans. Errs.
Plot Options...
Display All
Clear
324.4
323.8
323.6
323.4
323.6
323.0
322.6
322.8
322.6
323.2
322.8
322.4
Flow
Transport
x: 373806.4
y: 4616426.0
Object Manager (GuthrieCenter)
Aquifer Properties
Far Field/Uniform Flow
Elements (8)(88 segments)
Rivers (1)
River #1
Wells (5)
Well #1 (Q=-266.5 m³/d)
Well #2 (Q=-266.5 m³/d)
Well #3 (Q=-266.5 m³/d)
Well #5 (Q=-266.5 m³/d)
Well #8 (Q=-266.5 m³/d)
No-flow Boundaries (1)
No-Flow #1
Base Maps (3)
Aquifer Properties
Aquifer System
Number of Layers: 1
Topmost Base Elevation [m]: 304.8
Total Aquifer Thickness [m]: 13.7
Effective Transmissivity [m²/d]: 0.0
Unconfined Top Layer
Layer / Aquitard Properties
Level 1
Name
Aquifer # 1
Aquifer
Conductivity [m/d]: 29.69
Thickness [m]: 13.7
Porosity [-]: 0.2
Specific Storage [1/m]: 0.0002
318.5[m]
K=2.97e1[m/d]
304.8[m]
Add Layer
Remove Layer
Saltwater Intrusion (Single Layer Only)
Vertical X-Section (Single Layer Only)
OK

History of Source Water Protection 2010-2014

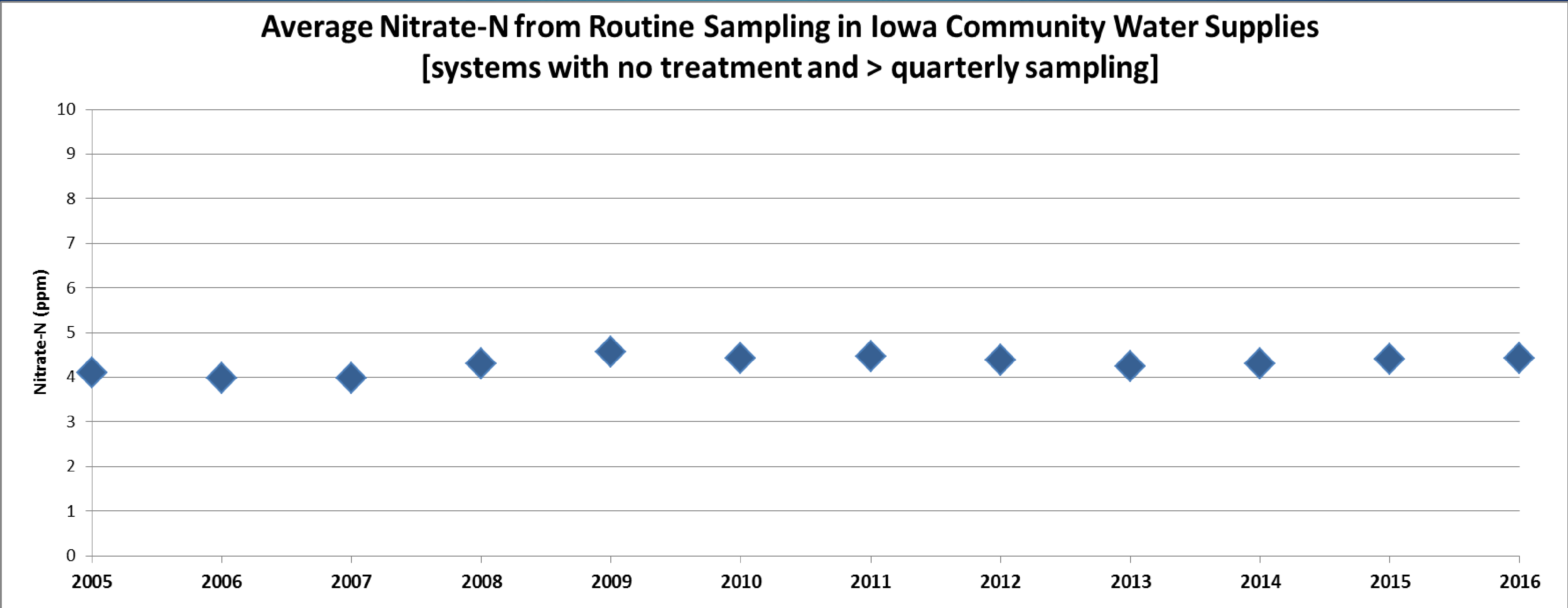
- 2010: Iowa's SWP Program split in two: **Targeted** and **Non-Targeted**
  - A **Targeted** Community:
    - Has identified a contaminant(s) that is trending upward
    - Nitrates above 5 mg/L and trending upward
    - Shallow alluvial wells that are highly susceptible
    - A willing community with willing stakeholders
    - Typically a groundwater investigation provided by IDNR
  - A **Non-Targeted** Community:
    - Any community in Iowa that is interested in Source Water Protection
    - Limited groundwater investigations, SWP Assessments
- Publications of Guidebook, Workbook, GIS starter guides, Publishing SWP GIS Resources, Workshop seminars, Wellhead CRP zone change, Source Water SRF loan funding, Source Water Mapper, etc., etc.
- Read more about it on our website: www.iowasourcewater.org

