Source Water Protection Program

Montana Department Of Environmental Quality

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October 24, 2007

Outline of Presentation

- Introduction
  - What are Public Water Supplies (PWSs)?
  - Statutory Authority and the Initial Mission
  - What is Source Water?
  - What does the Source Water Program do?
  - Project Areas and the distribution of Public Water Supplies
  - Where is the Source Water Program within DEQ.
- Source Water Protection in Montana
  - Two examples
  - Status
  - Some findings about threats to source water
  - Next steps - Source Water Protection Planning

What is a Public Water Supply?

- A water system that:
  - Has at least 15 service connections or
  - Regularly serves at least 25 persons daily for a minimum of 60 or more days in a calendar year

- PWS Class:
  - **Community:** serves year-round residents (towns and subdivisions)
  - **Transient non-community:** Serves a transient population over six months per year. (cafes, bars, campgrounds, motels… etc.)
  - **Non-transient non-community:** Not a community system but it does regularly serve at least 25 of the same persons over six months per year. (Factories and schools)

  - **Non-Public:** Multi-family subdivisions
    - Less than 15 service connections and less than 25 persons served

- There are more than 2,000 PWS in Montana

Statutory Authority and The Initial Mission

- Federal Safe Drinking Water Act
  - Amendments of 1996: Sections 1428 and 1453
  - Required all states to "assess water systems' susceptibility to contamination"
  - Using publicly available information sources
  - A first step in a multi-barrier approach to protect drinking water
  - Assessments are required – Planning is voluntary
- Assessments Steps: (SWDARs – Text, graphs, and mapping)
  - Identify sources of water used by each public water supply
  - Determine where the water comes from – map those land areas
  - Inventory significant potential contaminant sources
  - Evaluate the public system's susceptibility to potential contaminant sources
  - Provide the information to the public
- Original Deadline: 2003

Program Timeline

- SDA amendments added - 1996
- Funding available - early 1999
- Montana's program approved - November 1999
  - A guideline document for source water protection
- Deadline extended in 2003 to 2006
- Initial mission completed - December 2006
  - Public Water Supplies that were active in 1999
- Work continues for new systems and new facilities (wells etc.)

What is Source Water?

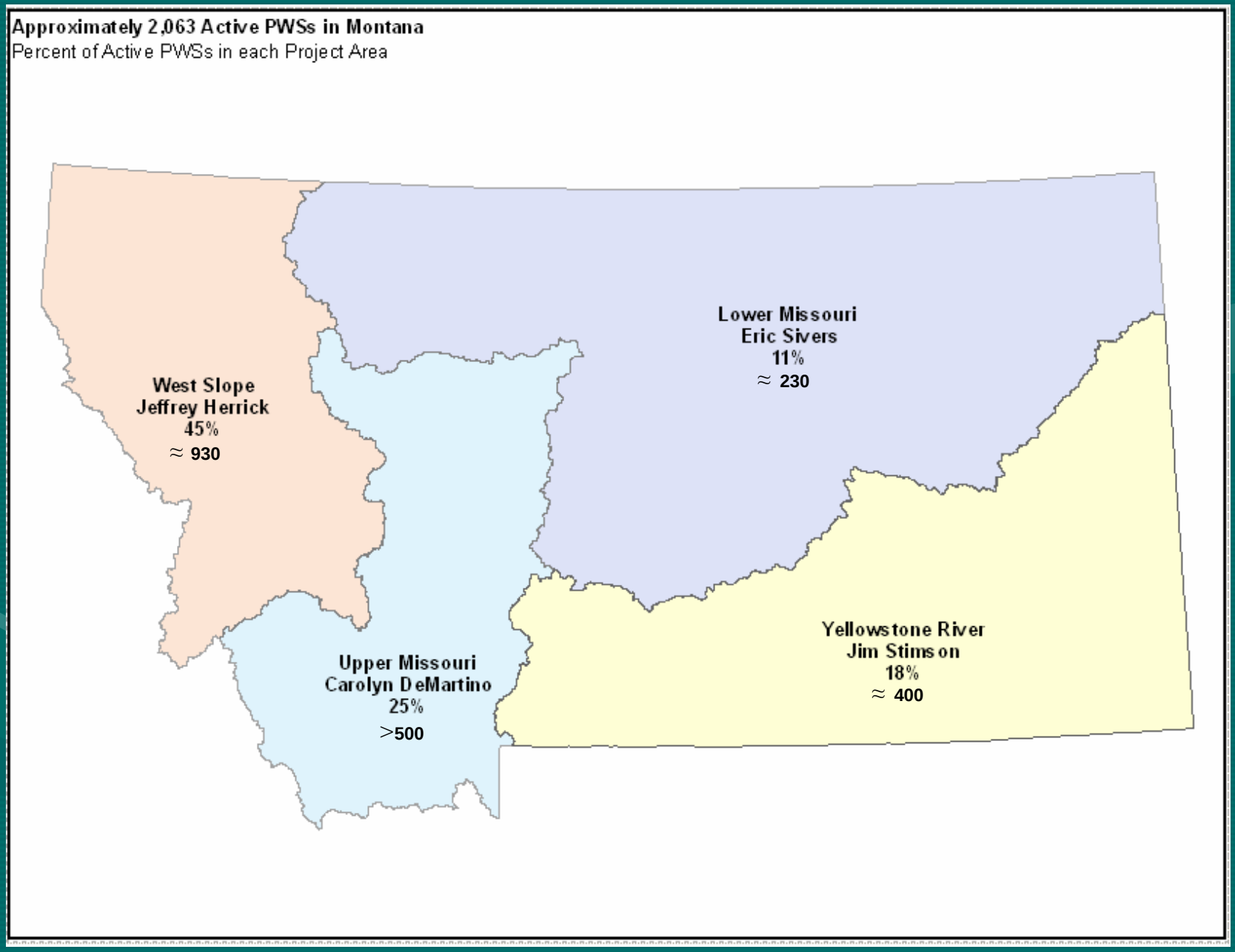
- "Raw" untreated water used by a Public Water Supply
  - Ground water before it enters a well or spring box or infiltration gallery
  - Surface water before it enters an intake
  - Some combination of these sources

What does the Source Water Protection Program do?

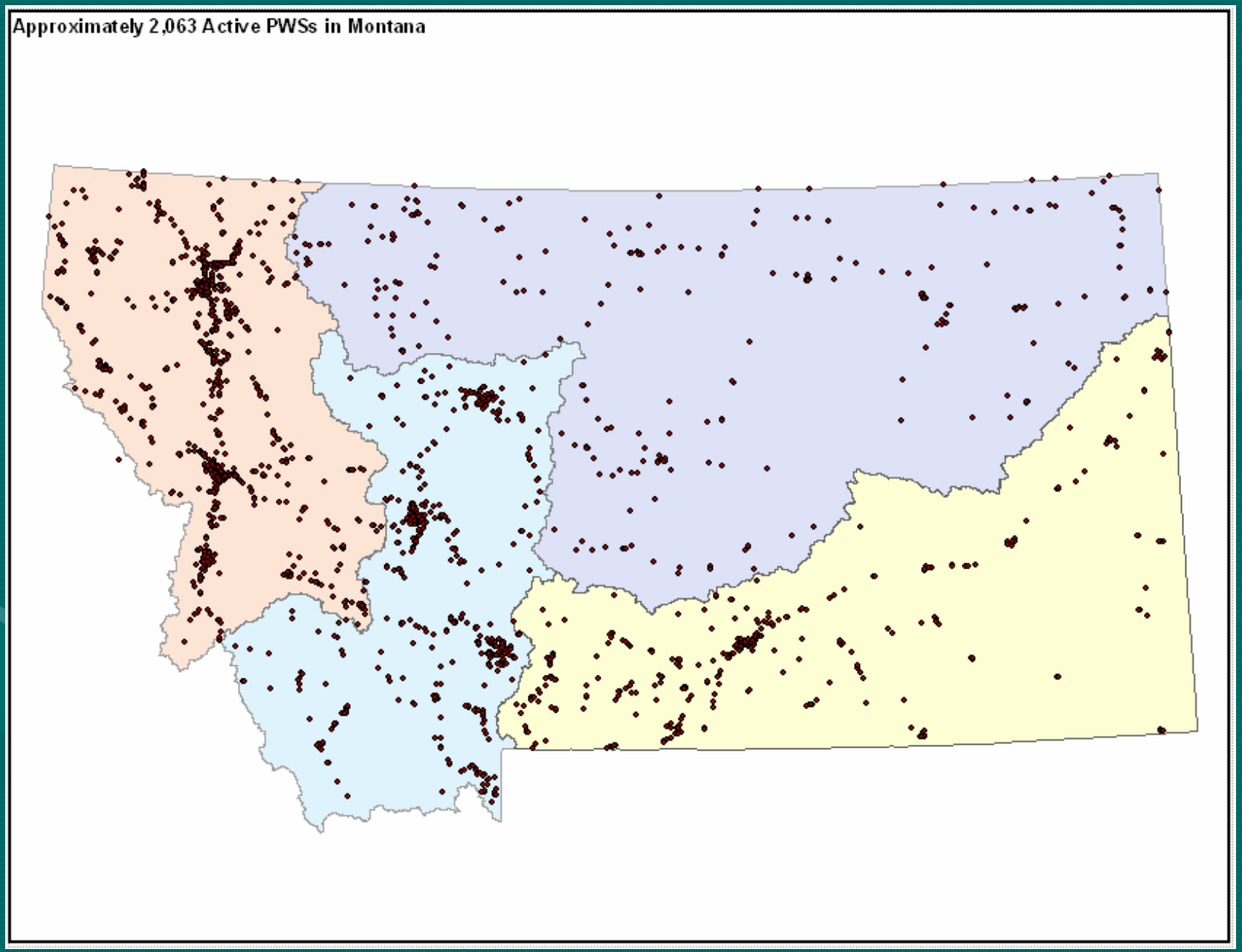
- Primary Tasks:
  - Work with Public Water Supplies (not private wells)
  - Write Source Water Protection Reports (SWDARS)
  - Help with the review of new wells and system changes

- Other Tasks:
  - Train public water supply operators
  - Provide public workshops – Septic Education
  - On-site inspections (Sanitary Surveys)
  - Provide technical assistance upon request to PWSs, WQ Districts, the public, and Other DEQ programs
  - Participate in the Ground Water Assessment Steering Committee, Watershed Advisory Council, Wetlands Council, and others as requested

