

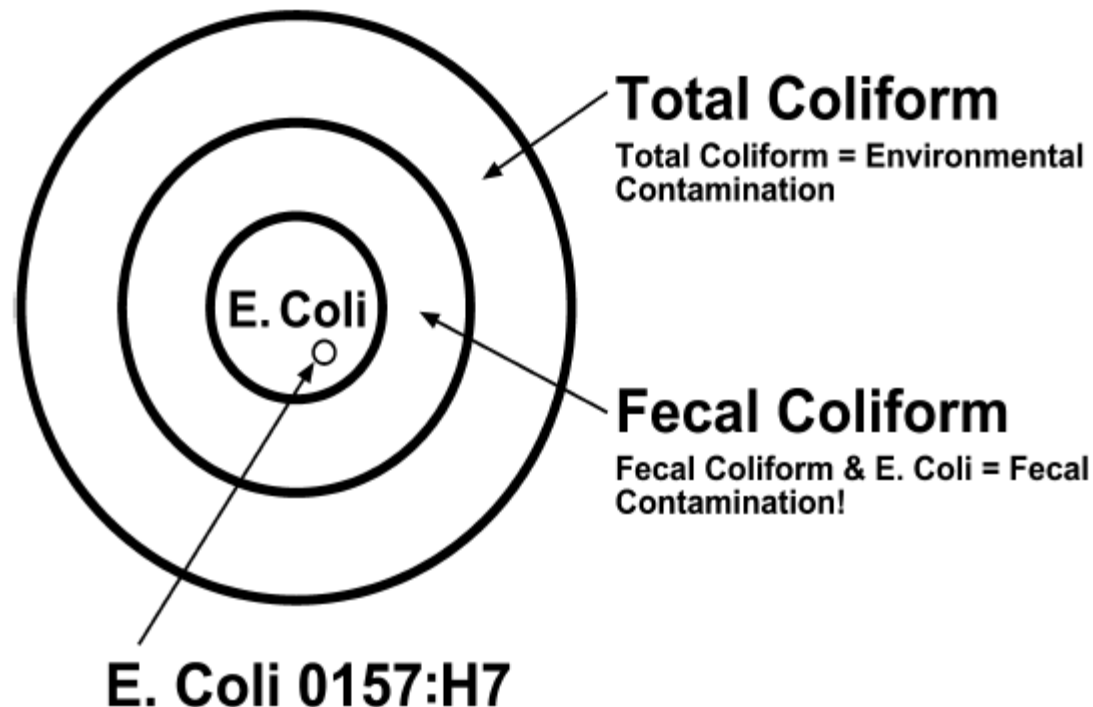
Scatter Creek Project - Historical Perspective

Objectives

- Past Studies
- Water Quality Concerns Identified
- What's Different Now

What is Coliform Bacteria?

TOTAL COLIFORM, FECAL COLIFORM AND E. COLI



What if Coliform are found in a Well?

- Indicates that disease-causing organisms, includes viruses, could be present
- Resample to confirm
- Examine system for construction problems
- Flush and Disinfect the well and water system
- Continuous disinfection or Find an alternative water source if aquifer is contaminated

What are Nitrates?

- Sources - Fertilizers, Manure, Sewage
- Natural levels in Groundwater < 2 mg/l
- Drinking Water Standard - 10 mg/l maximum
- Affects a person's health
- Indicates that other contaminants could be present, like pharmaceuticals

How are Nitrate results interpreted?

0 – 1.9 mg/l – Natural backgrd levels

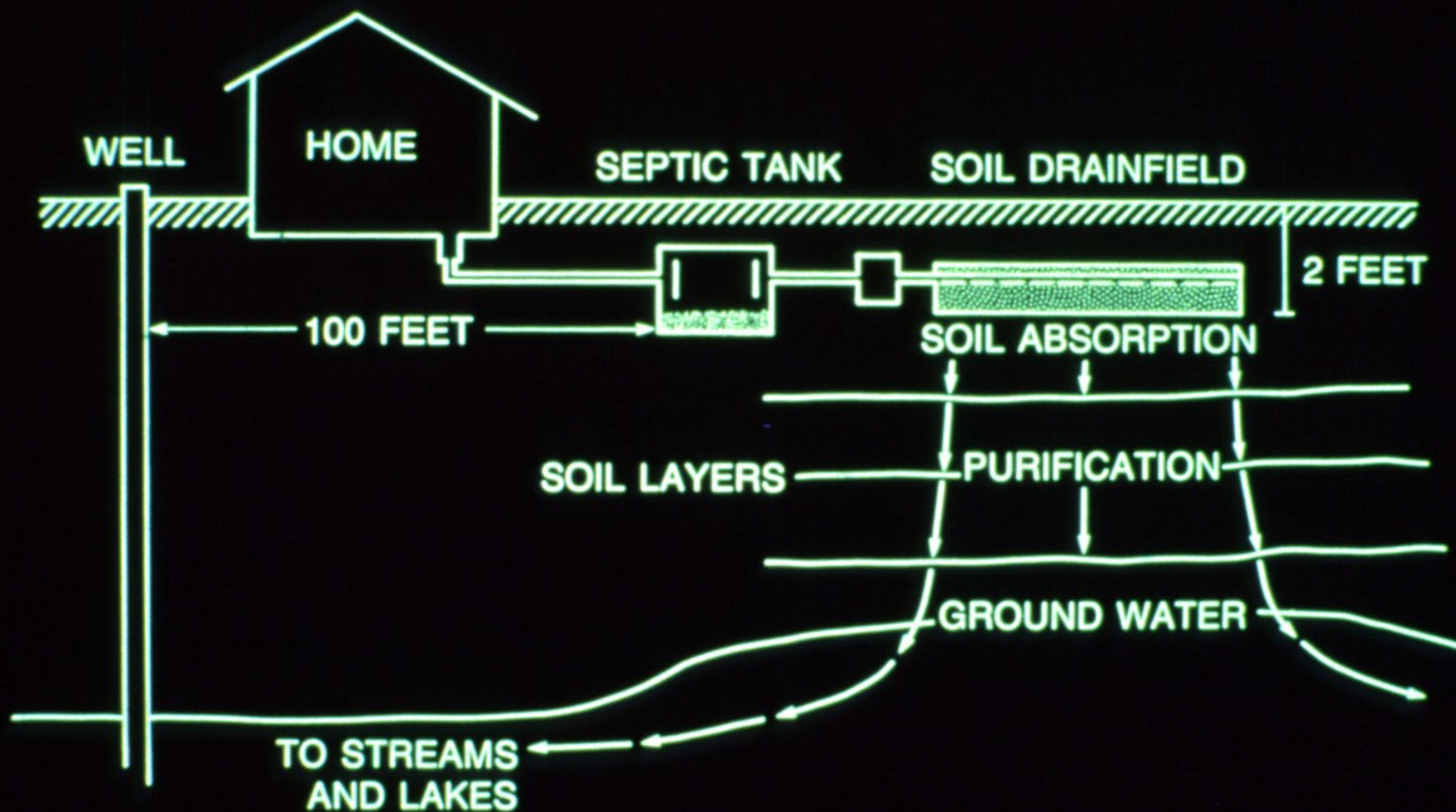
2 - 3.9 mg/l – Indicates that human activities
have begun to affect water quality

4 – 9.9 mg/L – Significantly above backgrd,
Warrants action

> 10 mg/L – Has known health effects; **Should not be consumed.**

What if Nitrate in Water Supply is over the drinking water limit?