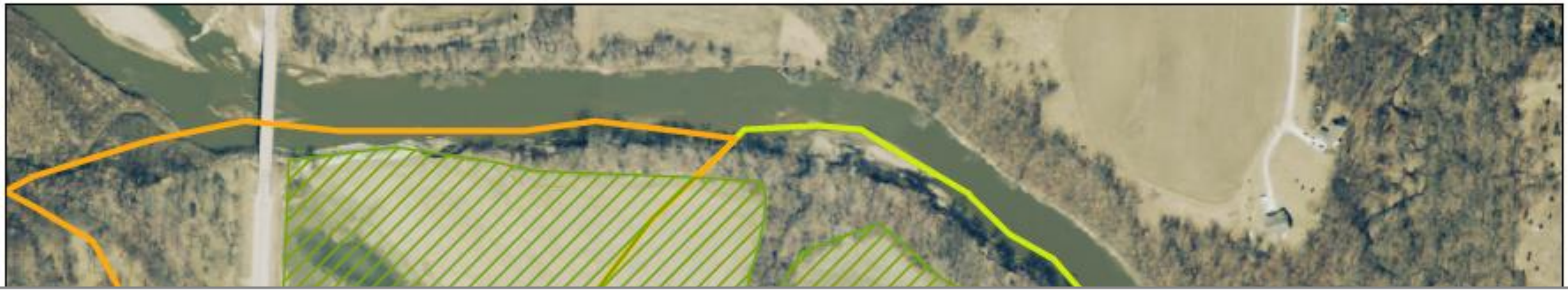
So…have we changed anything?