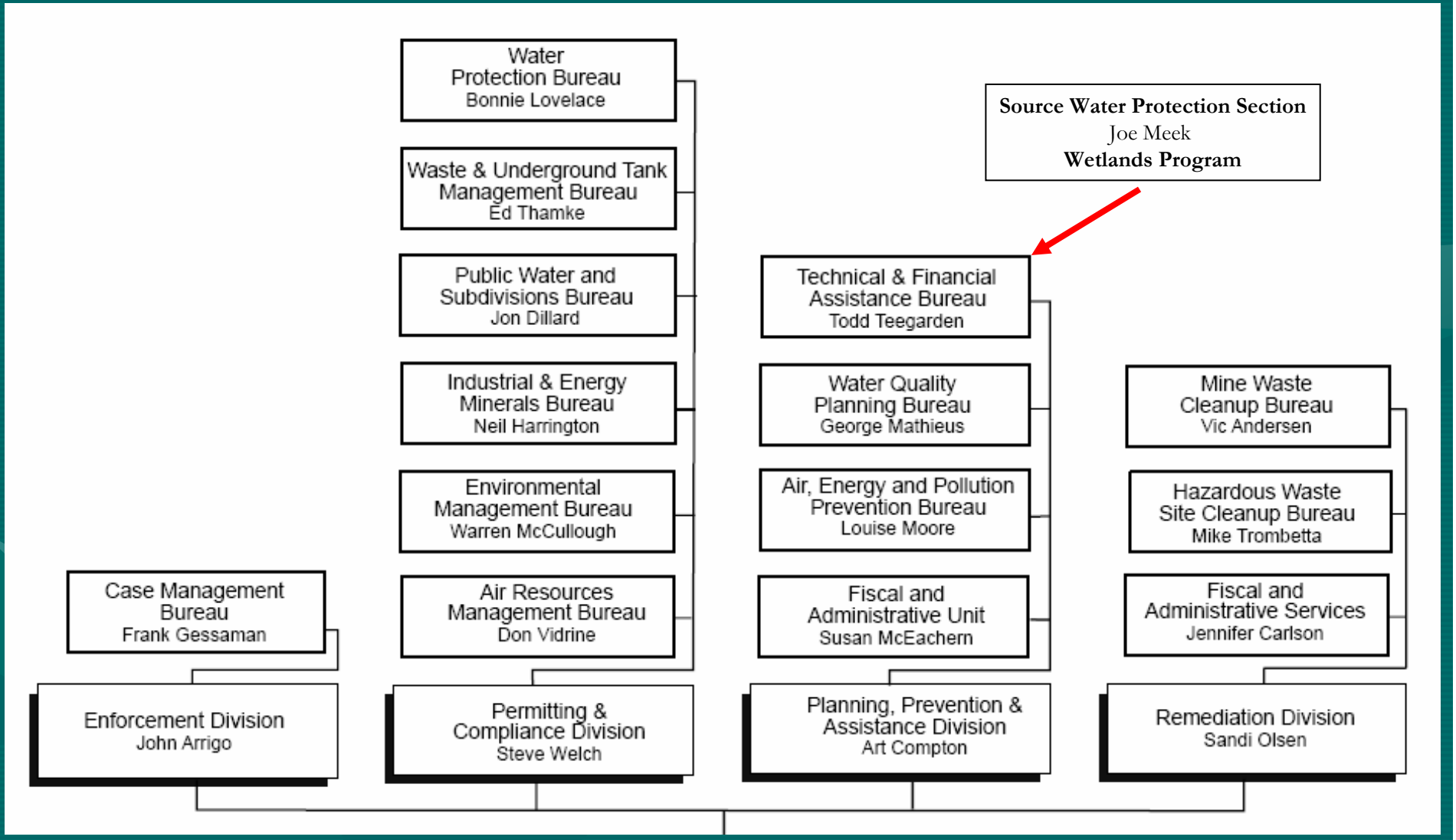
Project Areas – Staff - PWSs



Project Areas – Staff - PWSs



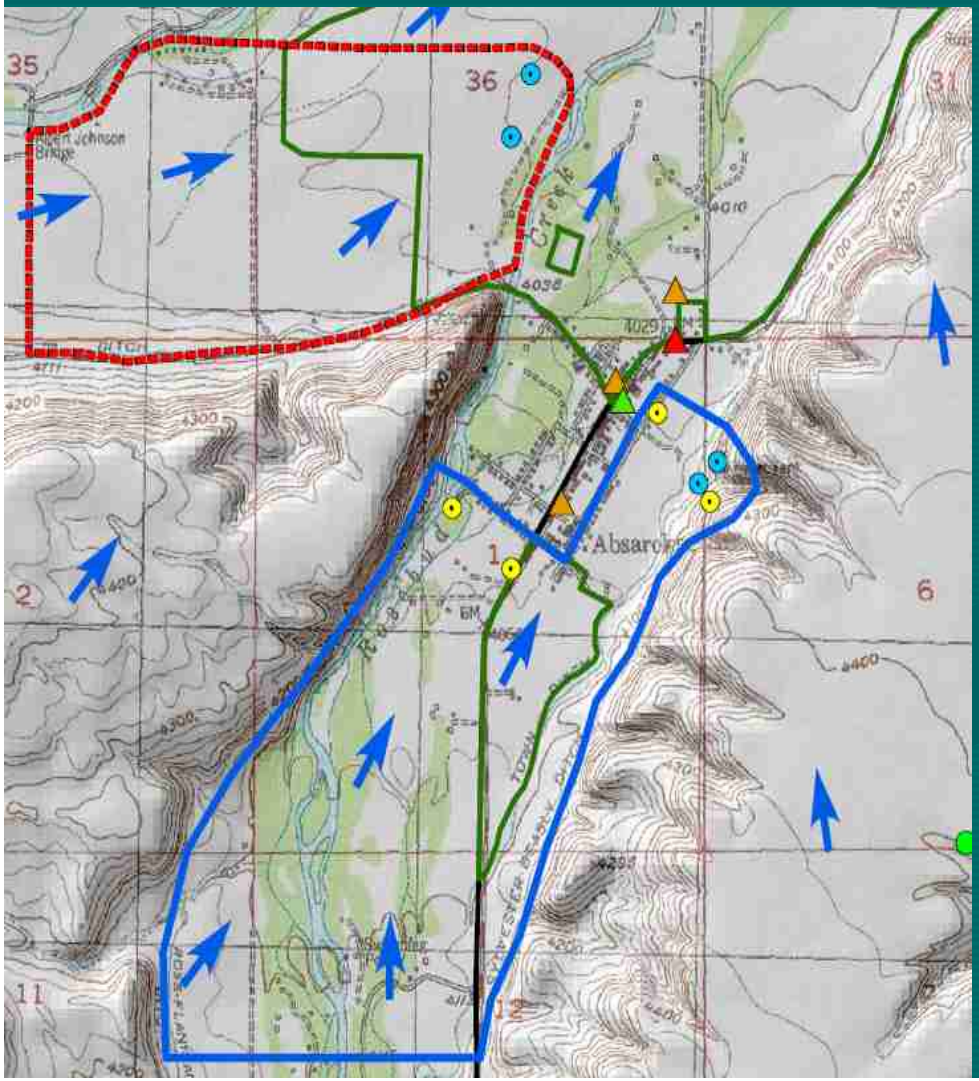
Where is the program within DEQ?

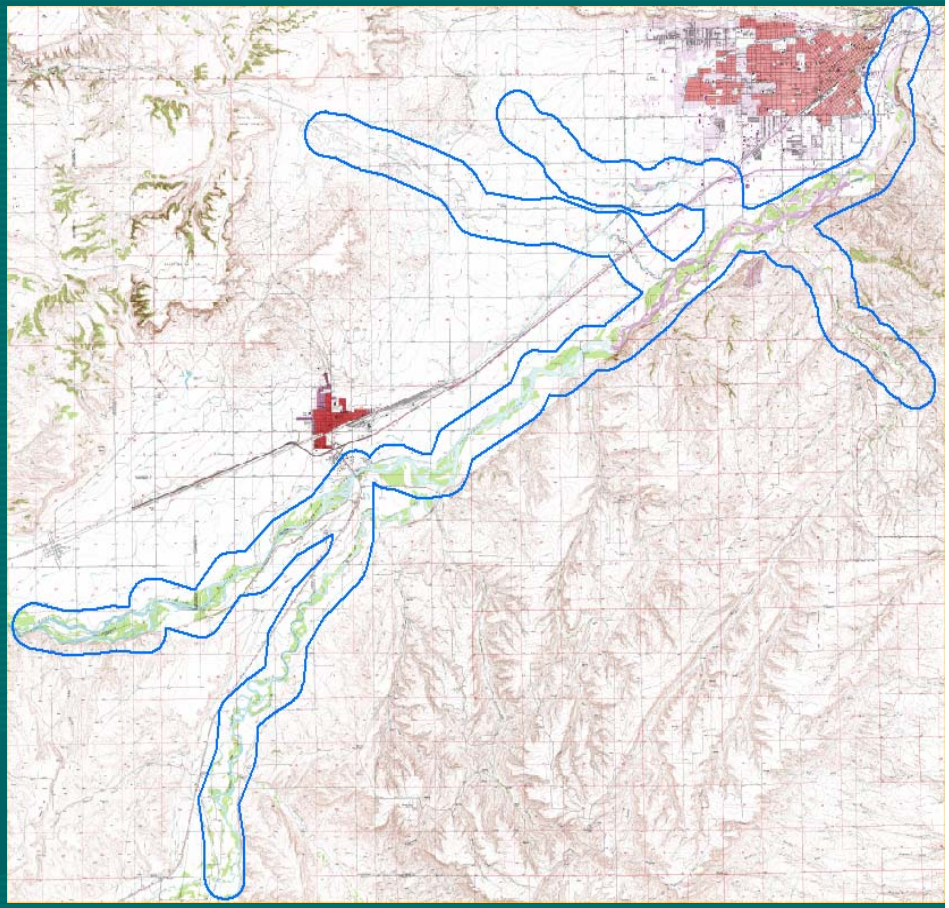


Source Water Delineation and Assessment

Examples

Ground Water





Surface Water

Public Information Sources

Montana Department of Environmental Quality

Montana Natural Resource Information System
Digital Atlas of Montana

GWIC
Ground-Water Information Center
Montana Bureau of Mines and Geology
Montana Tech of The University of Montana
1300 West Park Street - Main Hall 314
Butte Montana 59701-8997

MONTANA DNRC
DNRC Water Right Query System

USGS
science for a changing world
USGS Activities in Montana: Biology Geology Mapping Water
Water Resources of Montana

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
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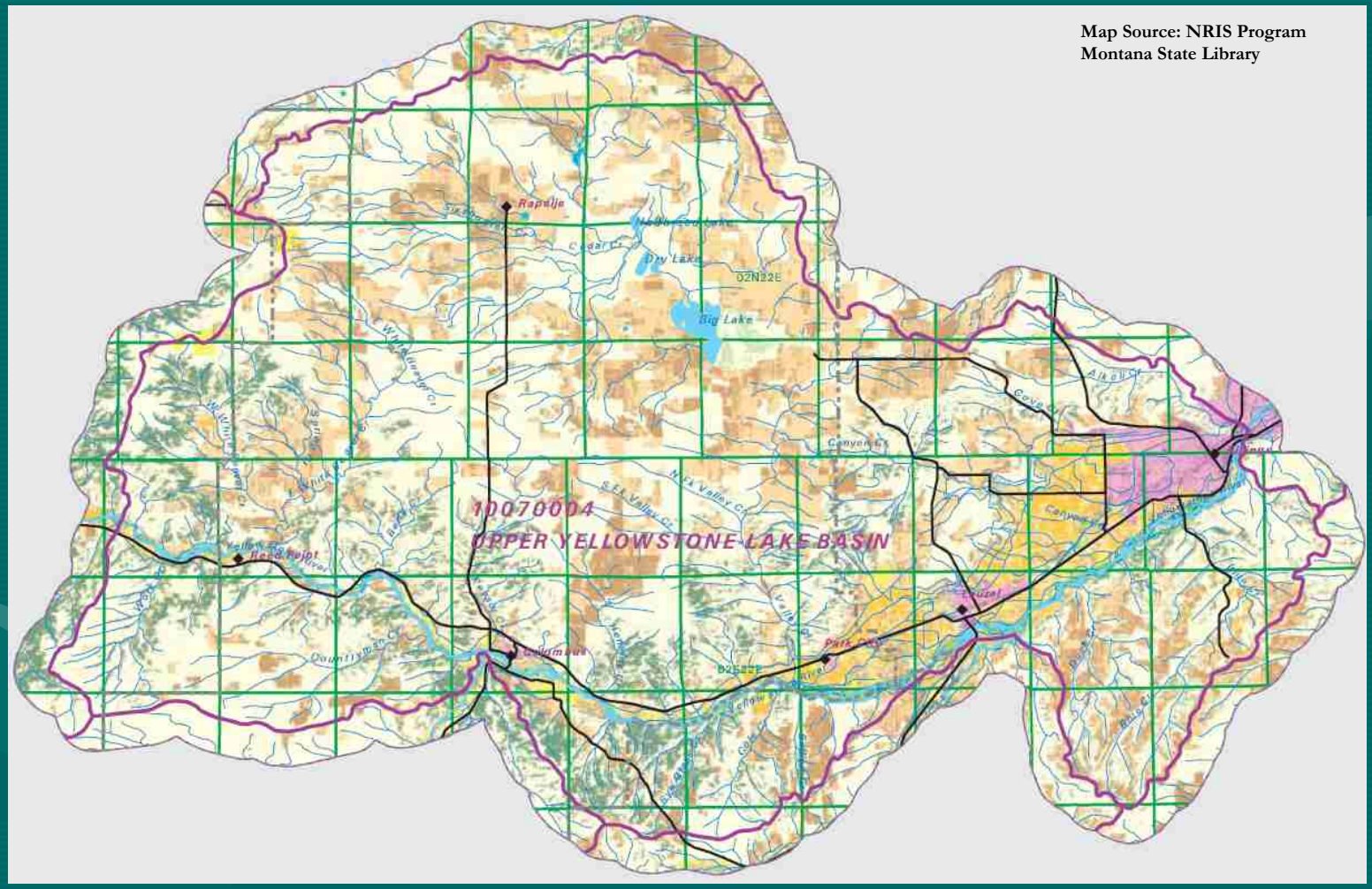
Source Water Delineation and Assessment

Identify The Source of Water

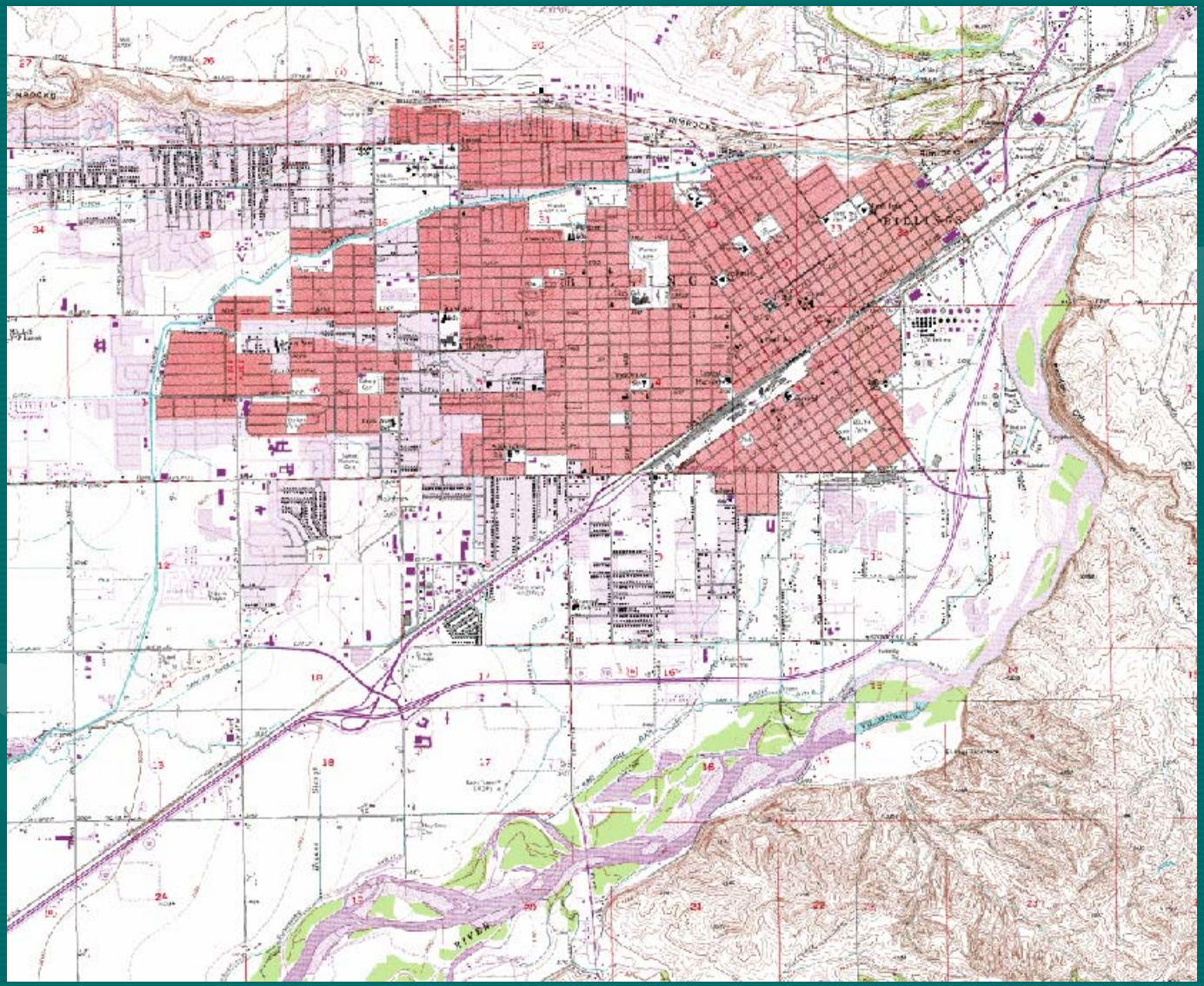
Surface Water Example



Source Water Delineation and Assessment

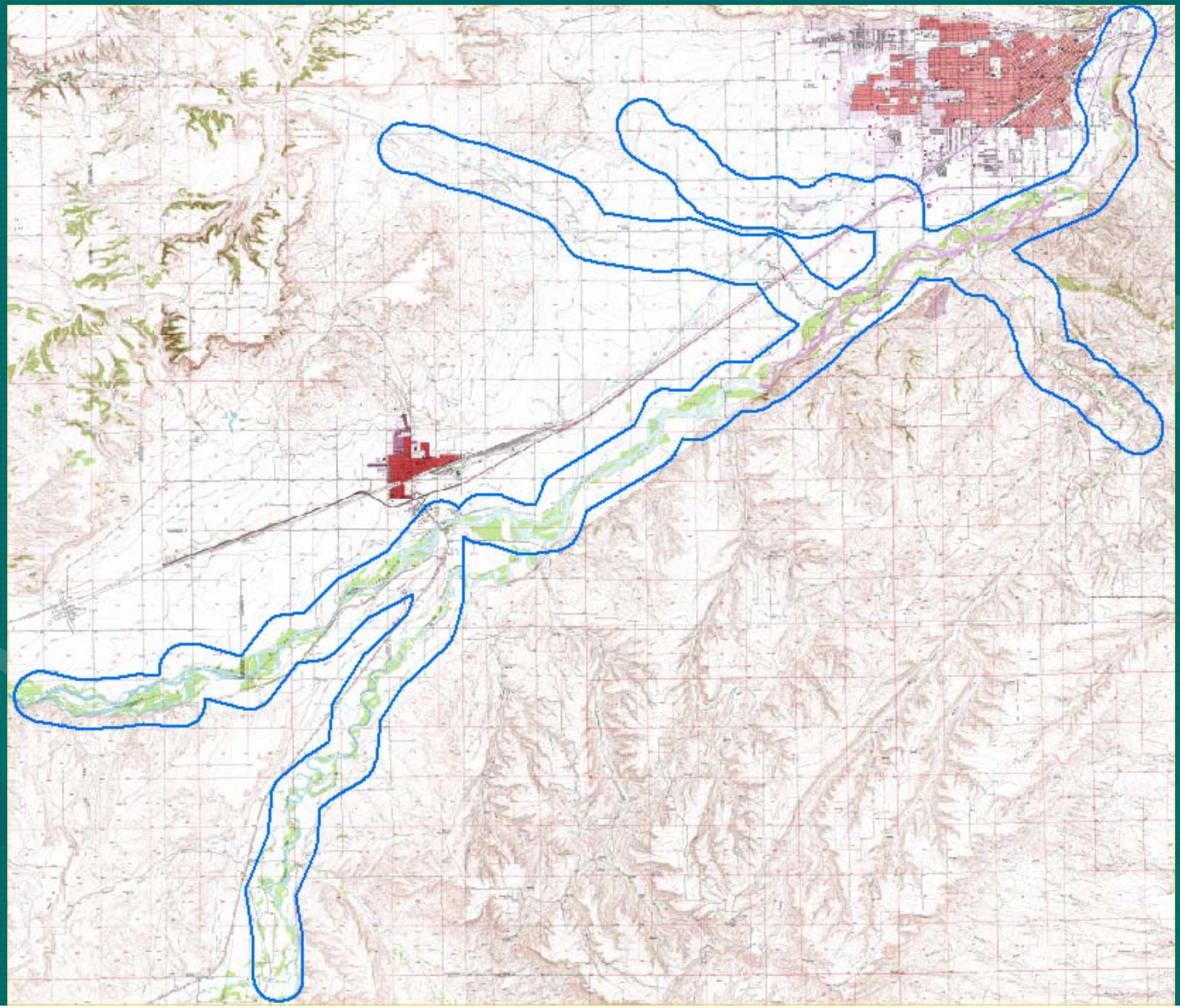
How Does The Source Water Get To The PWS?