- Find and eliminate the source(s)
- Install a treatment system, i.e. reverse osmosis or anion exchange
- Find an alternative water source



High Permeability Contributes to Ground Water Contamination



12.2 kg/year of NO_3^- per home

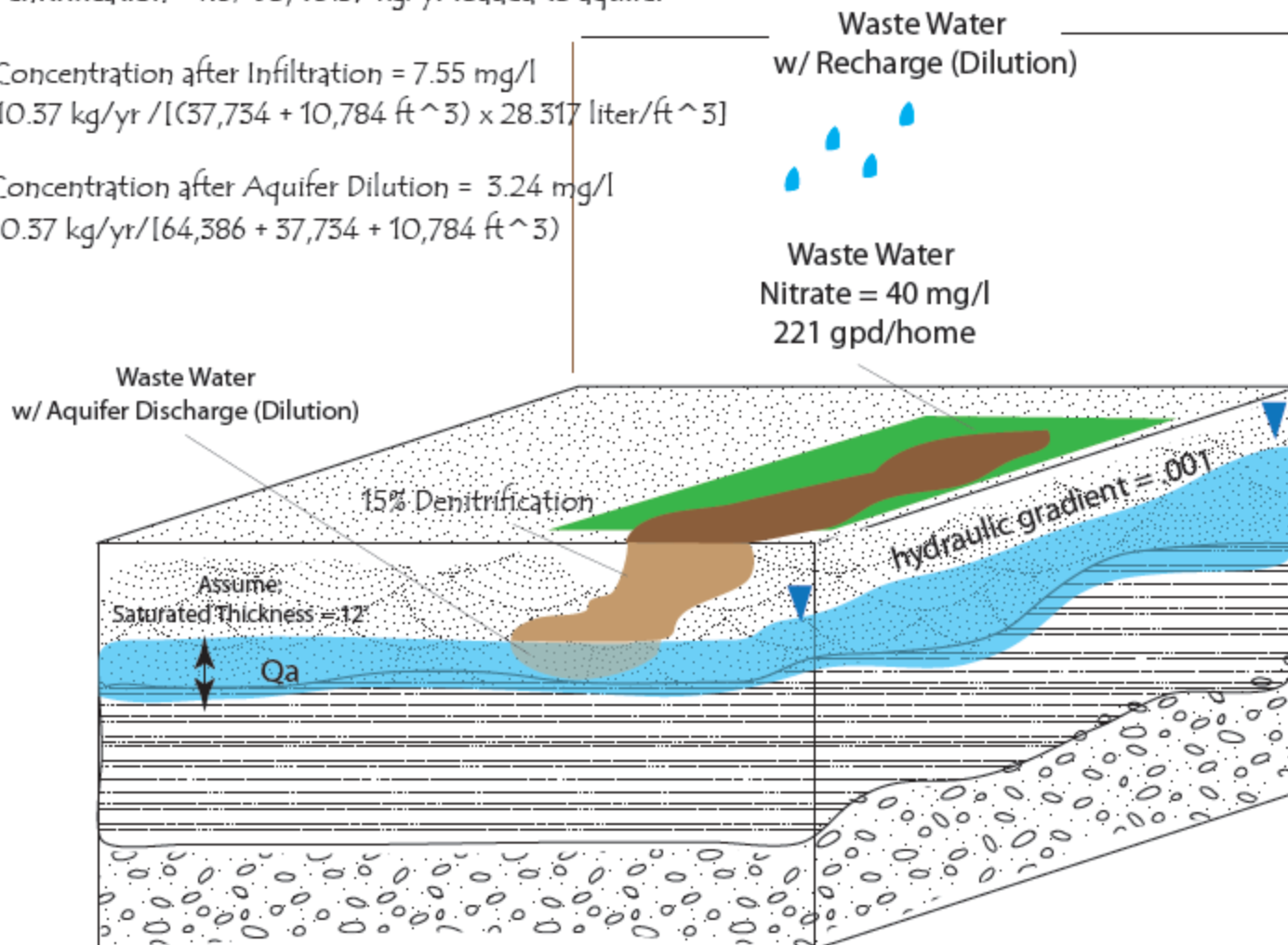
Denitrification = .15; So, 10.37 kg/yr loaded to aquifer

Concentration after Infiltration = 7.55 mg/l

$10.37 \text{ kg/yr} / [(37,734 + 10,784 \text{ ft}^3) \times 28.317 \text{ liter/ft}^3]$

Concentration after Aquifer Dilution = 3.24 mg/l

$10.37 \text{ kg/yr} / [64,386 + 37,734 + 10,784 \text{ ft}^3]$



Thurston County
Environmental Health

Project Site:
Number:

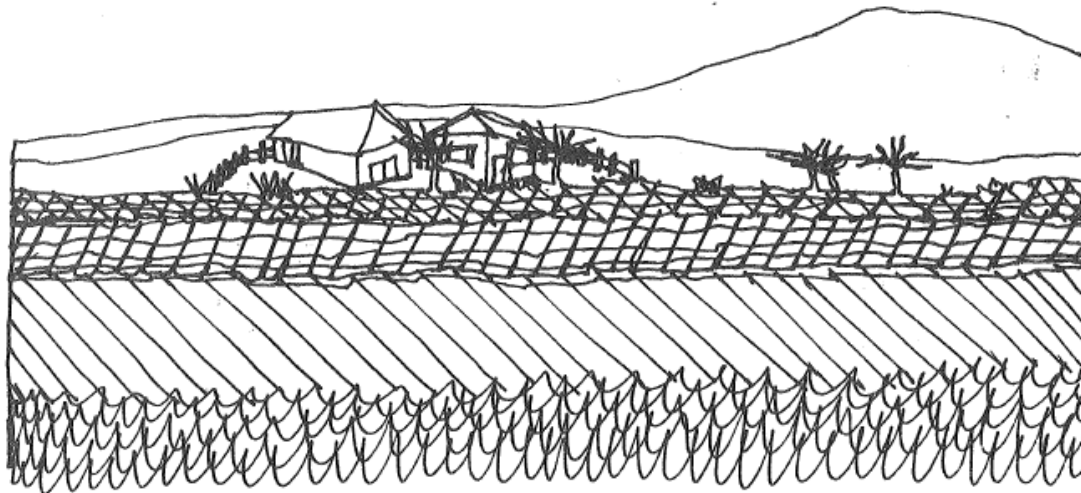
Title: Ground Water - Nitrate Diagram *DRAFT*

Drawn: Nadine L. Romero, Hydrogeologist, L.P.G., L.P.H.G.