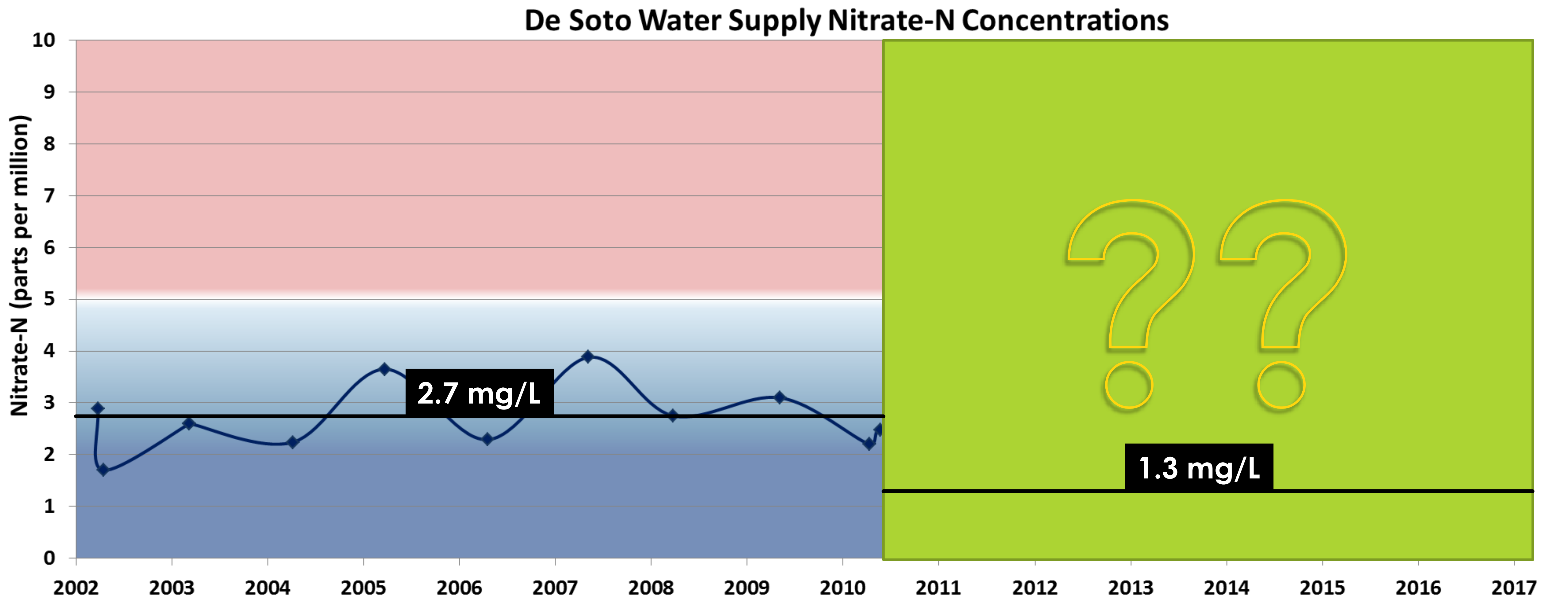


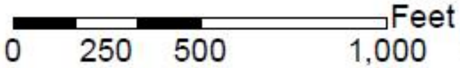
Land Use Type	1990 Land Cover (acres)	2016 Land Cover (acres)	Change (acres)
Grassland	105,664	49,329	-56,335
Alfalfa	25,681	7,346	-18,335
Other Rowcrop	12,063	109	-11,954
Barren	787	548	-239
Wetland	2,541	3,251	710
Forest	42,793	45,568	2,775
Developed	13,289	38,388	+25,100
Corn and Soybeans	242,159	300,308	**+58,149**