Surface Water



Source Water Delineation and Assessment

Delineate Source Water Protection Area



Source Water Delineation and Assessment
Inventory: Significant Potential Contaminant Sources

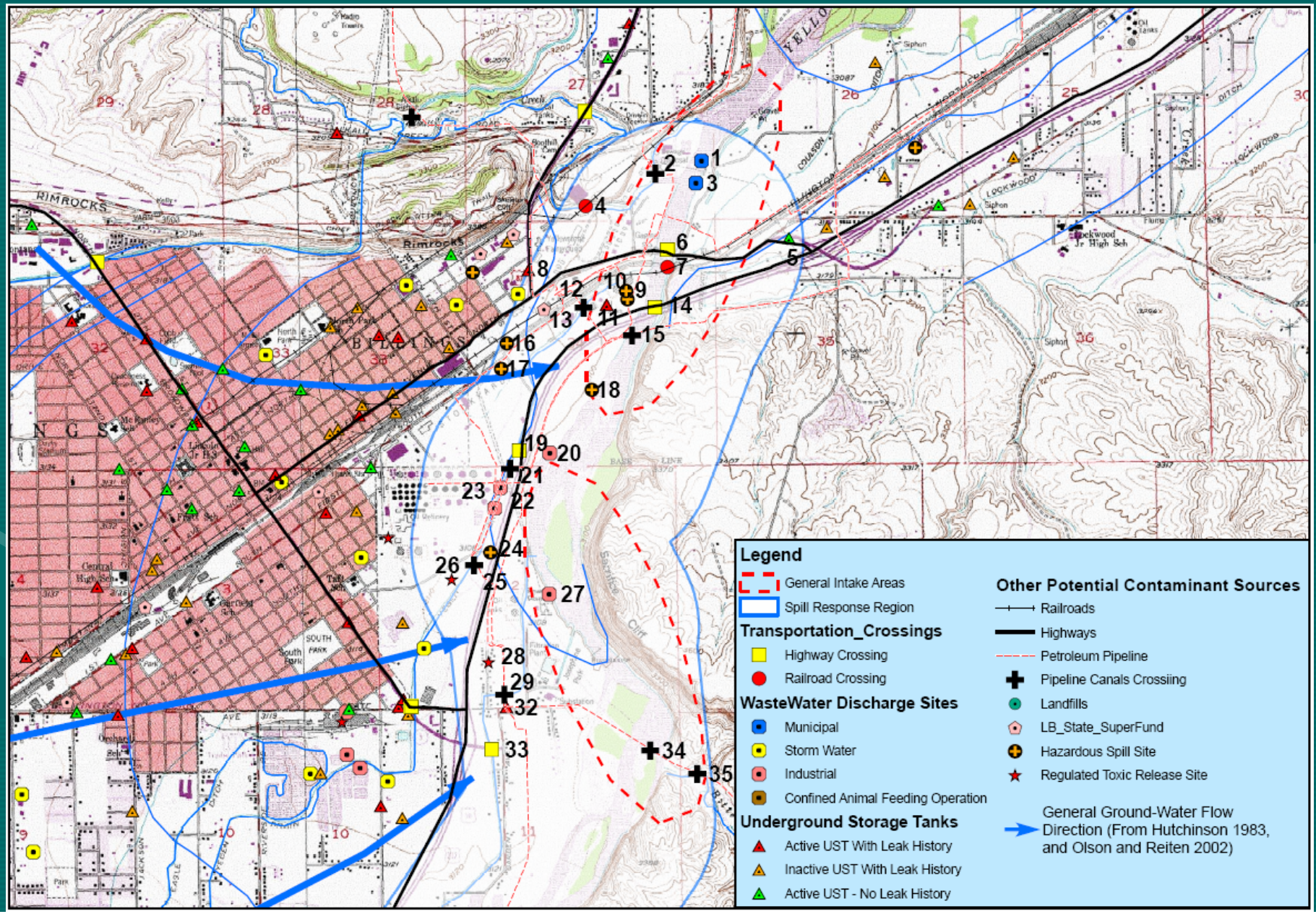
Used for both Surface Water and Ground Water

Table 7. Identification of Significant Potential Contaminant Sources.

Septic Systems	Landfills
Animal Feeding Operations	Abandoned Mines
Underground Storage Tanks	MPDES Wastewater Dischargers
Underground Storage Tanks Leaks	Municipal Sanitary Sewer
State and Federal Superfund Sites	Municipal Storm Sewers
RCRA Large Quantity Generators	Highways, Railways, Pipelines
Underground Injection Wells	Cultivated Croplands
Wastewater Treatment	**Other**: Activities or substances that can compromise source water quality.