Date: November 17, 2008

FIGURE A

GROUNDWATER QUALITY IN GRAND MOUND

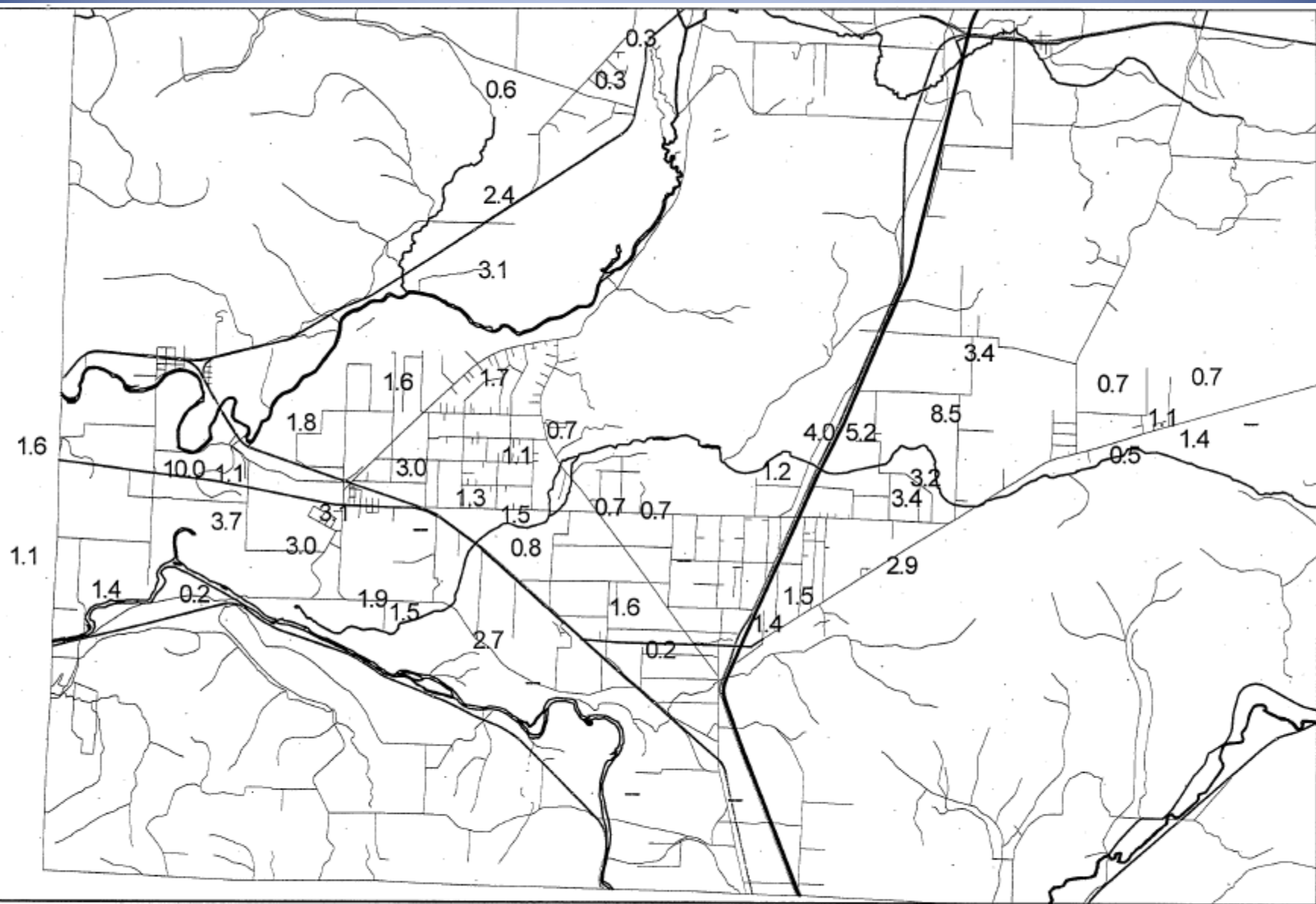


THE GROUNDWATER STUDY
GROUP * T.E.S.C. * SPRING, 1978

- Focus - Residential impact on groundwater
- In 1970's growth rate  1.7 new residences/yr to 28.5
- 75 wells sampled
- 7 had bacteria contamination
- Nitrate range - <1 – 18 mg/l; 49% <1; 6% >6
- Conclusions:
 - 1) aquifer's susceptible to contamination
 - 2) Contamination correlated w/housing density
- Recommendations for Development & Sewage

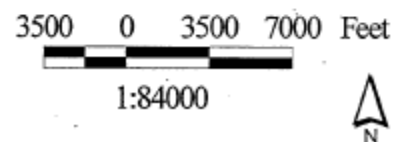
Grand Mound/Rochester Aquifer Survey, 1984

- County Health Dept
- Reviewed studies from similar areas
- Examined water quality
- Found aquifer is vulnerable & Contamination is occurring
- Designate as GSA &
Adopt Groundwater protection standards



Grand Mound/Rochester Aquifer Survey
March 1983 Nitrate Data

R. D. Mead
Map printed 1/25/1999



1992 Hydrogeologic Investigation of Scatter Creek/Black River Area

- Masters Thesis, by Sinclair & Hirschey
- Prompted by public concern to industrial impacts to groundwater
- Characterized aquifer & Developed water budget
- Evaluated water quality and land use
- Land use and contamination did not correlate

Table 21

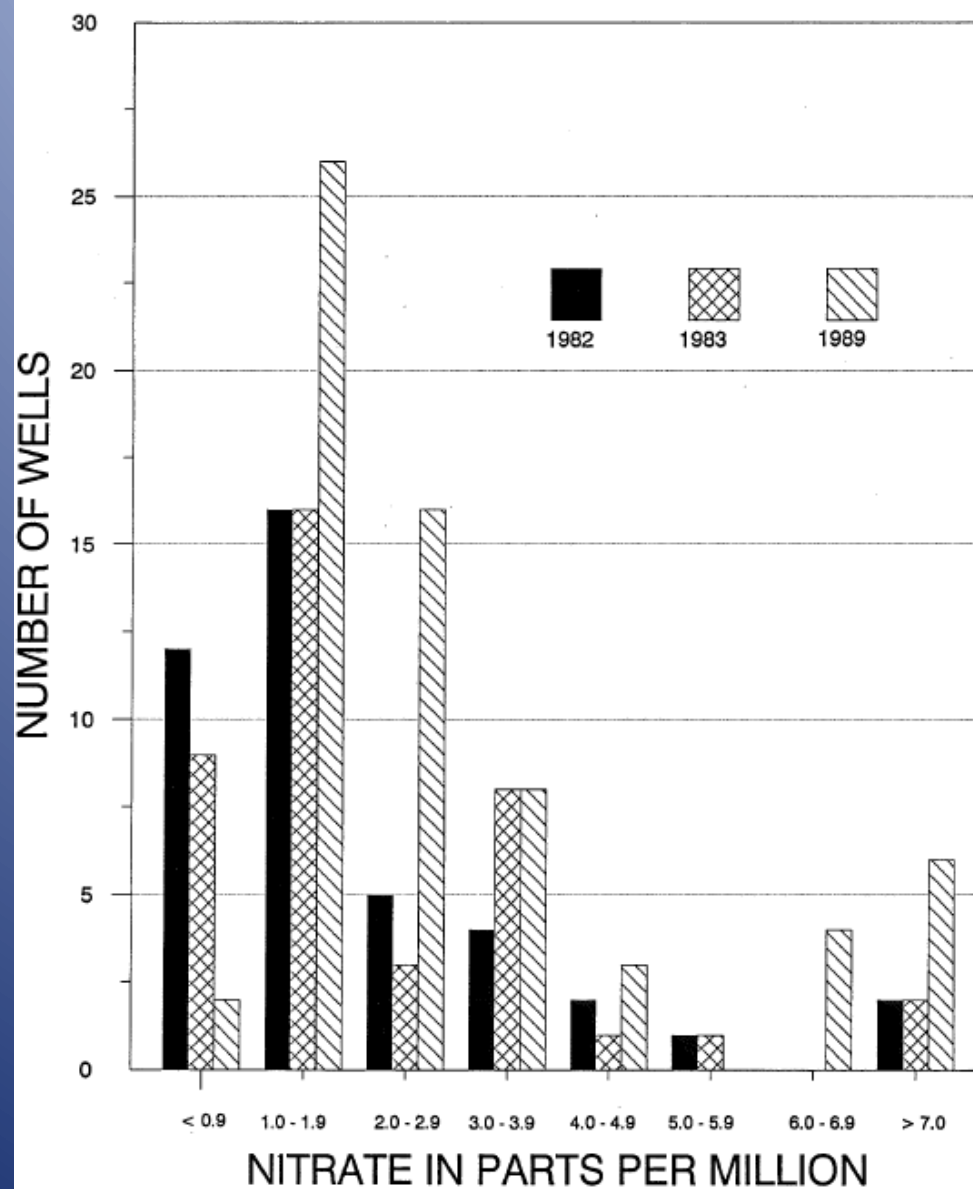
Summary of Land Use Categories

Land Use Type	Area in Acres	Percentage of Area	Number of Water Samples
Residential	4198	10.8	14
Undeveloped/Natural	12519	32.3	4
Agriculture/Range Land	17043	44.0	5
Agriculture/Fruit	461	1.2	0
Livestock-Poultry	486	1.3	1
Livestock-Cattle/Dairy	425	3.7	3
Livestock-Horses	357	0.9	1
Industrial	1351	3.5	0
Fish Hatchery	325	0.8	4
Tree Farm or Lumber	600	1.6	1