Nitrates in drinking water





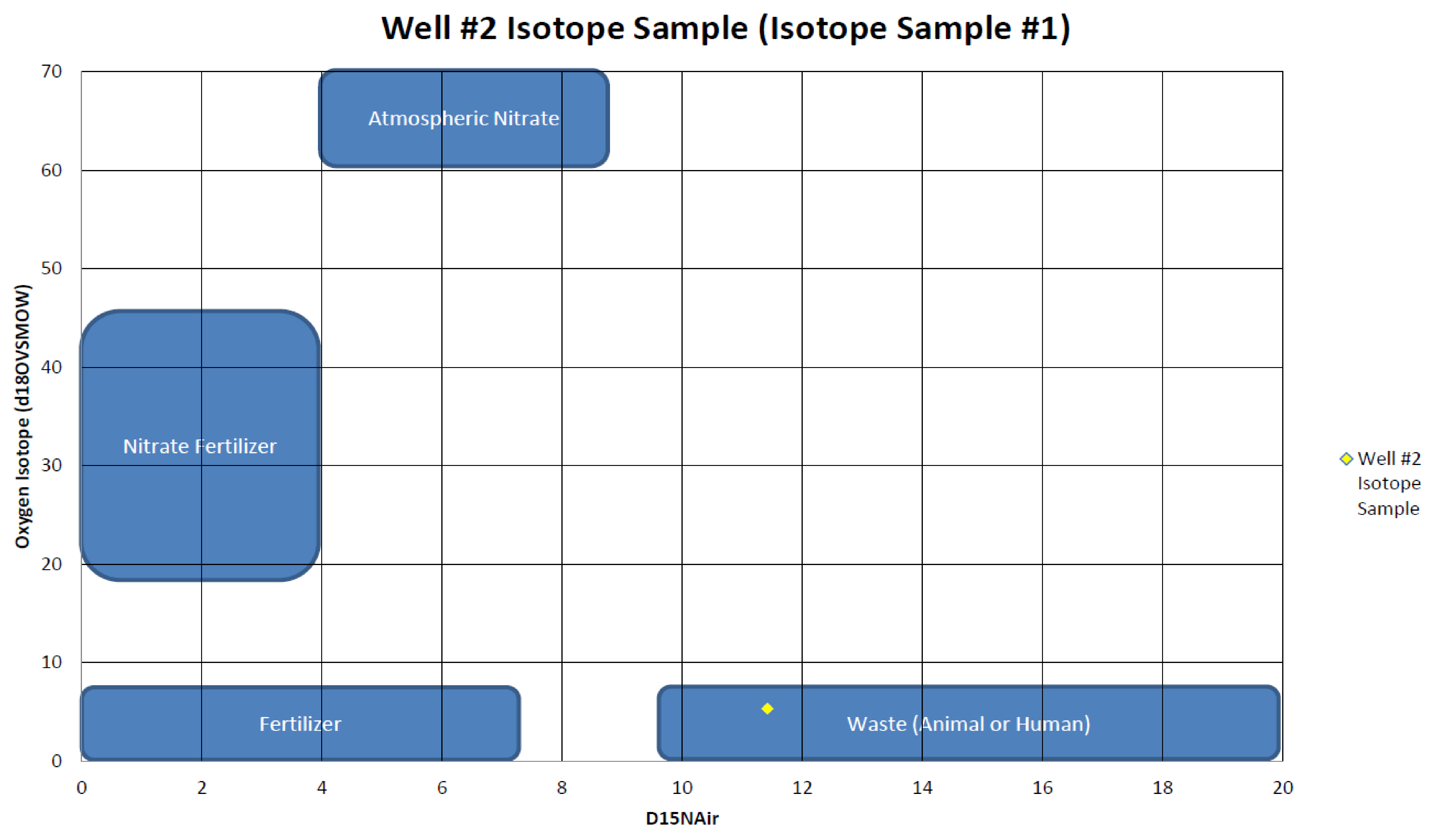




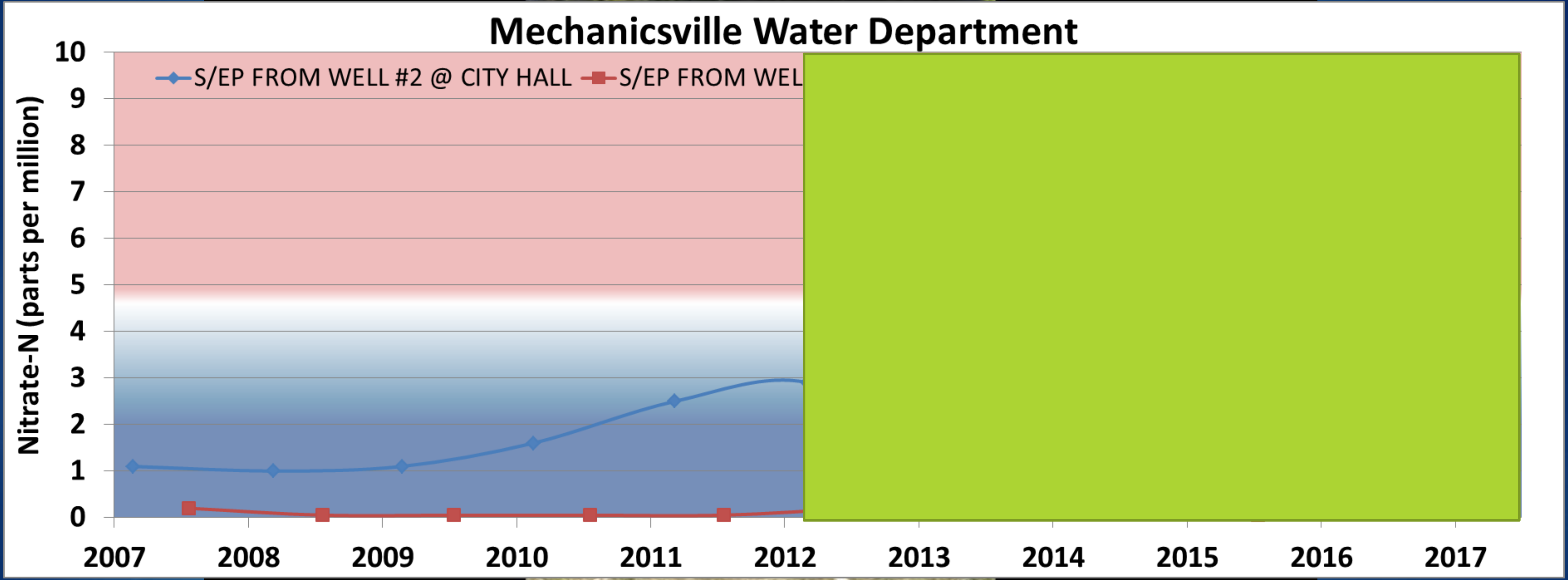
Source: IDNR GIS Database

Source Water Stories: City of De Soto

- Are we done with Source Water in De Soto now?
  - De Soto submitted their SWP Plan and Implementation efforts, and was accepted as "Substantially Implemented" by the program in 2012
  - De Soto won AWWA Exemplary Source Water Protection Award in 2012
  - Landowner of converted row crop acres threatened remove native vegetation and plant it all in corn again in 2014
  - Still an acttive Iowa DOT facility in wellhead area (with propane, diesel fuel, oil, etc.) in the capture zone



Well #2 Isotope Sample (Isotope Sample #1)
Atmospheric Nitrate
Nitrate Fertilizer
Fertilizer
Waste (Animal or Human)
Oxygen Isotope (d18OVSMOW)
D15NAir
0
10
20
30
40
50
60
70
0
2
4
6
8
10
12
14
16
18
20
Well #2 Isotope Sample



Mechanicsville Water Department
S/EP FROM WELL #2 @ CITY HALL
S/EP FROM WEL
Nitrate-N (parts per million)
10
9
8
7
6
5
4
3
2
1
0
2007
2008
2009
2010
2011
2012
2013
2014
2015
2016
2017

History of Source Water Protection 2015-today

- Source Water Coordinator – Jeff Vansteenburg, Iowa DNR.
- Source Water "Phase 1" Assessments - Bob Rowden and Chad Fields, Iowa DNR
- Source Water "Phase 2" Plans:
  - Iowa Rural Water Association – Lisa Walters
    - 5 entities, annual reporting to state, 5-step plans
  - Iowa Department of Natural Resources – Rebecca Ohrtman
    - IDNR Field Office 1 in NE Iowa
  - Conservation Districts of Iowa – Bridget Durst and Jesse Kielman
    - IDNR ESD Field Offices 3 and 4
  - Tetratech – Aileen Malloy and Jennifer Olson
    - Surface Water Systems
  - And others! (Sioux City, Duane Arnold Energy, Iowa COGs, etc.)