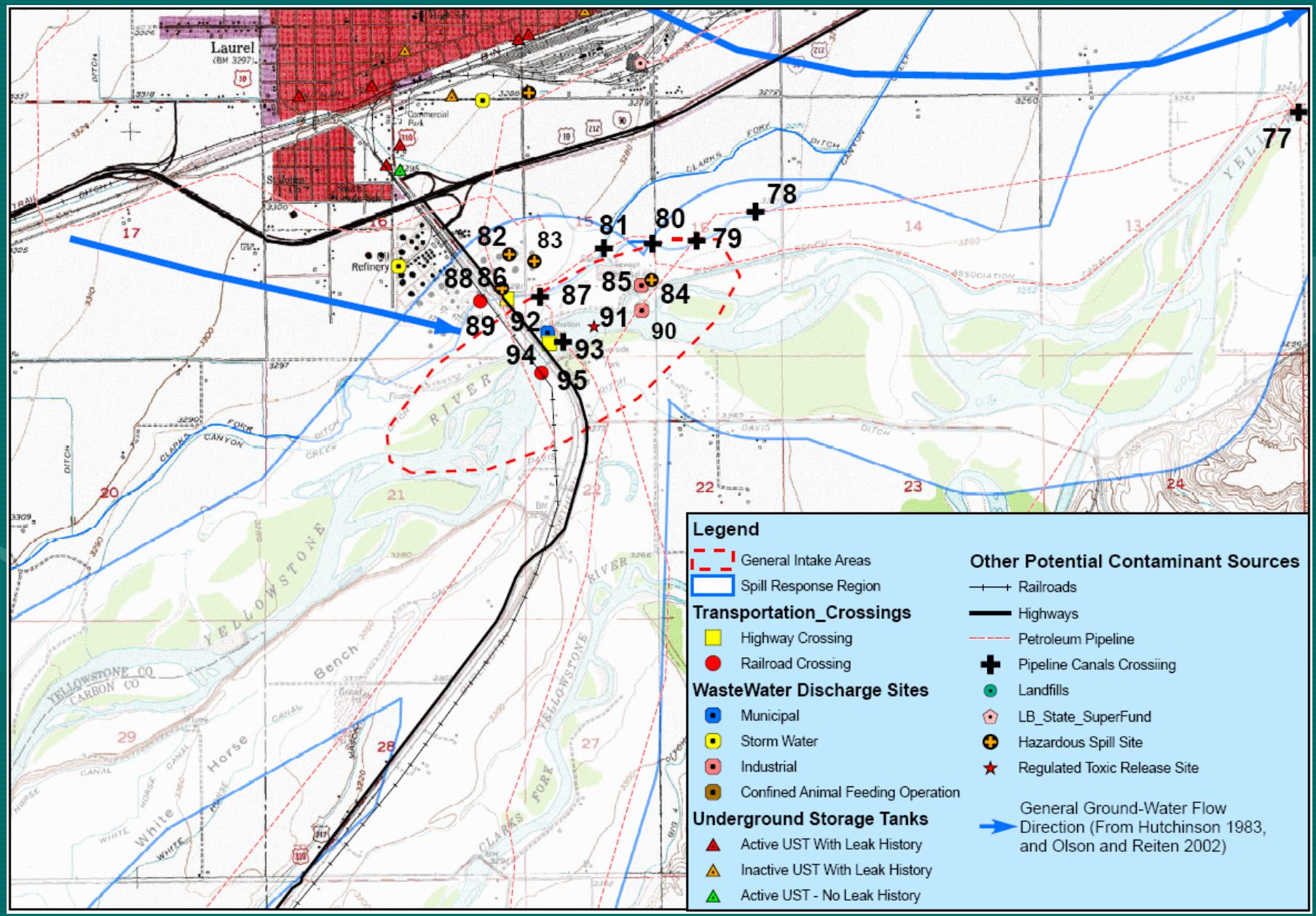
Source Water Delineation and Assessment

Inventory: Significant Potential Contaminant Sources



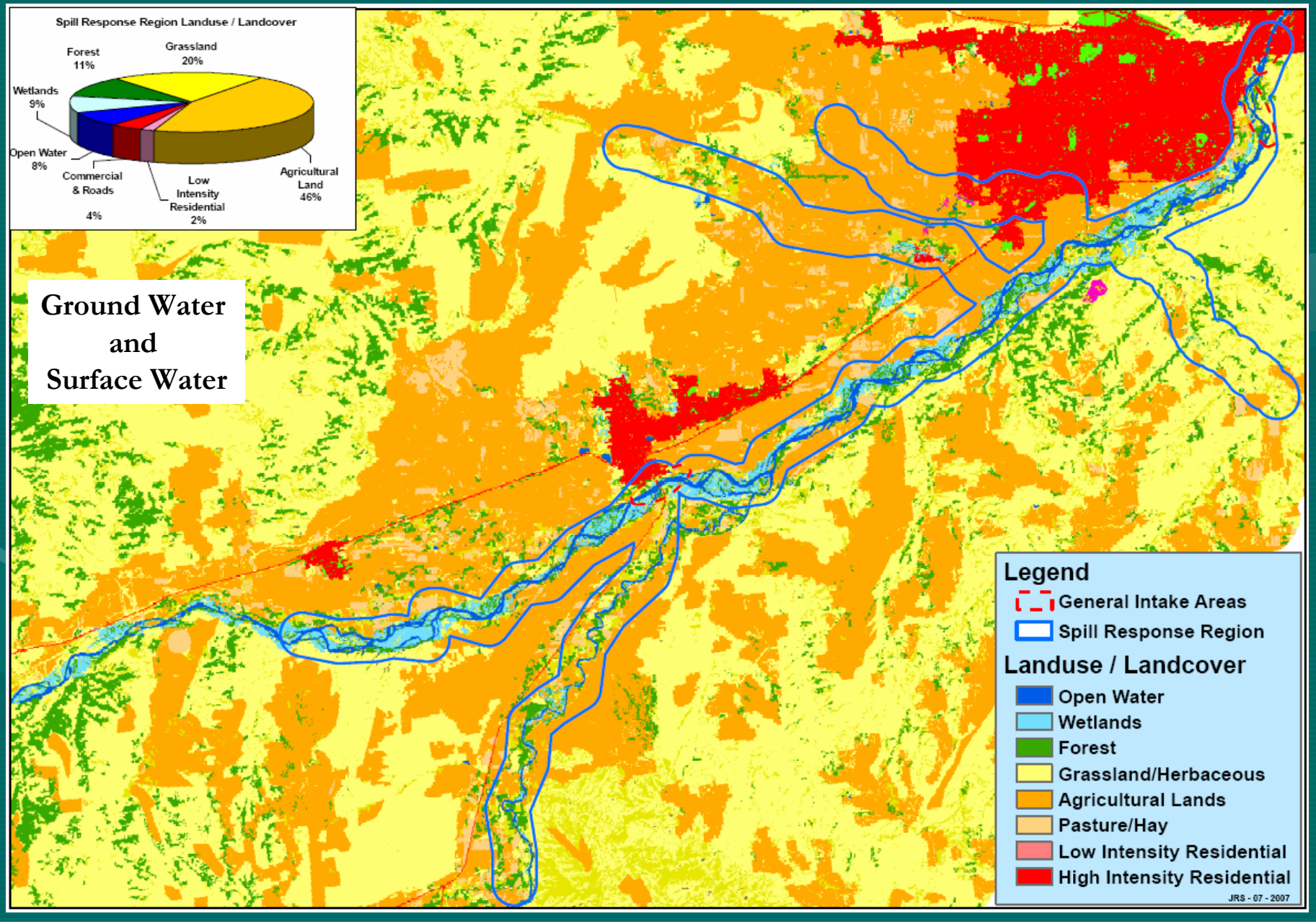
Source Water Delineation and Assessment

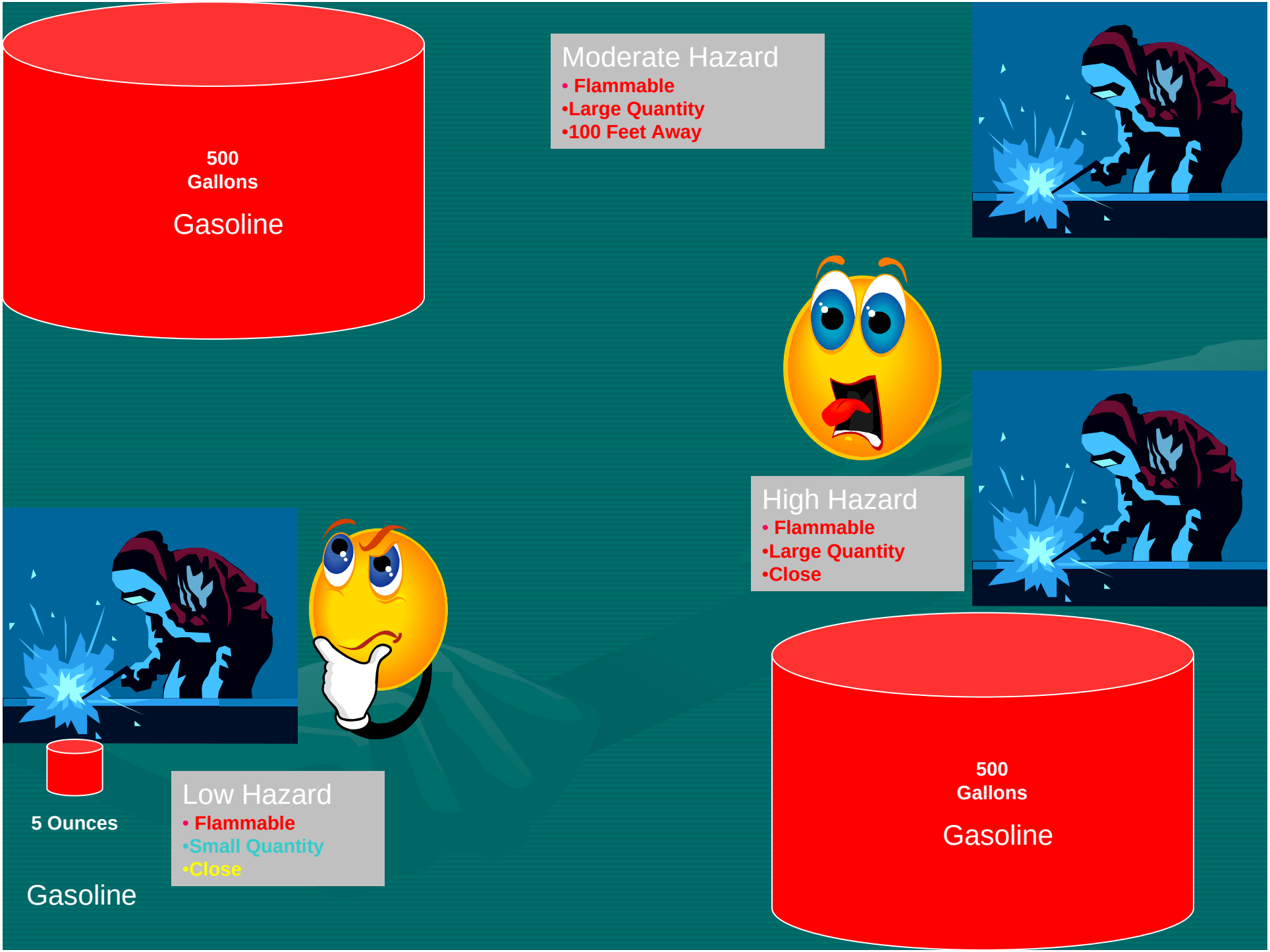
Inventory: Significant Potential Contaminant Sources



Source Water Delineation and Assessment

Watershed Level Inventory




500
Gallons
Gasoline
Moderate Hazard
• Flammable
•Large Quantity
•100 Feet Away
High Hazard
• Flammable
•Large Quantity
•Close
5 Ounces
Gasoline
Low Hazard
• Flammable
•Small Quantity
•Close
500
Gallons
Gasoline

Source Water Delineation and Assessment

Susceptibility Analysis

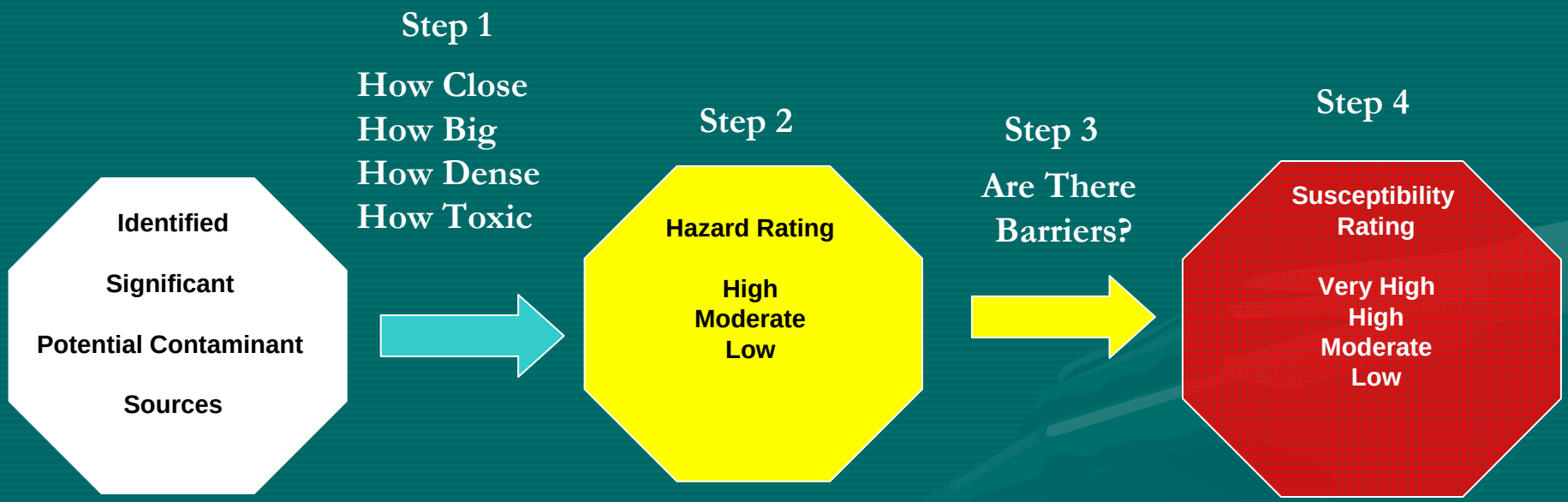


Table 9a. (MT SWPP Table 6) SURFACE WATER SOURCES: Hazard of potential contaminant sources.

Potential Contaminant Source	High Hazard	Moderate Hazard	Low Hazard
Point Sources	Potential for direct discharge to Source Water	Potential for discharge to GW that is hydraulically connected to SW	Potential contaminant sources present within the watershed
Septic Systems	More than 300 per sq. mi.	50 – 300 per sq. mi.	Less than 50 per sq. mi.
Municipal Sanitary Sewer (percent land use)	More than 50 percent of region	20 to 50 percent of region	Less than 20 percent of region
Cropped Agricultural Land (percent land use)	More than 50 percent of region	20 to 50 percent of region	Less than 20 percent of region