Scatter Creek/Black River Head Map for June 1990



FIGURE 4
NITRATE DATA
DISTRIBUTION BY CLUSTERS



1993 Aquifer Protection Strategy

- “Blueprint for Directing County Efforts to Protect Ground Water Supplies in South Thurston County”
- Prompted by Commissioners and Citizens
- Recommendations for :
 - 1) Monitoring
 - 2) Livestock Waste Mgt
 - 3) Gravel Mines
 - 4) Sewage Disposal
 - 5) Stormwater
 - 6) Citizen Involvement
 - 7) Funding

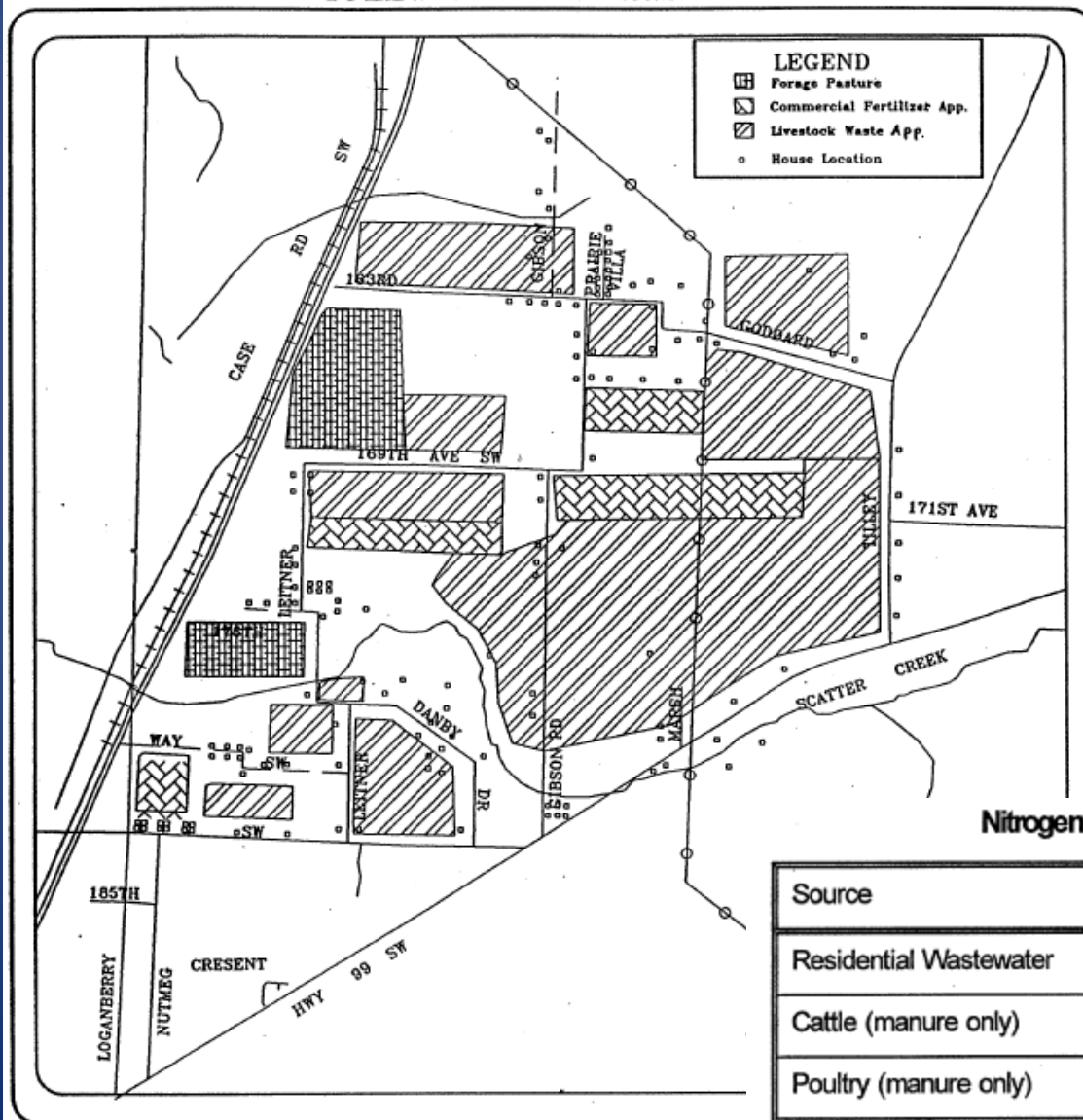
Was Anything Implemented?

- 1992 - Nonpoint Source Pollution Ordinance
- 1993 – 99 - Well Monitoring twice/year
- Special studies
- 1993 - Gravel Mine Ordinance
- 1995 - Assimilative Capacity Policy
- 1995 – Septic regulations change to require ½ acre lot size in aquifer sensitive areas
- 1996 - Adoption of EWL and CAL resolution

Violet Prairie Special Area Study 1995

- By Thurston County Health Dept
- Objectives:
 - Delineate areas of Nitrates above background
 - Identify the sources
 - Verify seasonal change
 - Track nitrate change as land uses change