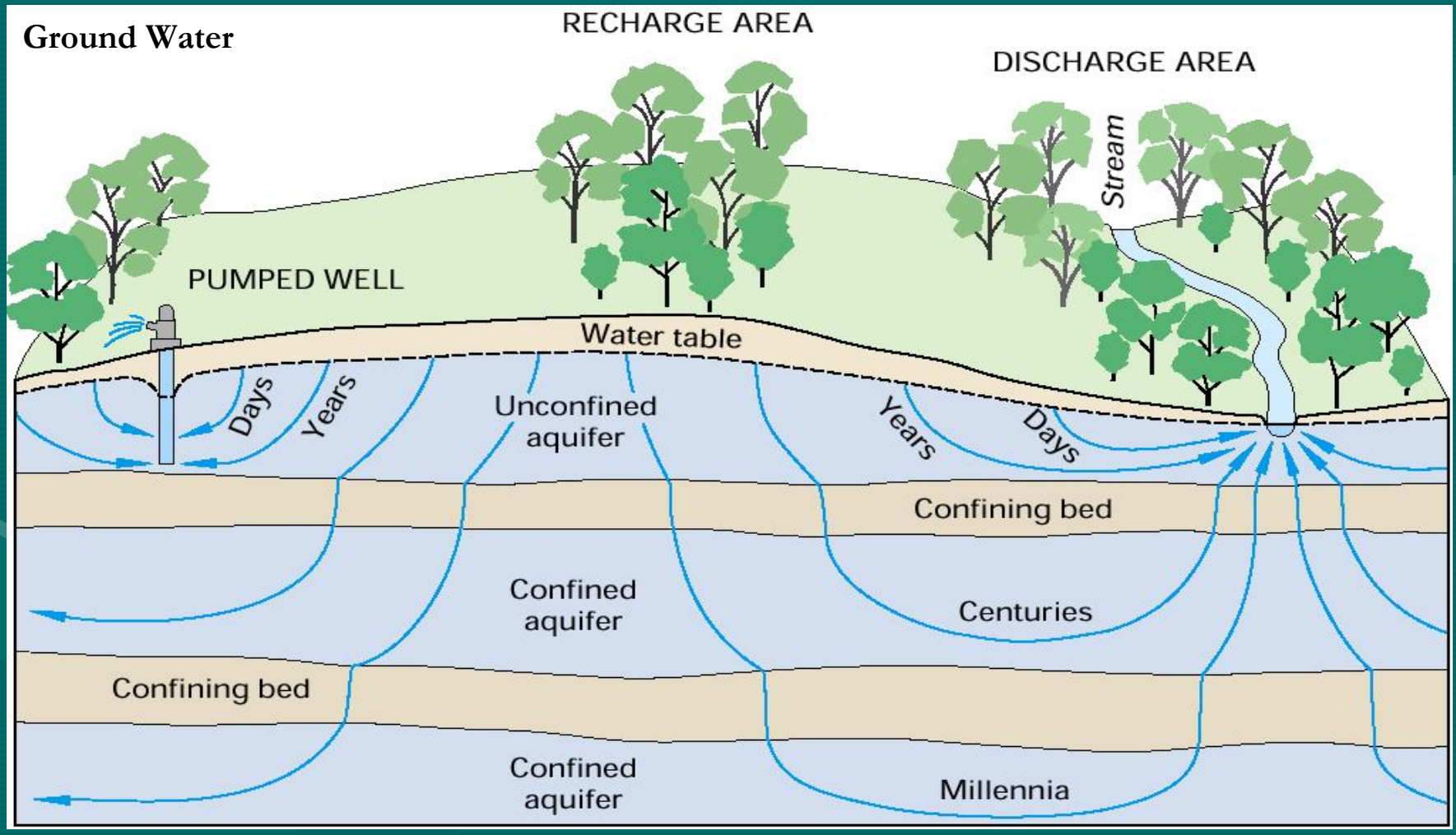
Source Water Delineation and Assessment

Identify The Source of Water

Ground Water

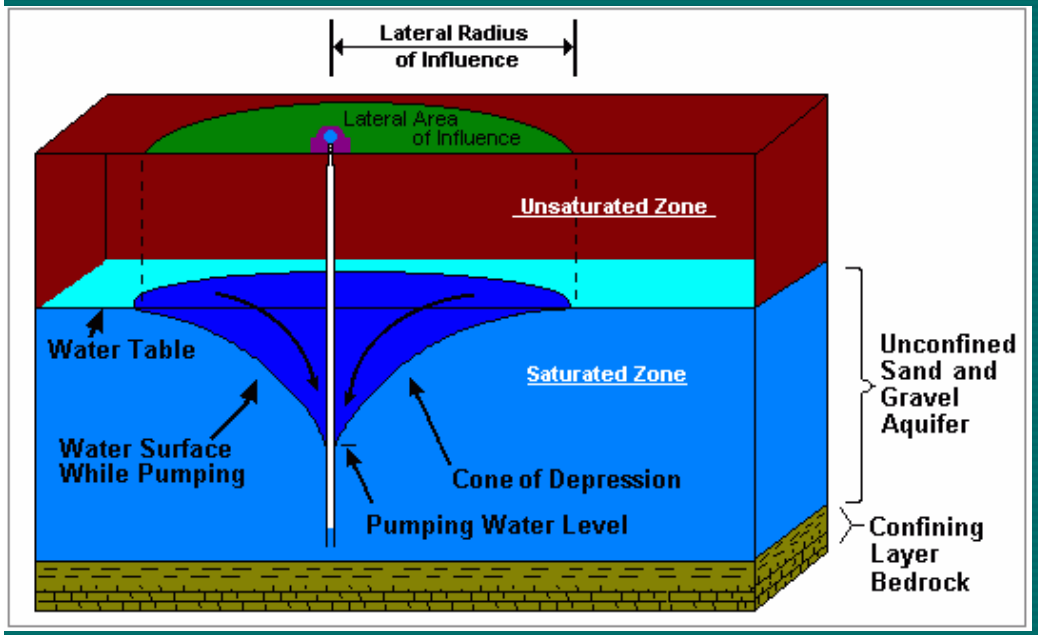
Source Water Delineation and Assessment

Identify The Source of Water



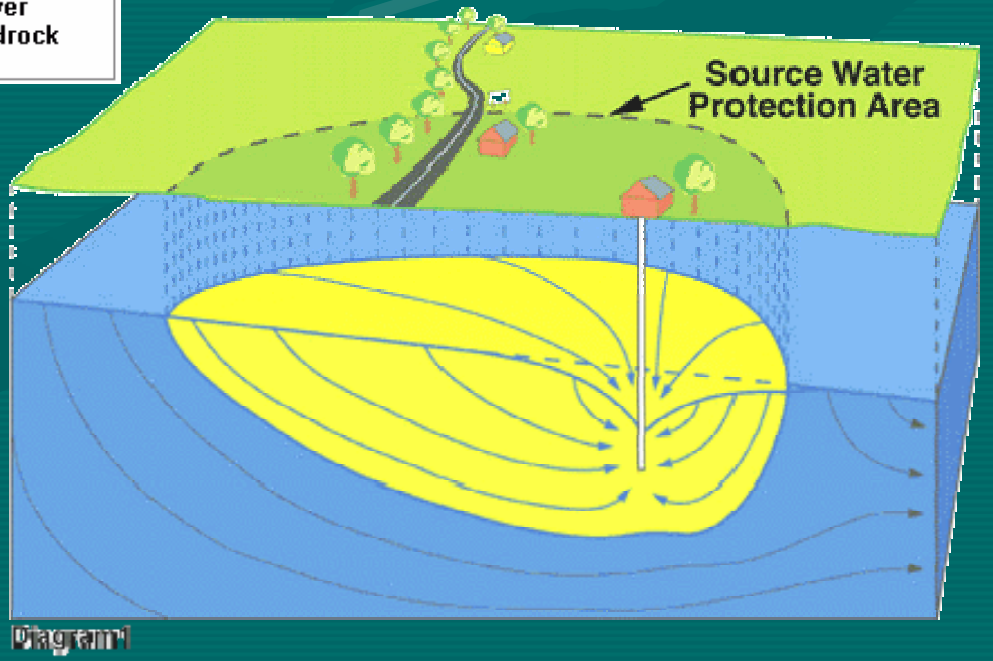
Source Water Delineation and Assessment

Identify The Source of Water



100 ft. Radius Circle around a well

- Zone of Exclusion
- Control Zone

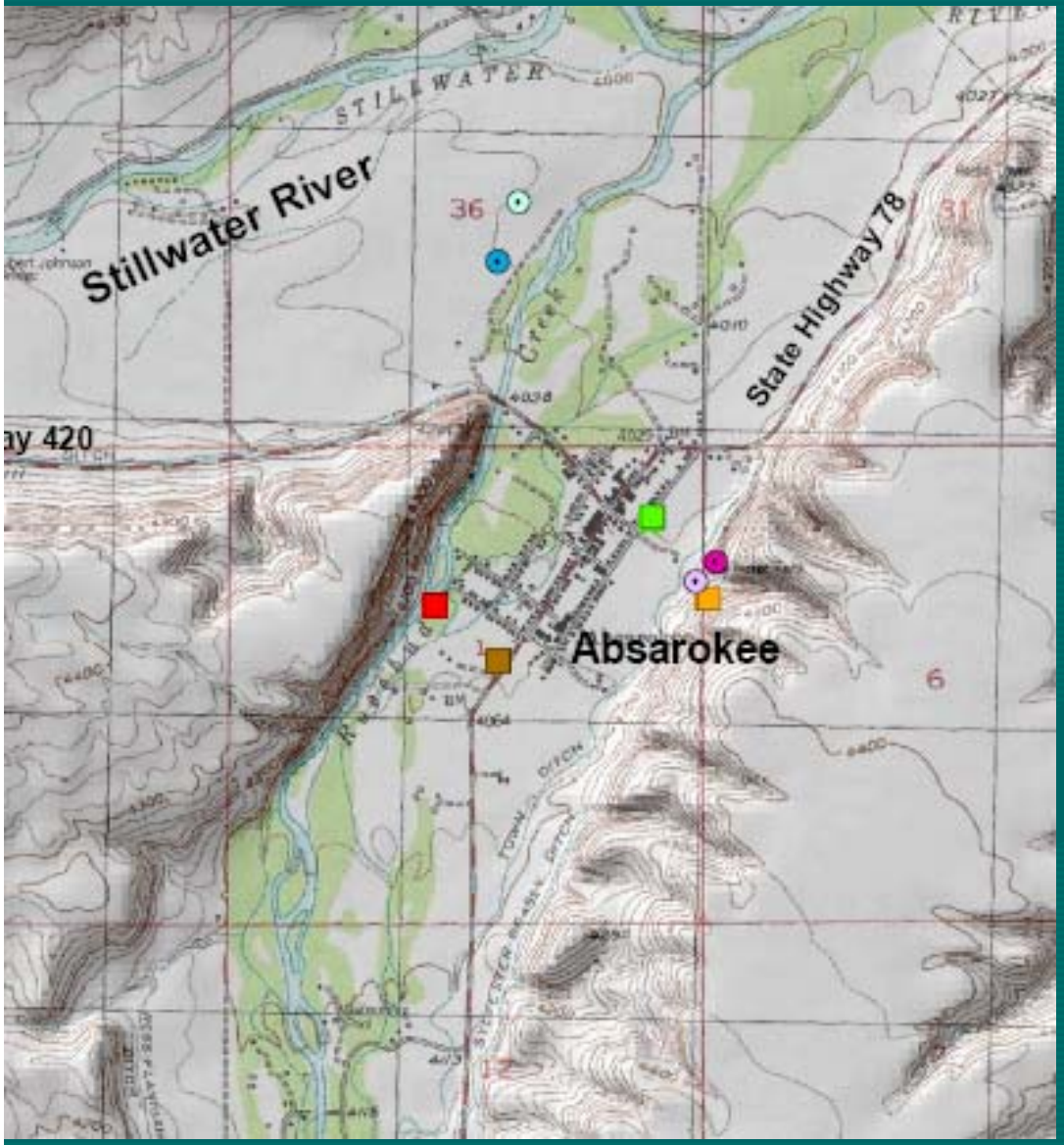


Zone of Contribution

- Inventory Region

Source Water Delineation and Assessment

How Does The Source Water Get To The PWS?



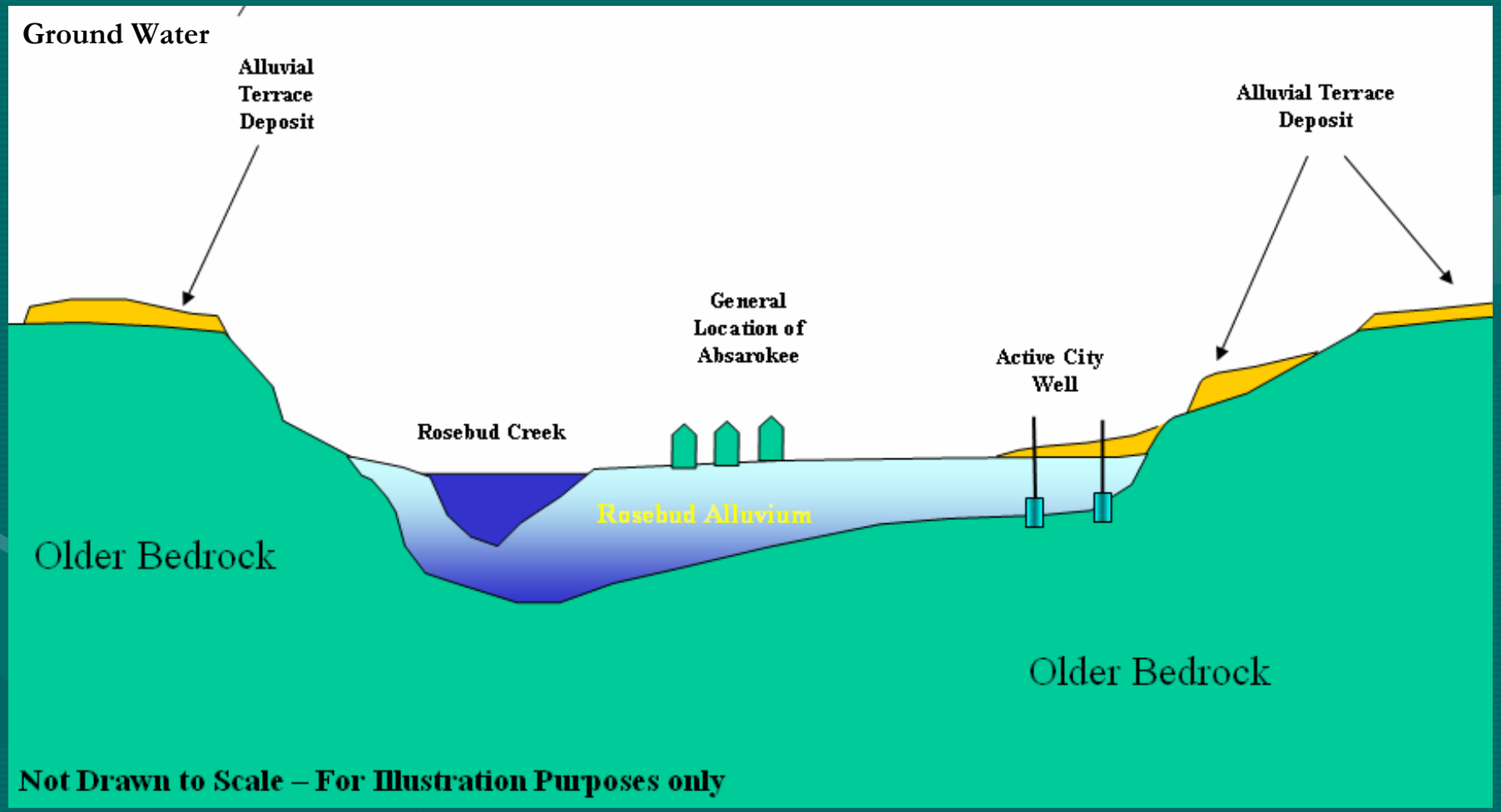
MBMG – Well Driller's Log

From	To	Description
0	3	TOPSOIL
3	12	SANDROCK GRAVEL
12	28	ROCK AND GRAVEL
28	34	BROWN CLAY
34	56	HARD BROWN SANDSTONE (WATER 44-69 FEET)
56	66	HARD GREY SANDSTONE
66	69	BROWN SANDSTONE
69	75	GRAY SHALE

Source Water Delineation and Assessment

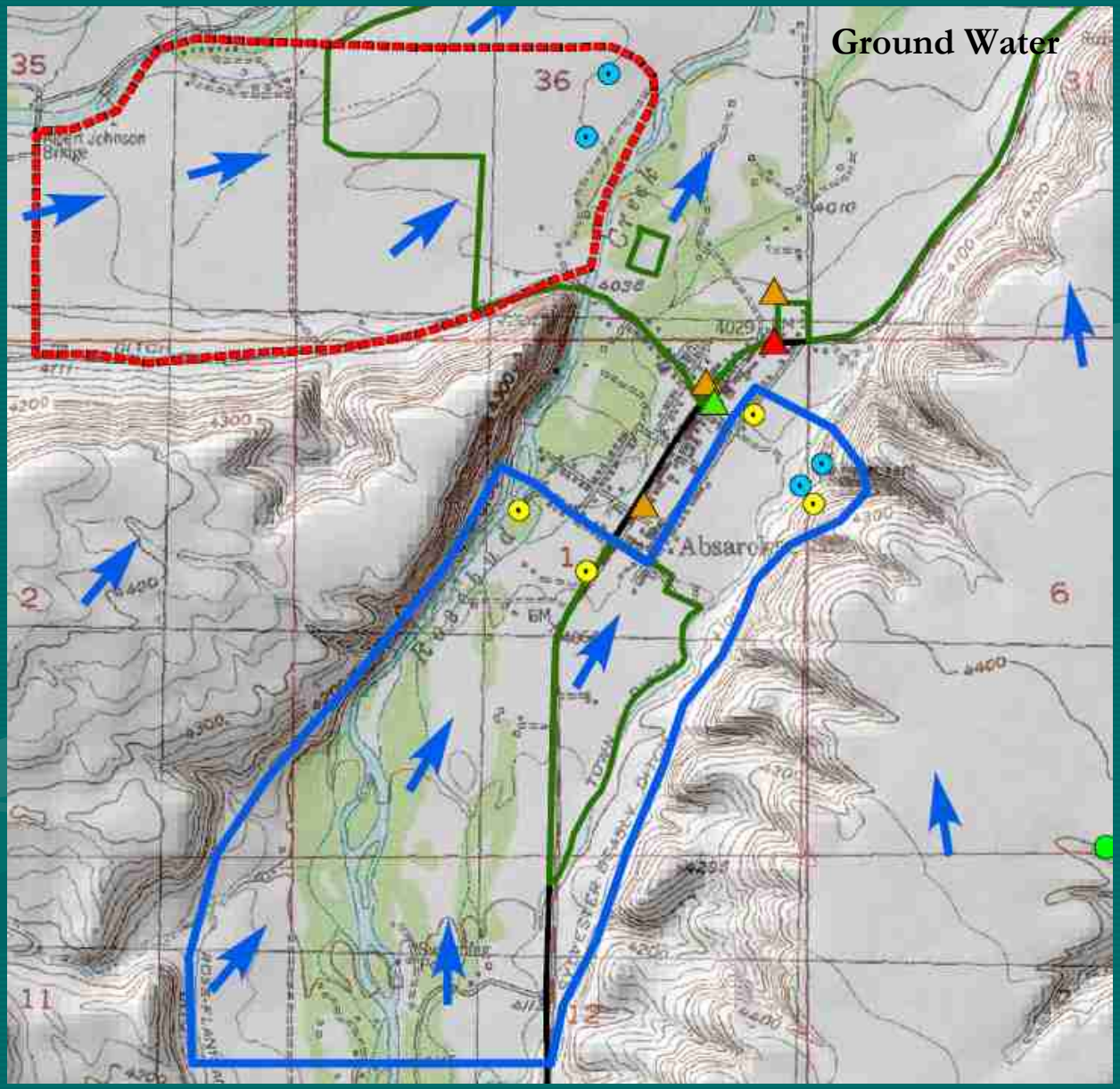
How Does The Source Water Get To The PWS?

Conceptual Model for Ground-Water Flow



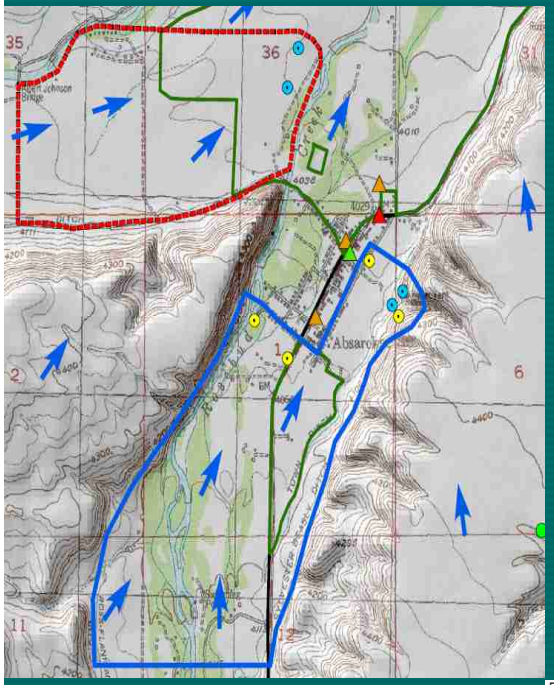
Source Water Delineation and Assessment

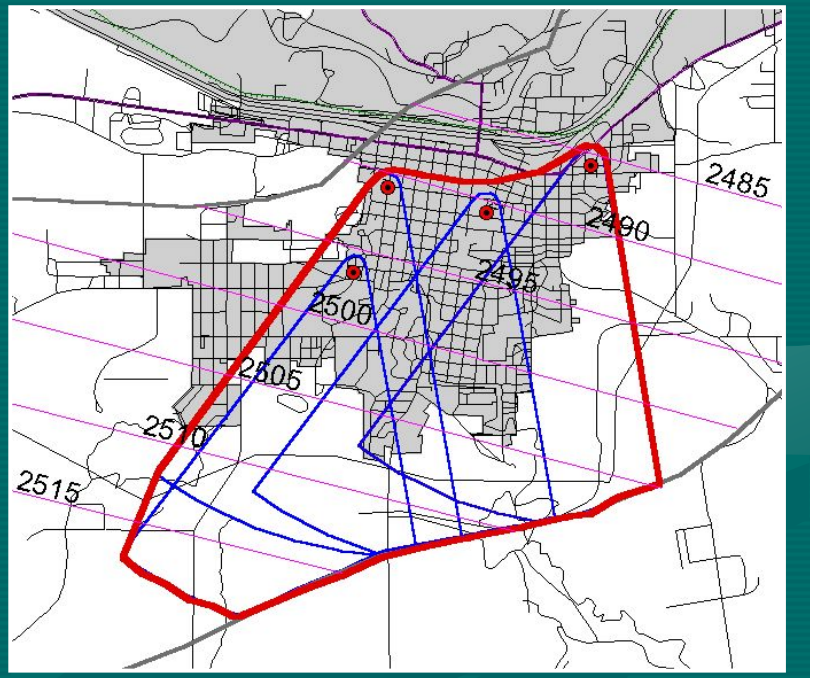
Delineate Source Water Protection Area

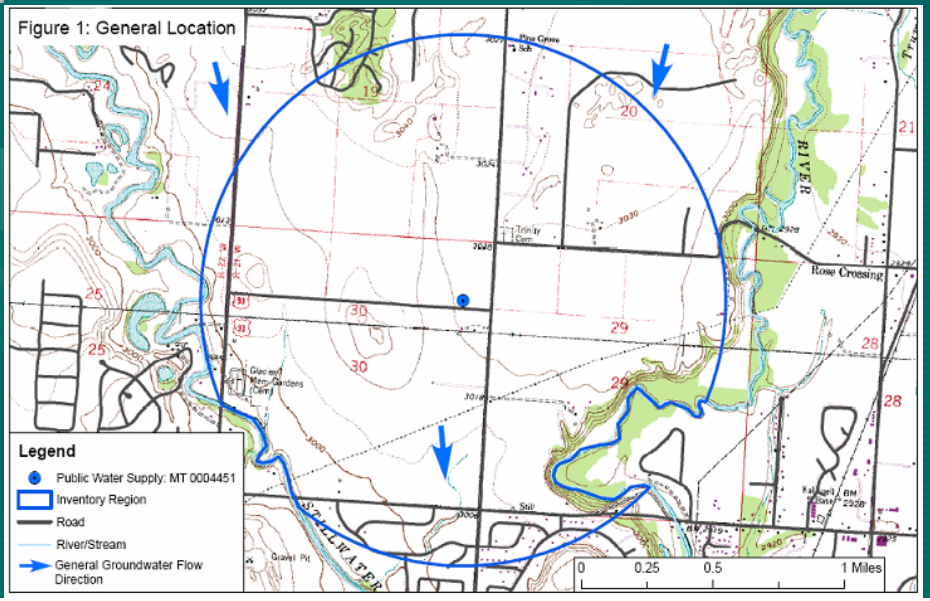


Source Water Delineation and Assessment

Options for Delineating Ground-Water Sources

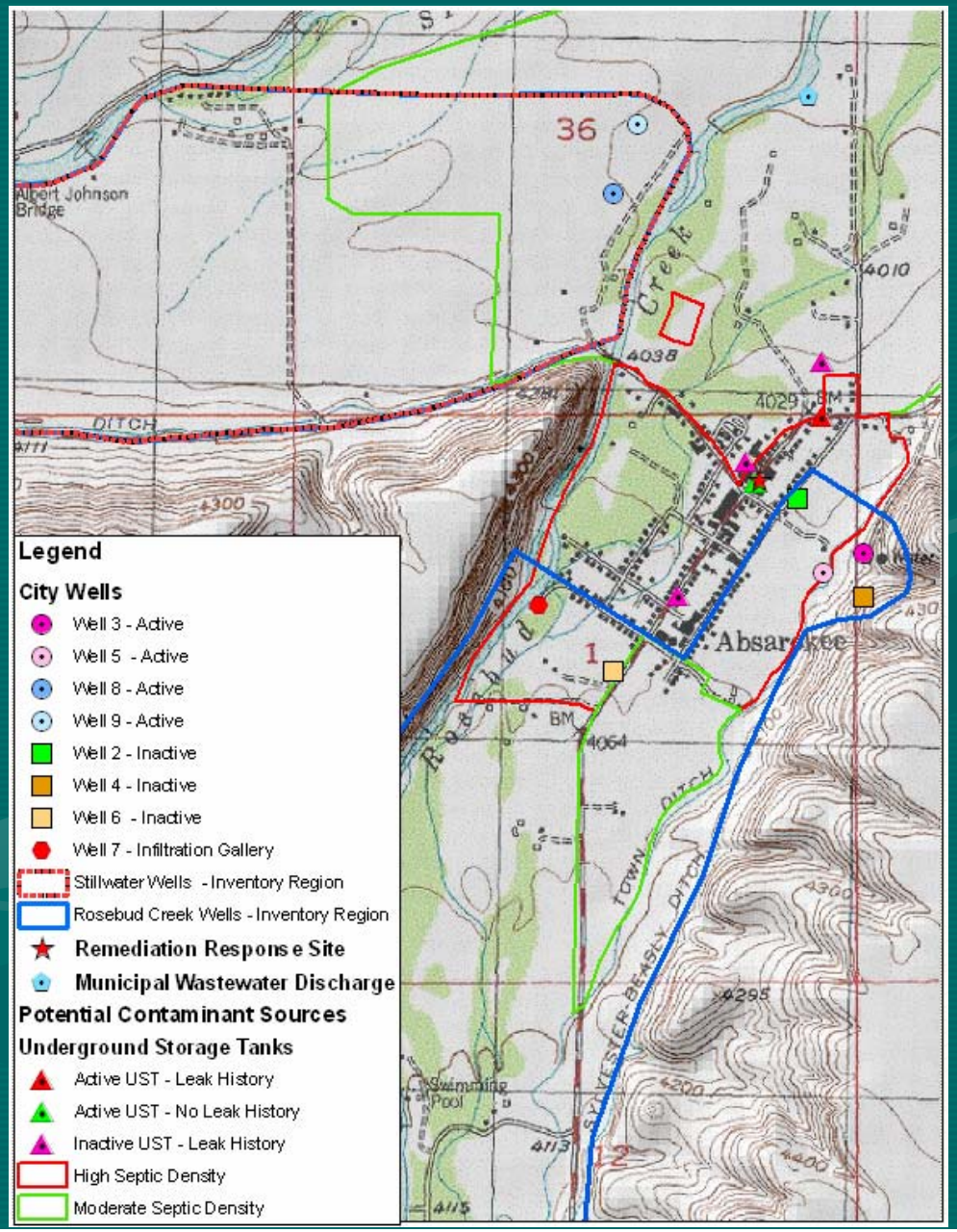






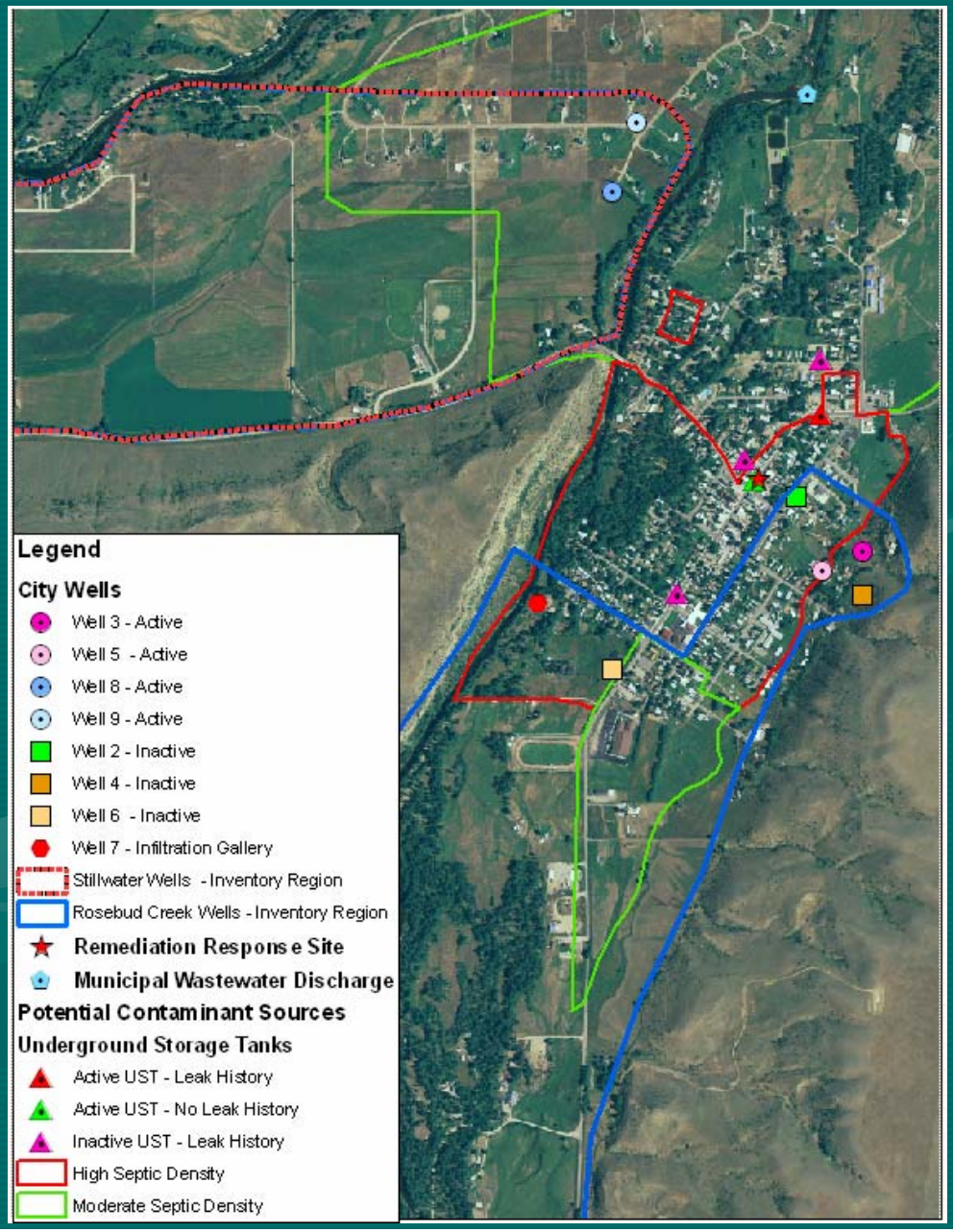
Source Water Delineation and Assessment

Significant Potential Contaminant Sources



Source Water Delineation and Assessment

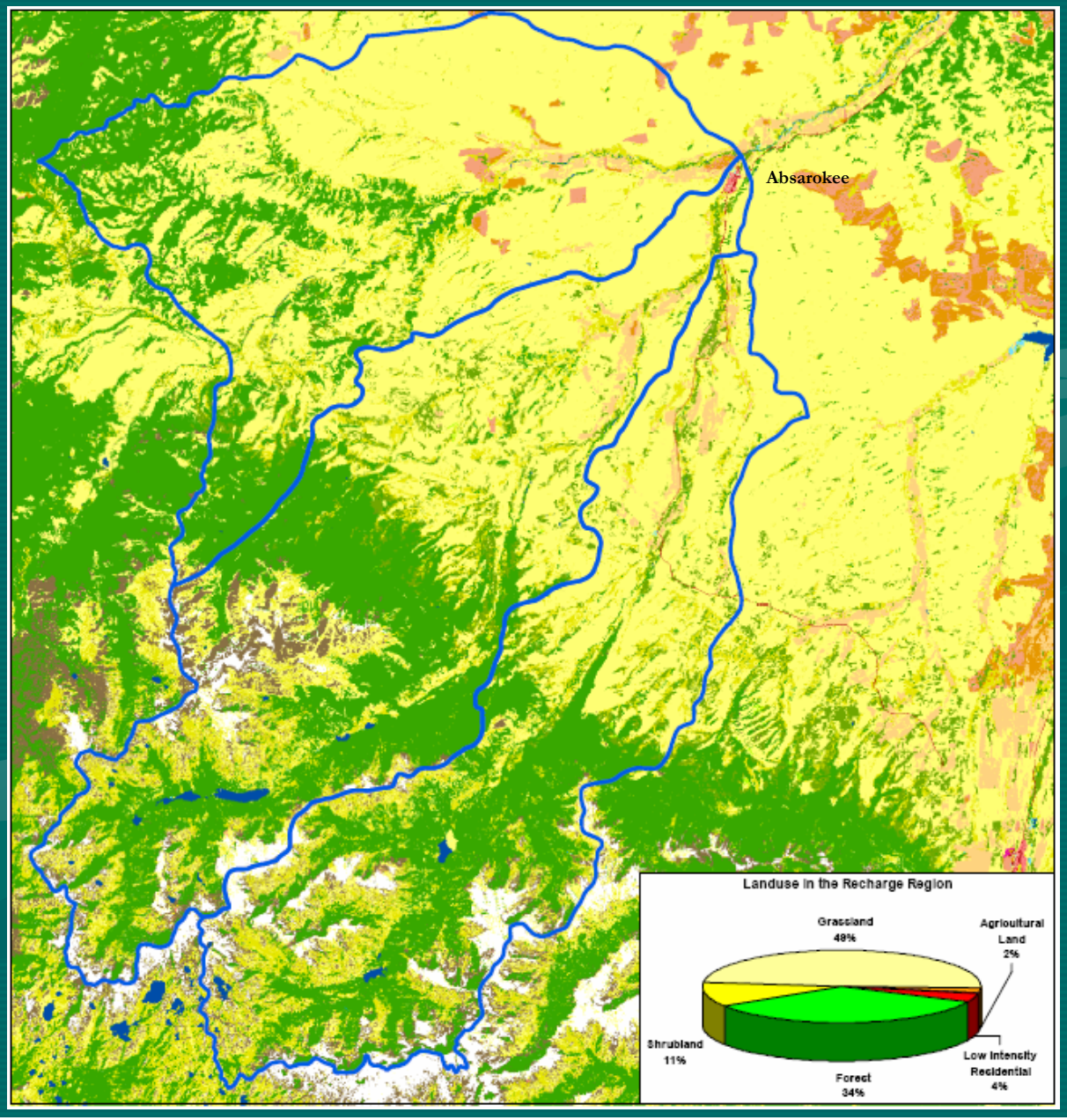
Significant Potential Contaminant Sources



Source Water Delineation and Assessment

Watershed Level Inventory

Ground Water
and
Surface Water



Source Water Delineation and Assessment

Susceptibility Analysis

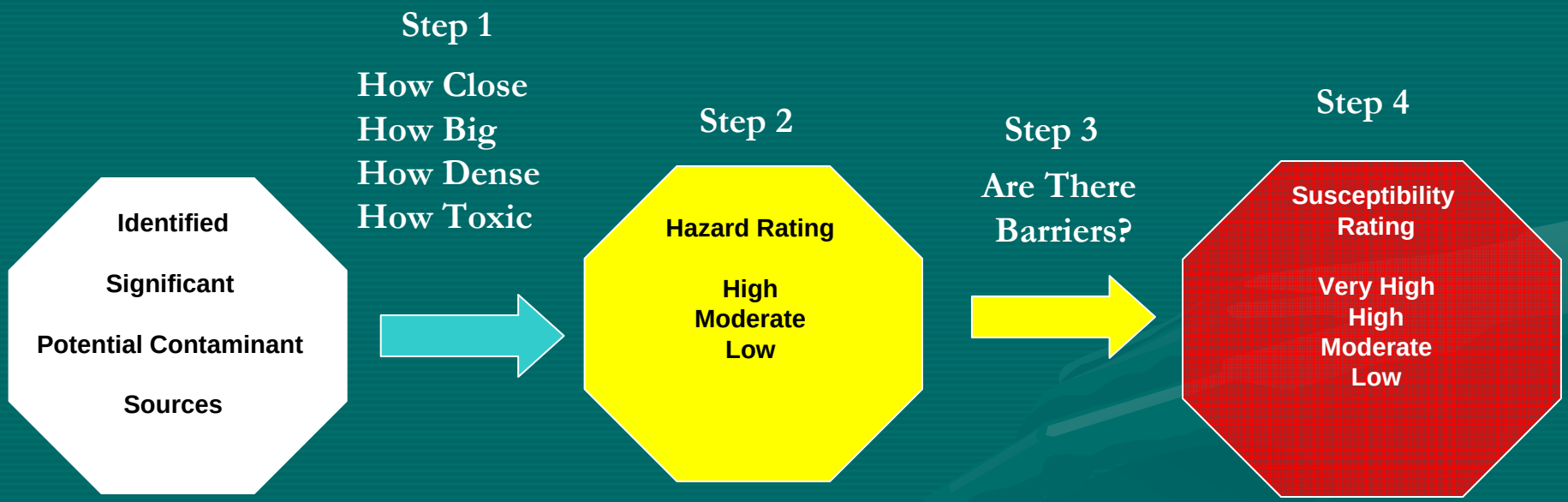


Table 9b. (MT SWPP Table 6) UNCONFINED AQUIFERS: Hazard of potential contaminant sources.