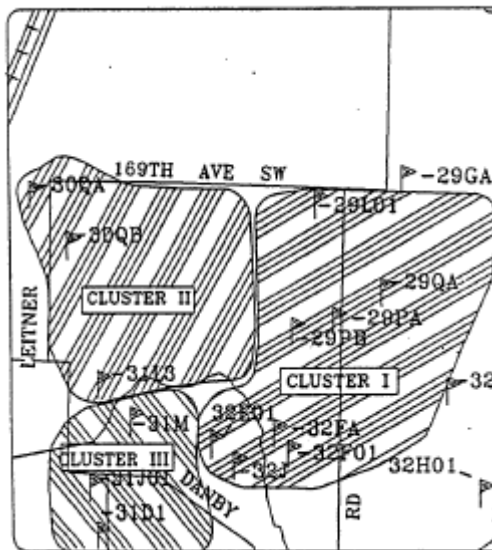
VIOLET PRAIRIE LAND USE



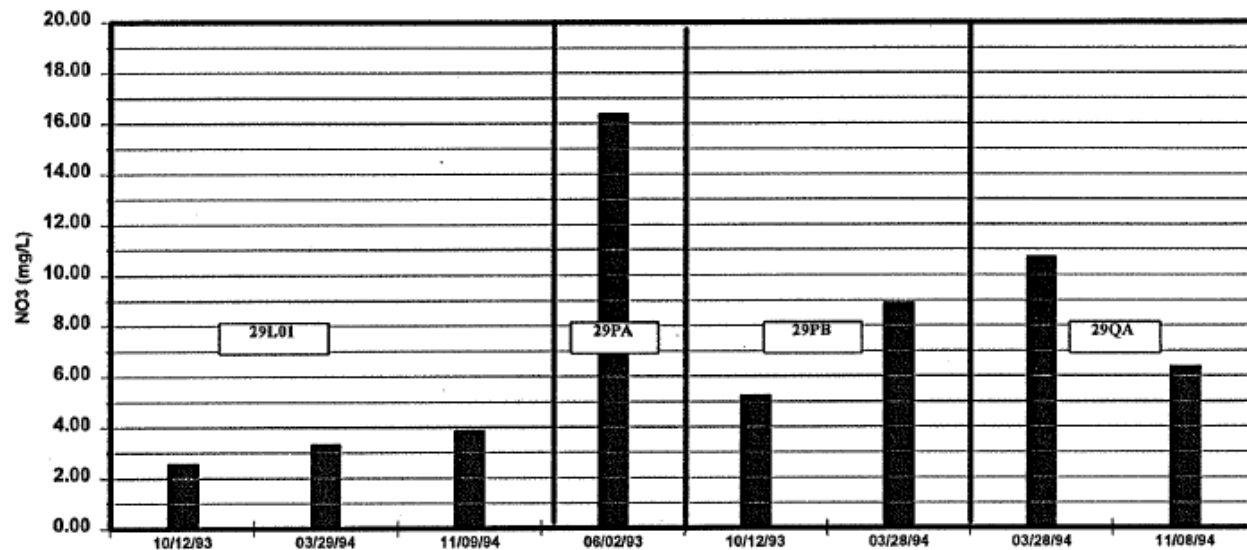
Nitrogen Production From Primary Sources in Violet Prairie

Source	Total Waste Produced	Nitrogen Component
Residential Wastewater	353,400 lbs/day (wet weight)	25 lbs/day
Cattle (manure only)	140,000 lbs/day	788 lbs/day
Poultry (manure only)	13,680 lbs/day	186 lbs/day
Residential Wastewater Annual Total	128,991,000 lbs (wet weight)	9125 lbs
Commercial livestock Annual Total	56,093,200 lbs	355,510 lbs

SUB-AREA WELLS



Cluster 1A Violet Prairie Wells



Cluster 1B Violet Prairie Wells

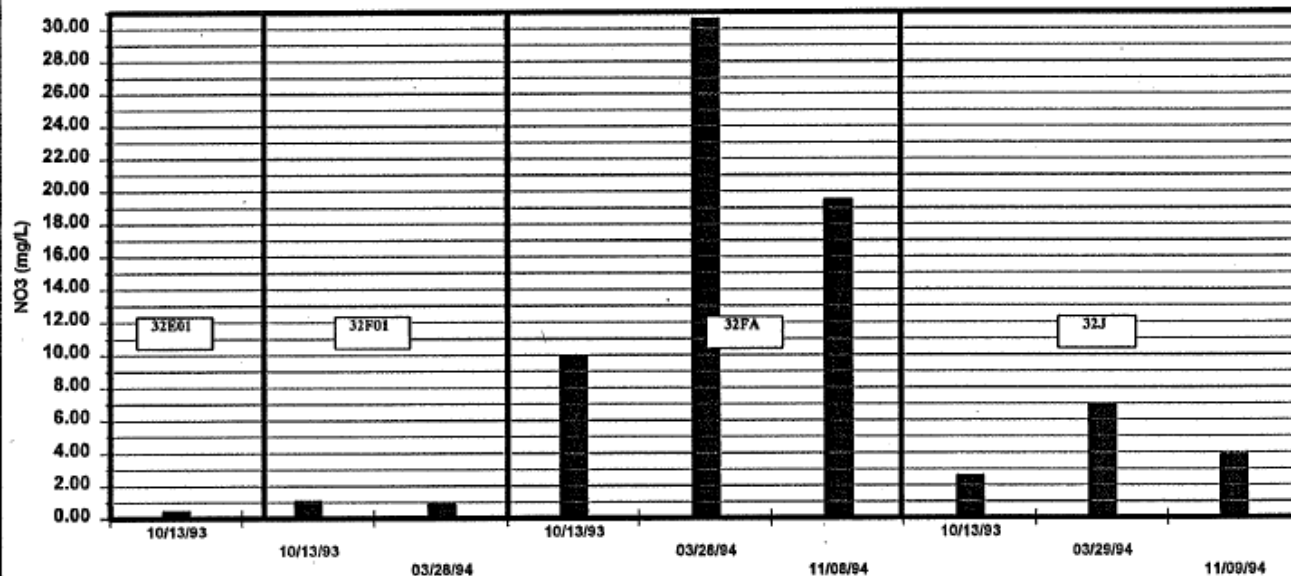


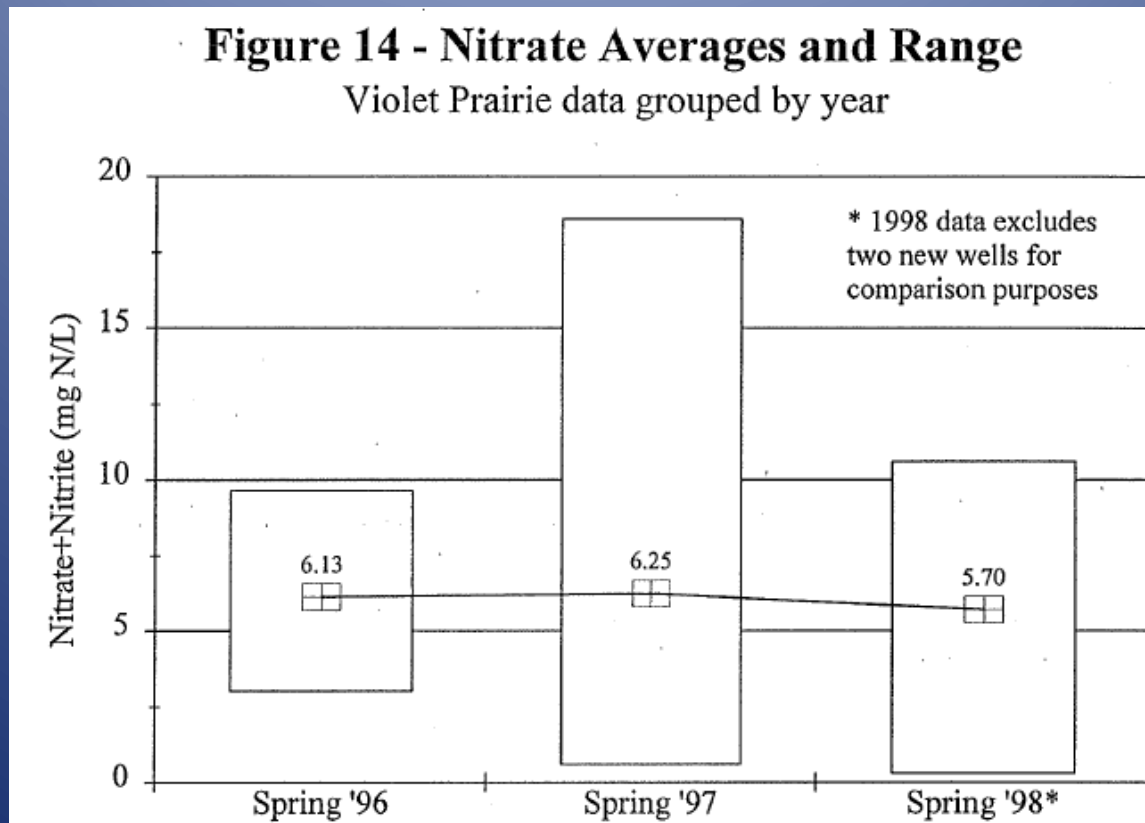
Figure 5

Conclusions:

- Nitrates > bkgrd in 23 of 25 wells
- Failing septic probable source for 1 well
- Manure applications likely source(s) in specific areas
- Deeper wells have lower nitrate
- Higher nitrate levels in Spring than in Fall

Other '90's Work

- Southern Thurston County Aquifer Characterization Study, 1996
- 1996/97 & 1997/98 Monitoring Reports
- 1999 - 1st Attempt to Computer Model Aquifer



2004 Private Well Monitoring

- GOAL: Raise Awareness & Gather Data
- Geographic focus was east of I-5
- 81 wells tested for Coliform
 - 31% had *Unsatisfactory* results
 - No pattern
- 52 wells tested for Nitrate
 - Range 0.3 – 11.6 mg/l; Average 3.3
 - Pattern showed increase from east to west

The City of Tenino

THURSTON COUNTY

Scatter Creek Sampling Results

November Through December 2004

Nitrate Results

- 0.1 to 1.9 mg/L
- 2.0 to 3.9 mg/L
- 4.0 to 9.9 mg/L
- > 10 mg/L

Coliform Bacteria Results

- Satisfactory
- Unsatisfactory

*Note: Two symbols on the same parcel show the result of the initial sample and a repeat sample.

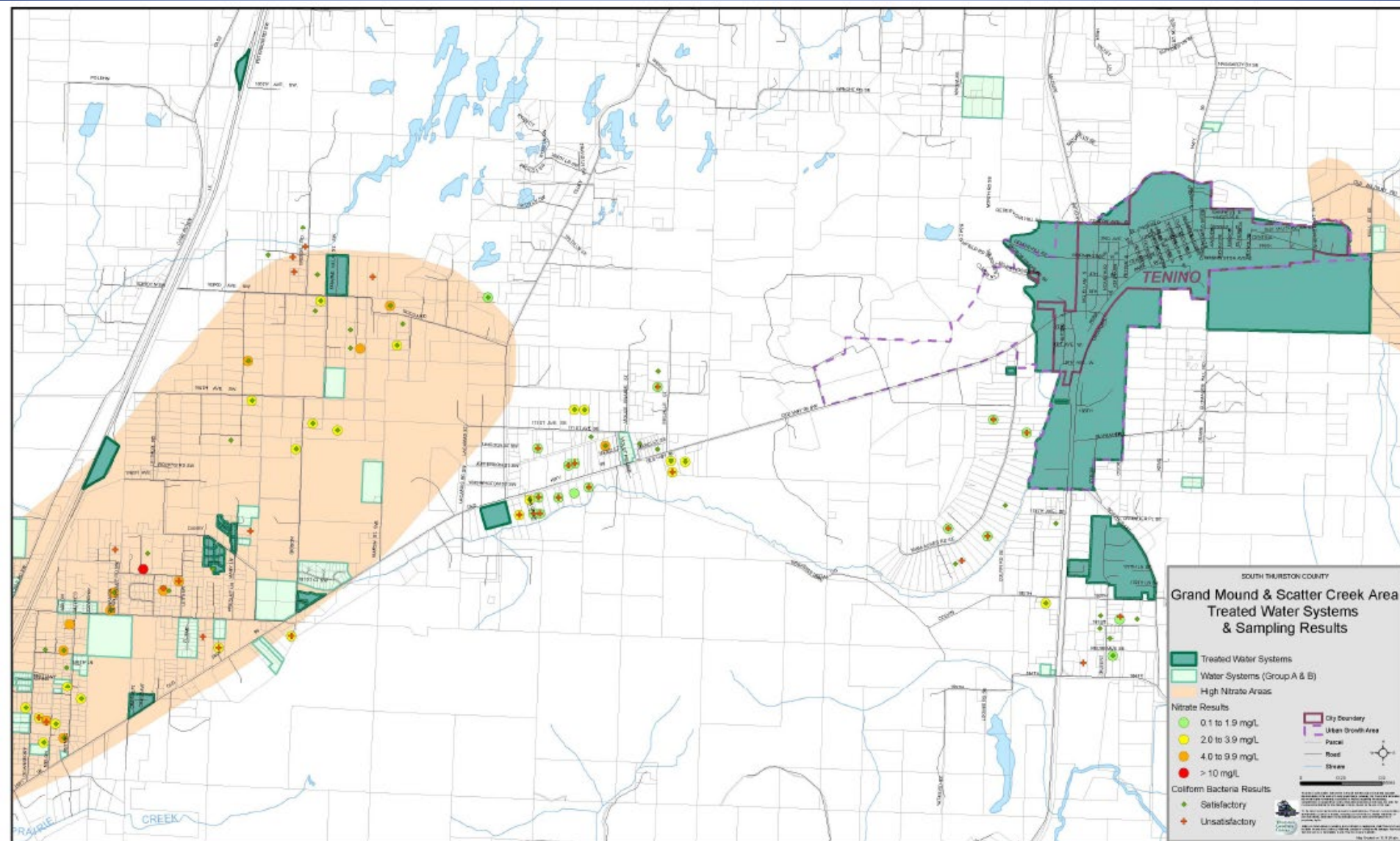
0 0.2 0.4 Miles

Map Created on 01.18.05 abc

Thurston GeoData Center

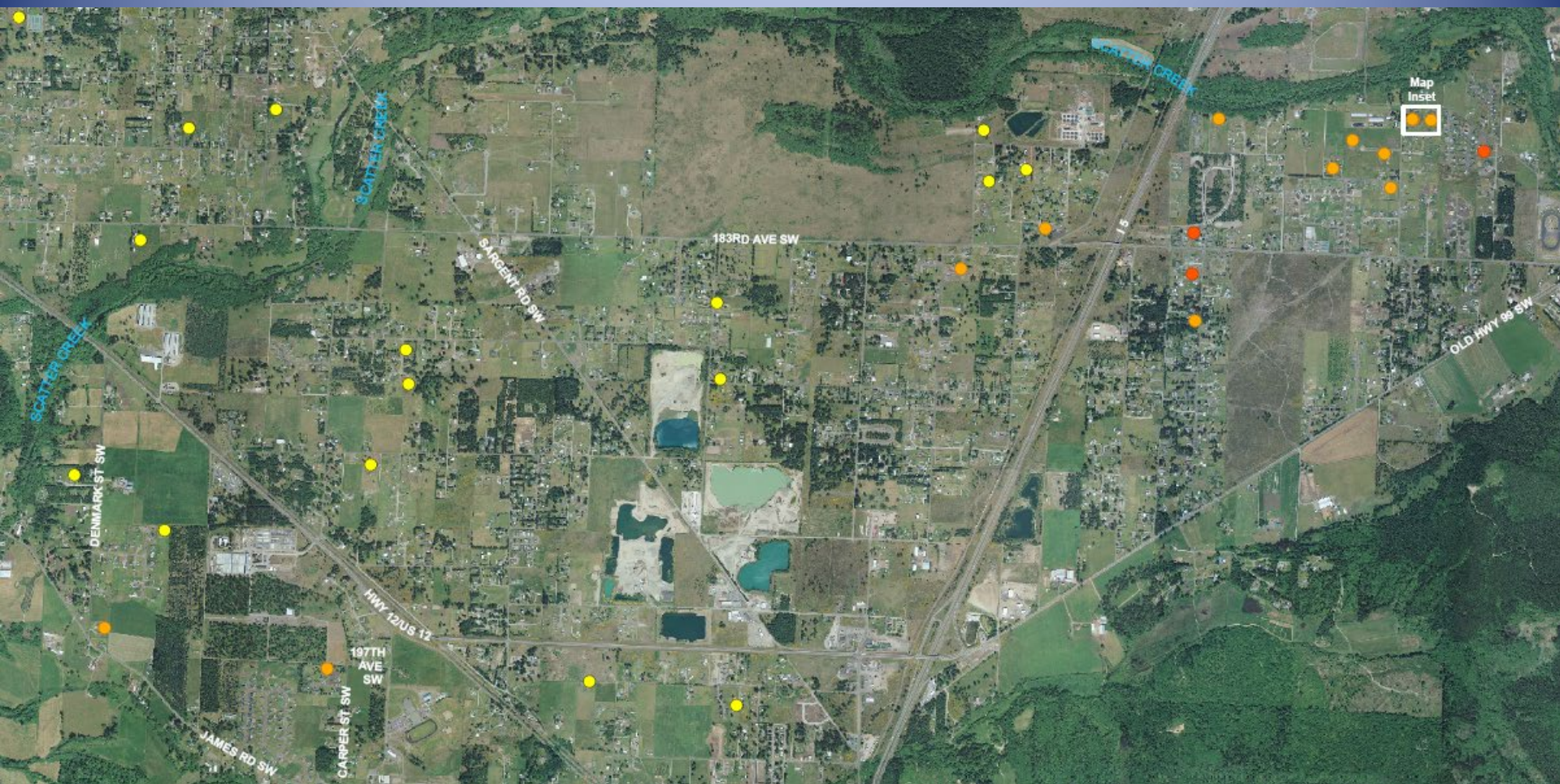
Thurston County is not responsible for the accuracy of the data or the results of the sampling. The data is provided as a reference only. The County does not warrant the accuracy of the data or the results of the sampling. The County does not warrant the accuracy of the data or the results of the sampling. The County does not warrant the accuracy of the data or the results of the sampling.

Water Systems with Disinfection



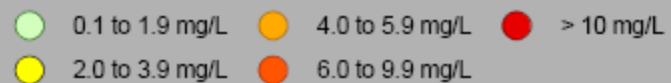
2008-2009 Monitoring Summary

- 10 of 114 samples (9%) had coliform bacteria present, but no E. Coli
- 120 samples for nitrate
 - Range 1.7 – 7.8 mg/l
 - Average 4.1 mg/l
 - Levels seemed to have increased in some areas & decreased in others.
- 2x/yr monitoring has continued