Potential Contaminant Source	High Hazard	Moderate Hazard	Low Hazard
Point Sources	Within 1 year TOT	Between 1 to 3 years TOT	Over 3 years TOT
Septic Systems	More than 300 per sq. mi.	50 – 300 per sq. mi.	Less than 50 per sq. mi.
Municipal Sanitary Sewer (percent land use)	More than 50 percent of region	20 to 50 percent of region	Less than 20 percent of region
Cropped Agricultural Land (percent land use)	More than 50 percent of region	20 to 50 percent of region	Less than 20 percent of region

Source Water Delineation and Assessment

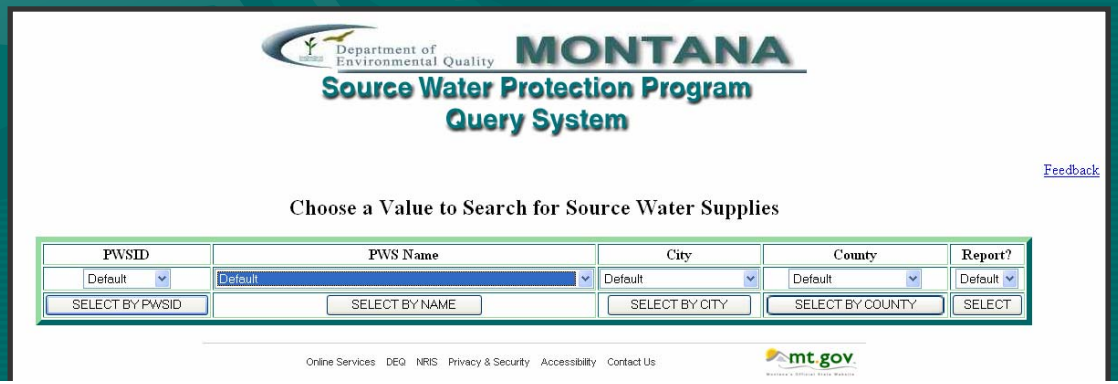
Susceptibility Analysis In The Report

Table 3: Significant Potential Contaminant Sources

Source	Contaminant	Hazard Rating	Barriers	Susceptibility	Management
Large capacity septic system	Pathogens, nitrate	High	1. Aquifer depth >100 feet below ground surface (bgs) 2. Intake depth of >50 feet below static water level. 3. Thick clay layers overlie the aquifer 4. Distance from the PWS well(s)	Moderate	Properly operate and maintain on-site septic tank, drainfield and distribution lines.
High Density Septic systems	Pathogens, nitrate	Low	1. Down Gradient 2. Distance	Very Low	Encourage and support city and county efforts to extend city sewer or to promote maintenance of septic tanks and distribution lines.
Cultivated Croplands	Fertilizers, pesticides, pathogens, nitrate	Moderate	1. Down Gradient location of portion of land 2. Thickness of confining layer	Low	Encourage and support city and county efforts to provide educational information, materials and resources to land owners on the proper application and storage of pesticide and fertilizers; implement agricultural BMPs

Finalizing The Report

- SWDAR
  - Send Draft Report to PWS Operator
  - Modify Report Based On Operator Comments
  - Final review and concurrence form (≈ 40%)
  - "Publish" Finalized Report
    - Print Copies For Files
    - Send To The Operator, Water District Board, Others
    - Publish On The DEQ Website



Release The Information To The Public

Draft

City of Billings
Public Water System
PWSID # MT0000153

City of Laurel
Public Water System
PWSID # MT 0000270

Lockwood Water and Sewer District
Public Water System
PWSID # MT000156-005

Date of Report: 02/09/03
Revised Date: 04/07/04

SOURCE WATER DELINEATION AND ASSESSMENT REPORT

PWS Contact Person:
Boris A. Krizek
Environmental Engineer

PO Box 30958
Billings, MT 59119

Phone: (406) 247-8517

/Source Water Delineation and Assessment Report

Town of Absarokee

PWSID MT00003

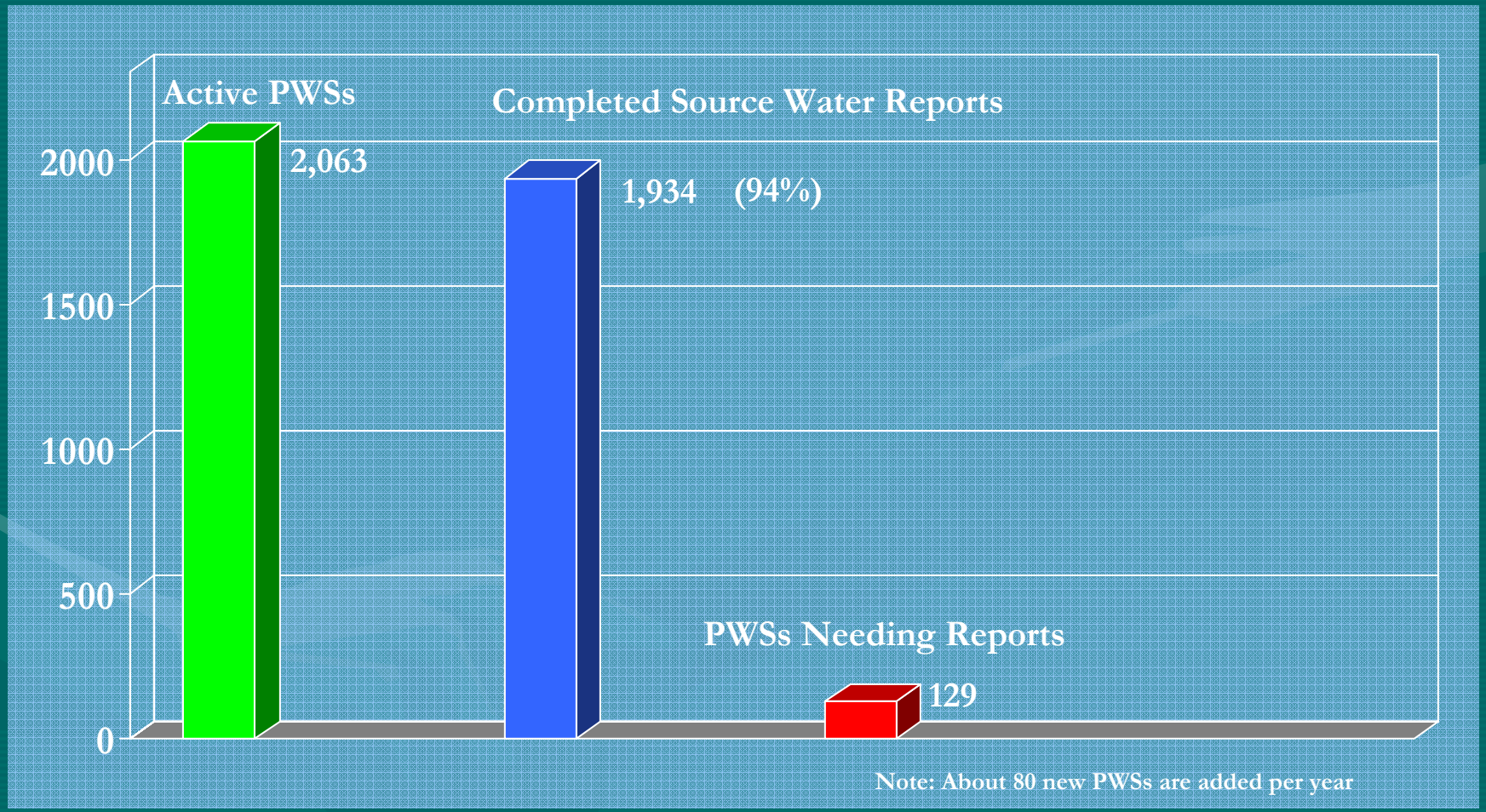
Report Date: August 17, 2004
Revised:

Certified Operator:
Andy Jensen,
406-328-4748

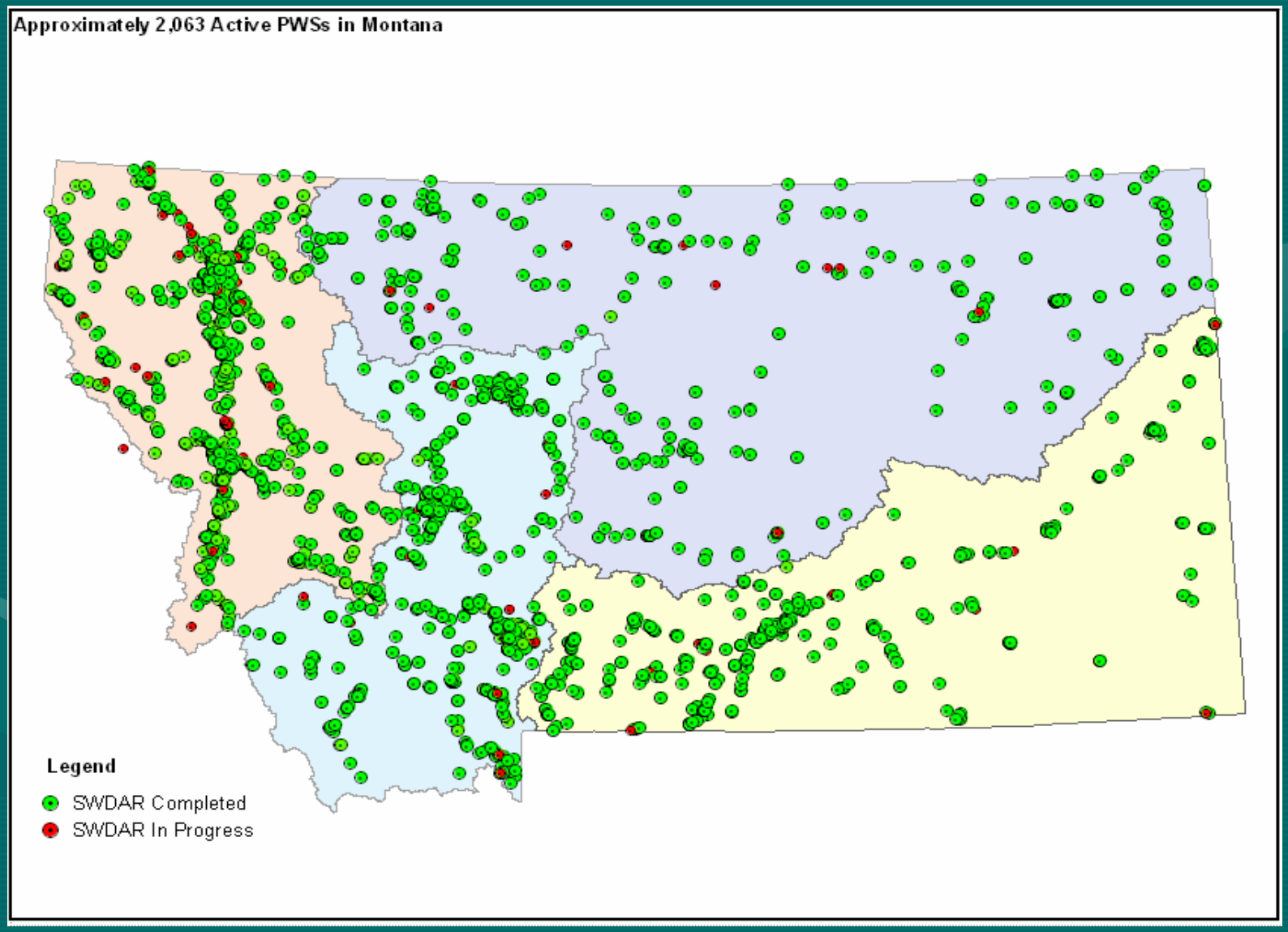
Owner:
Town of Absarokee
PO BOX 365
Absarokee, Mt. 59007

Source Water Protection Status

Note: Reports for PWSs active in 1999 were completed by December 2006



Status


Approximately 2,063 Active PWSs in Montana
Legend
SWDAR Completed
SWDAR In Progress

Status

- Original Mission
  - Completed: December 2006 – Systems active in 1999
  - About 80 new systems added each year
- Current Status:
  - Total 2,063
  - Completed 1,934 about 94%
  - Need Reports 129 at this point in time

Findings
Most Threatening Potential Contaminant Sources

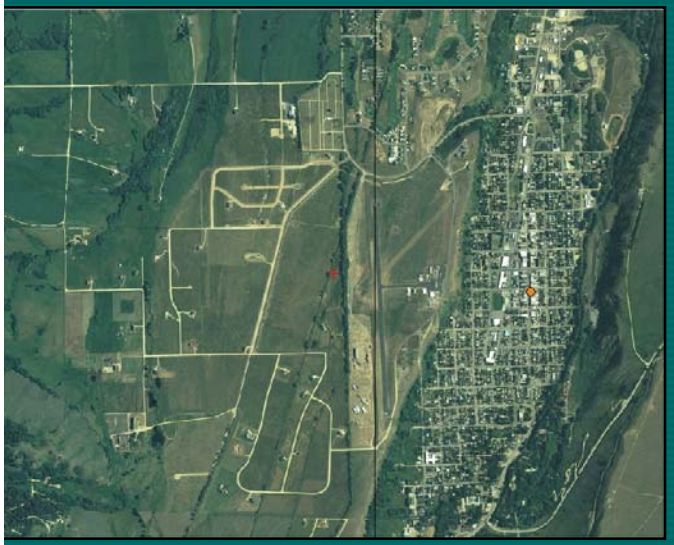
How many times are these potential contaminants assigned Very High or High Susceptibility for Community and Non-Transient Non-Community Public Water Supplies?