Scatter Creek Sampling Results 2008-2009

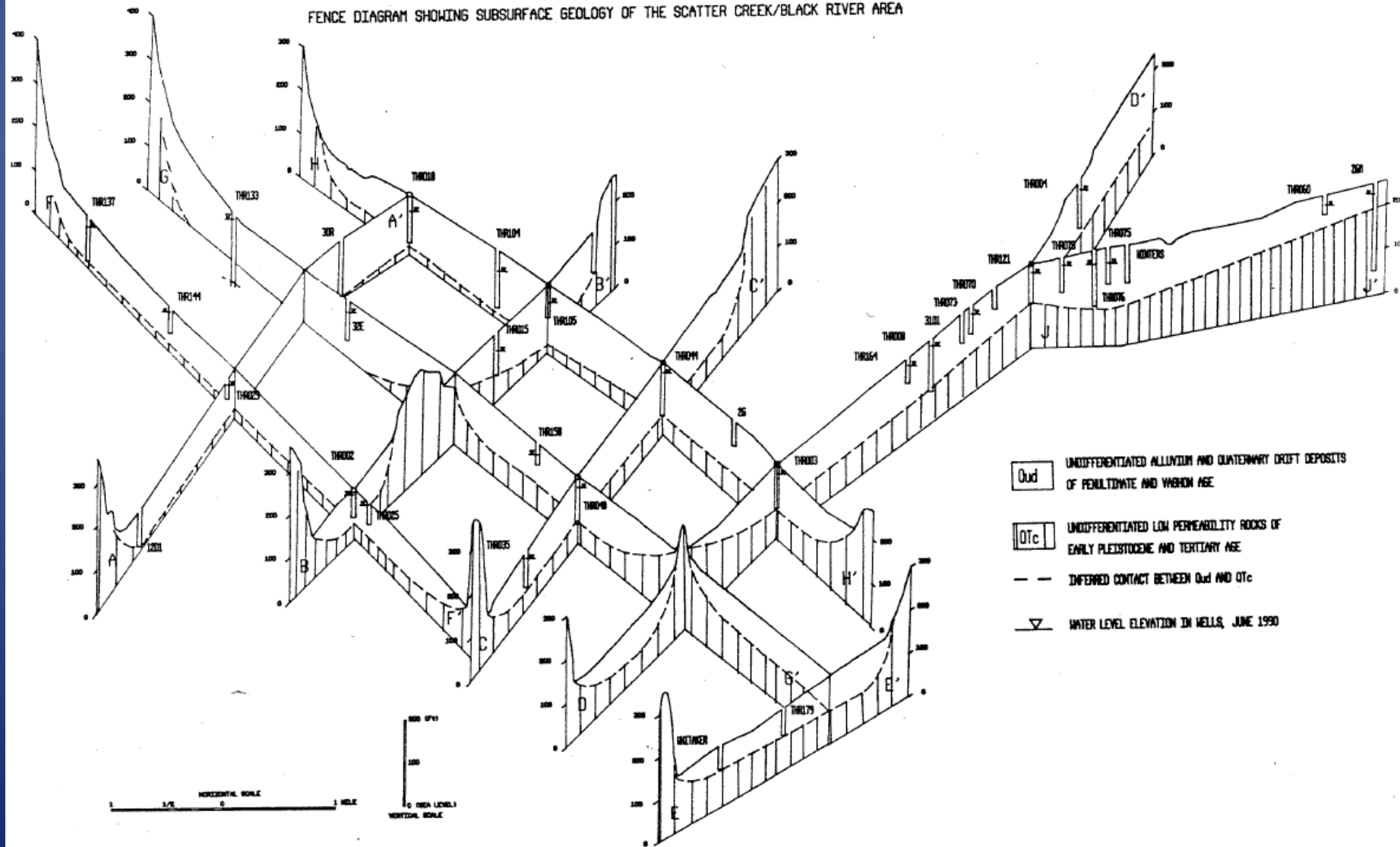
Nitrate Results

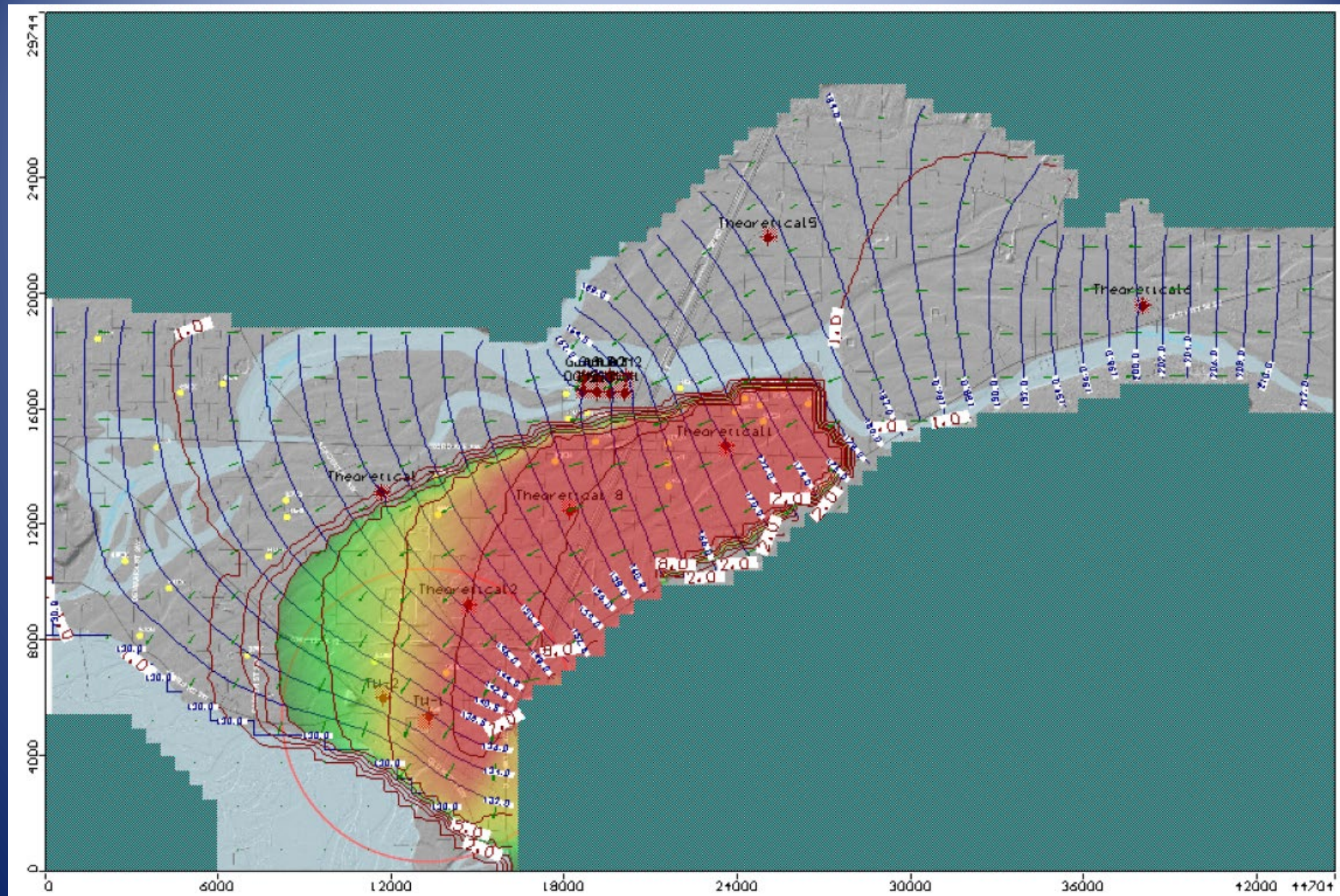


What's Changed?

- Tools available to Model and Forecast
- Funding opportunity
- Land Use in transition

FIGURE 2
FENCE DIAGRAM SHOWING SUBSURFACE GEOLOGY OF THE SCATTER CREEK/BLACK RIVER AREA





1996 Aerial – Violet Prairie



2002 Aerial – Violet Prairie



2009 Aerial – Violet Prairie



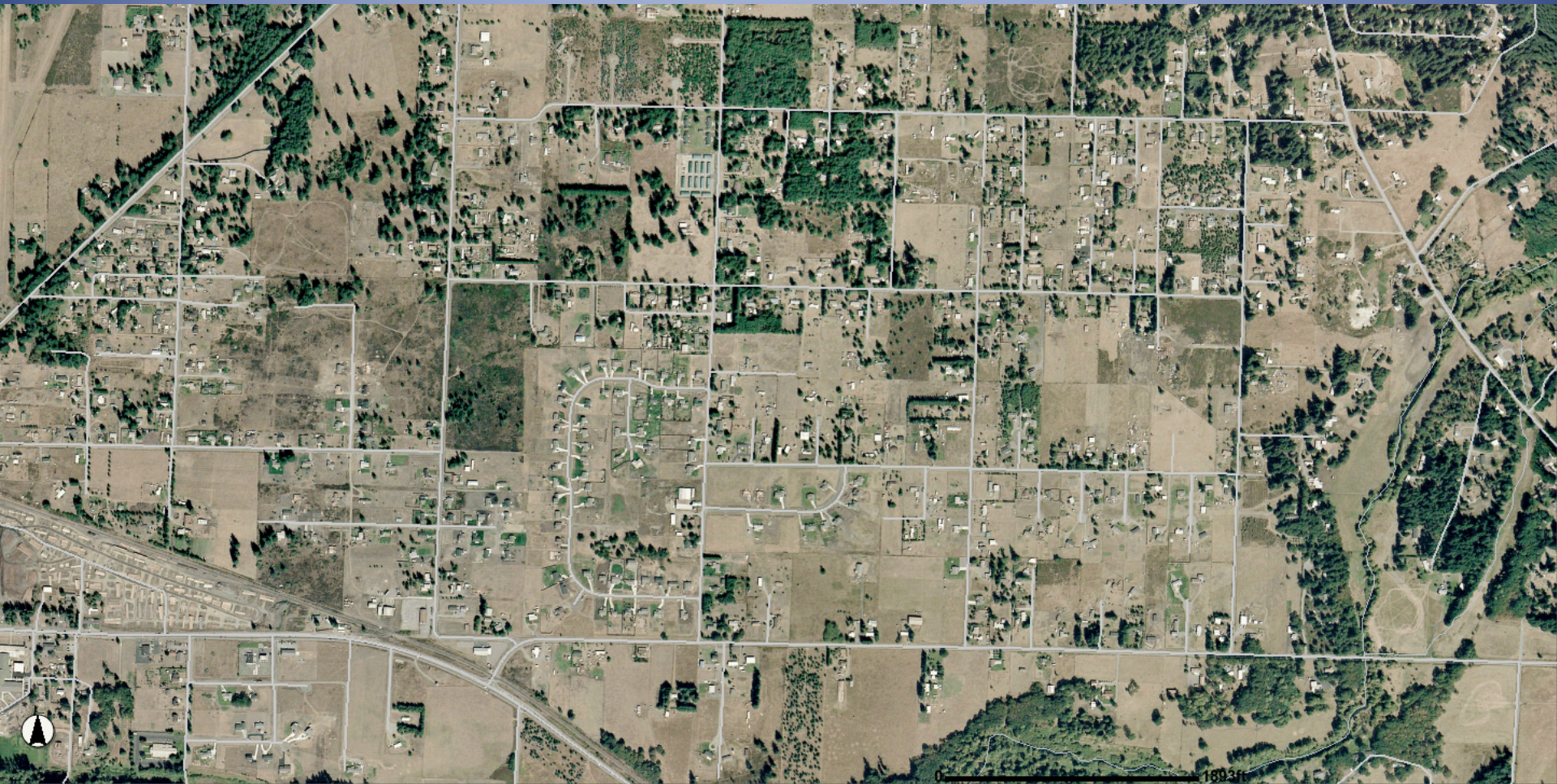
2009 Parcels – Violet Prairie



1996 Aerial - Rochester



2002 Aerial - Rochester



2009 Aerial - Rochester



2009 Parcels - Rochester



Summary

- Know the Groundwater has been contaminated by land uses in past
- Seen improvement
- Land Use is in transition
- Have opportunity to examine future impacts and take action to prevent