Note: This analysis has not been completed for all PWSs at this time

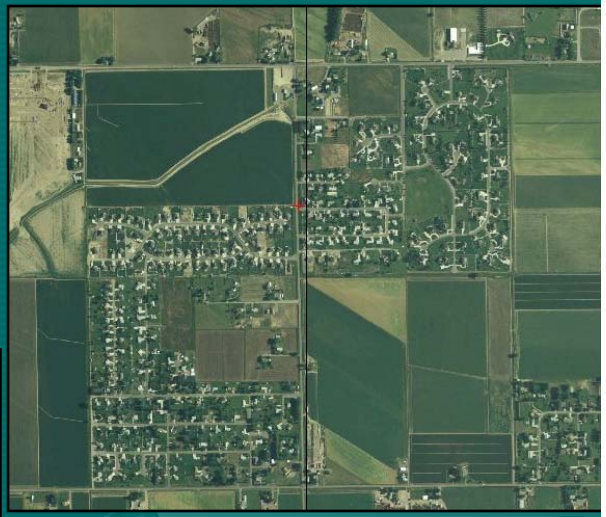
Potential Contaminant	Frequency
Transportation	290
Septic Systems	238
Ag-land	186
Sewer Systems	90
Large Capacity Septic Systems	58
Petroleum Pipelines	57
UST-LUST	55
Stormwater Discharge	48
Machine Shop	45
Auto Shops	36
Landfill	30
Class V Injection Wells (Floor Drains)	26
Smelter	22
Animal Waste Collection	21
Chemical Storage	18
Sewage Lagoons	16
Gravel Pits	12

Future Work
SWP Planning

Red Lodge area



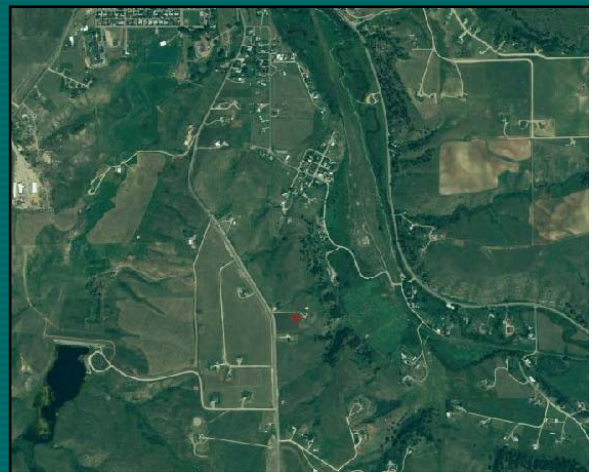
West of Billings



West of Sidney

Hamilton area

South Lewistown



Future Work
Source Water Protection Planning

- Source Water Protection Planning
  - Voluntary but very important
  - Builds off of the SWDAR
  - Montana Rural Water Association also helps develop plans
- Expands management options
  - Attempt to reduce or remove threats to the source water
- Adds contingency planning
  - Emergency Planning and preparedness
  - Starts the effort to identify alternative water sources
  - Raises community awareness of local issues and management options

The End

Thank You

Source Water Protection Program
Department of Environmental Quality

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October 24, 2007

More Detail Slides

- Multi-Barrier Approach: Barriers Listed
- Susceptibility Analysis (Slide 1)
- Susceptibility Analysis (Slide 2)
- Aquifer Sensitivity & Significant Potential Contaminants Tables
- Hazard Assignment Tables
- Funding

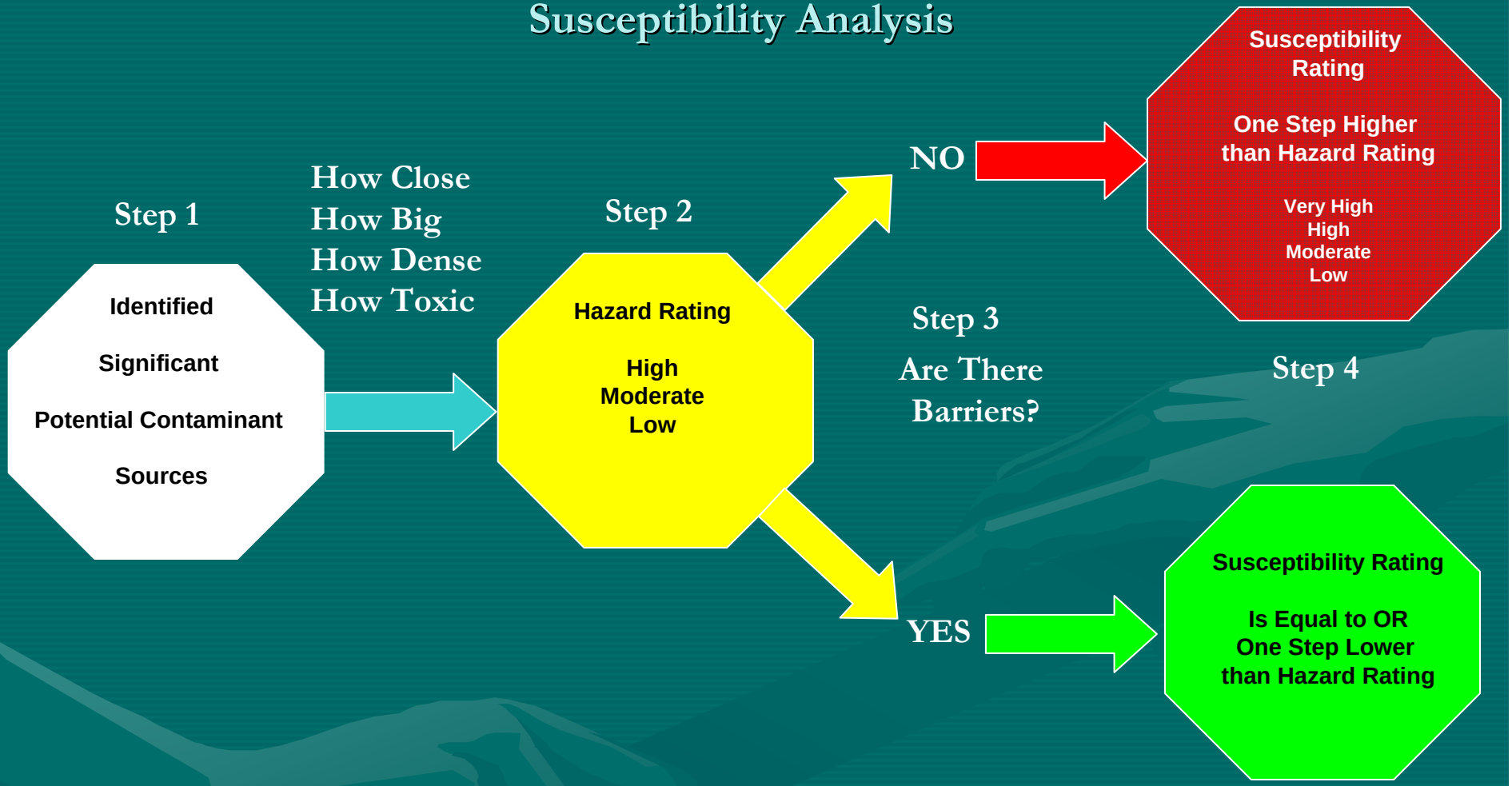
Multi-Barrier Approach

1) SDWA:
   - assessing and protecting drinking water sources,
   - protecting wells and collection systems,
   - making sure water is treated by qualified operators,
   - ensuring the integrity of distribution systems, and
   - making information available to the public on the quality of their drinking water.

2) GWR Version:
   - sanitary surveys,
   - triggered source water monitoring,
   - hydrogeologic sensitivity analyses (HSAs),
   - routine monitoring,
   - corrective action, and
   - compliance monitoring.

Source Water Delineation and Assessment

Susceptibility Analysis



Example 1: PCS assigned High Hazard – No Barriers – Susceptibility = Very High

Example 2: PCS assigned High Hazard – One Barrier – Susceptibility = High

Example 3: PCS assigned High Hazard – Multiple Barriers – Susceptibility = Moderate

Steps To Assign Final Susceptibility

Identify Potential Contaminant Sources (PCS)

Significant PCS: Facilities or Locations where potential contaminants are generated, used, stored, transported, or disposed.

Assign Hazard Rating

Point Sources: Proximity To Well (**How Close**)
Non-Point Sources: Aerial Extent (**Density**) of Land Use or Land Cover
Confined Aquifers: Construction & Condition of PWS well and other wells in the inventory region

Identify Barriers

Barriers: Anything that decreases the chances that contaminated water will reach a public water supply.

Assign Final Susceptibility Rating

Example: Hazard Rating	# of Barriers	Final Susceptibility Rating
High	None	Very High
High	1	High
High	Multiple	Moderate
Moderate	None	High
Moderate	1	Moderate
Moderate	Multiple	Low

Miscellaneous Slides

Aquifer Sensitivity & Significant Potential Contaminants

Table 2. Source Water (Aquifer) Sensitivity Table.

High Source Water Sensitivity	Moderate Source Water Sensitivity	Low Source Water Sensitivity
▪ Surface water and GWUDISW ▪ Unconsolidated Alluvium (unconfined) ▪ Fluvial-Glacial Gravel ▪ Terrace and Pediment Gravel ▪ Shallow Fractured or Carbonate Bedrock	▪ Semi-consolidated Valley Fill sediments (semi-confined) ▪ Unconsolidated Alluvium (semi-confined)	▪ Consolidated Sandstone Bedrock ▪ Deep Fractured or Carbonate Bedrock ▪ Semi-consolidated (confined)

Table 7. Identification of Significant Potential Contaminant Sources.

Septic Systems	Landfills
Animal Feeding Operations	Abandoned Mines
Underground Storage Tanks	MPDES Wastewater Dischargers
Underground Storage Tanks Leaks	Municipal Sanitary Sewer
State and Federal Superfund Sites	Municipal Storm Sewers
RCRA Large Quantity Generators	Highways, Railways, Pipelines
Underground Injection Wells	Cultivated Croplands
Wastewater Treatment	**Other**: Activities or substances that can compromise source water quality.

Miscellaneous Slides

Hazard Assignment Tables

Table 9a. (MT SWPP Table 6) SURFACE WATER SOURCES: Hazard of potential contaminant sources.

Potential Contaminant Source	High Hazard	Moderate Hazard	Low Hazard
Point Sources	Potential for direct discharge to Source Water	Potential for discharge to GW that is hydraulically connected to SW	Potential contaminant sources present within the watershed
Septic Systems	More than 300 per sq. mi.	50 – 300 per sq. mi.	Less than 50 per sq. mi.
Municipal Sanitary Sewer (percent land use)	More than 50 percent of region	20 to 50 percent of region	Less than 20 percent of region
Cropped Agricultural Land (percent land use)	More than 50 percent of region	20 to 50 percent of region	Less than 20 percent of region

Table 9b. (MT SWPP Table 6) UNCONFINED AQUIFERS: Hazard of potential contaminant sources.

Potential Contaminant Source	High Hazard	Moderate Hazard	Low Hazard
Point Sources	Within 1 year TOT	Between 1 to 3 years TOT	Over 3 years TOT
Septic Systems	More than 300 per sq. mi.	50 – 300 per sq. mi.	Less than 50 per sq. mi.
Municipal Sanitary Sewer (percent land use)	More than 50 percent of region	20 to 50 percent of region	Less than 20 percent of region
Cropped Agricultural Land (percent land use)	More than 50 percent of region	20 to 50 percent of region	Less than 20 percent of region

Table 9c. CONFINED AQUIFERS (modified from MT SWPP Table 6): Hazard of potential contaminant sources.

Potential Contaminate Sources	The PWS well is not sealed through the confining layer	Other wells in the inventory region are not sealed through the confining layer	All wells in the inventory region are sealed through the confining layer
Point Sources	High	Moderate	Low
Septic Systems (# per square mile)	High: > 300 Moderate: 50 to 300 Low: < 50	Moderate: > 300 Low: < 300	Low
Sanitary Sewer (% land use)	High: > 50 Moderate: 20 to 50 Low: < 20	Moderate: > 50 Low: < 50	Low
Cropland (% land use)	High: > 50 Moderate: 20 to 50 Low: < 20	Moderate: > 50 Low: < 50	

Table 10. (MT SWPP Table 5). Relative susceptibility to specific contaminant sources as determined by hazard and the presence of barriers.

Presence Of Barriers	Hazard		
	High	**Moderate**	**Low**
No Barriers	Very High Susceptibility	High Susceptibility	Moderate Susceptibility
One Barrier	High Susceptibility	Moderate Susceptibility	Low Susceptibility
Multiple Barriers	Moderate Susceptibility	Low Susceptibility	Very Low Susceptibility

Funding

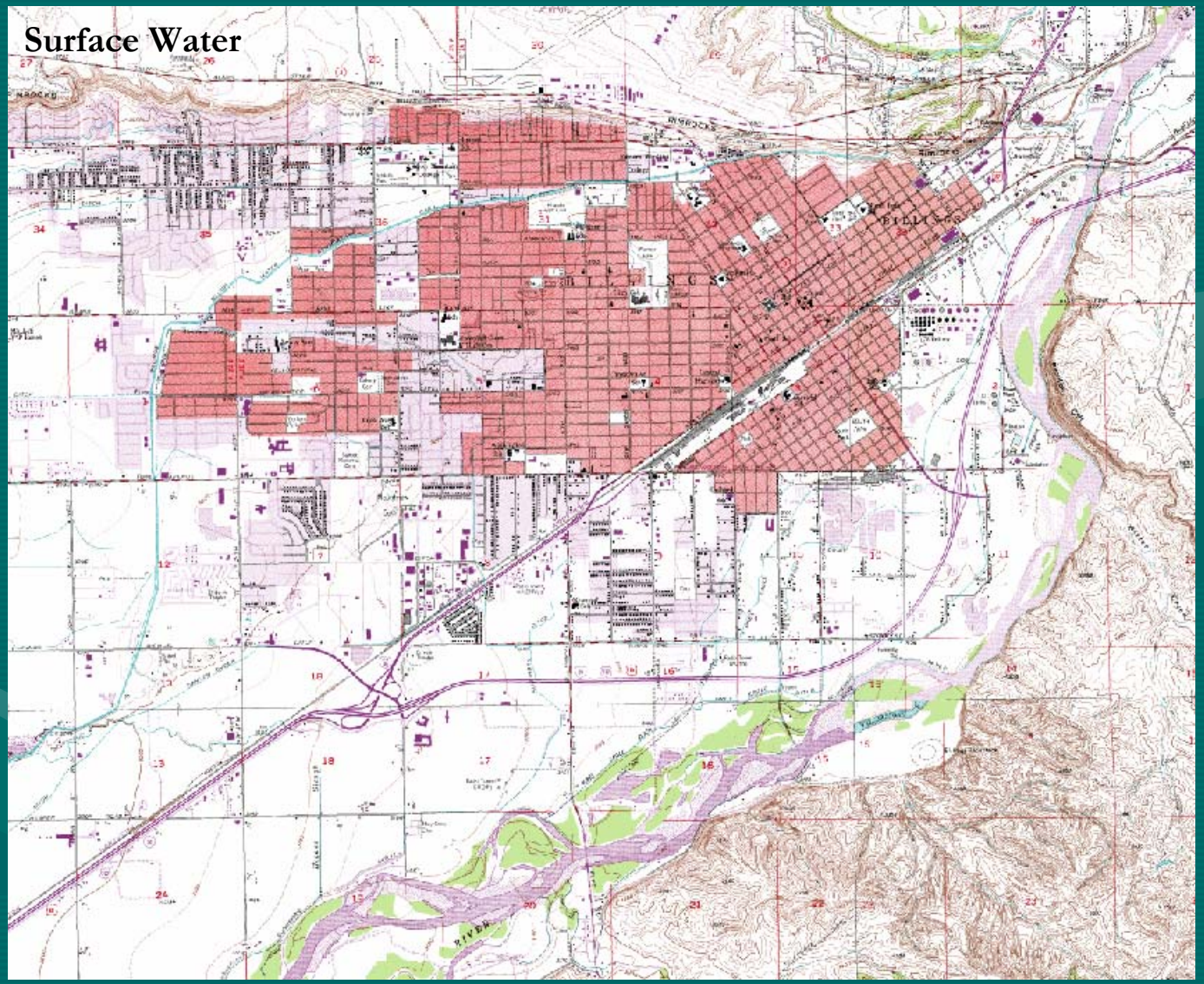
- In 1999 – $1.4 Million
  - One time funding allocation for Montana
  - Intended to cover work through 2003
  - Funds were expended by 2006
  - Allowed approximately $675 per source water assessment
- Current Funding:
  - Earmarked set-asides through SRF Grants (Federal $)
  - DEQ – EPA Performance Partnership Grant

Source Water Delineation and Assessment

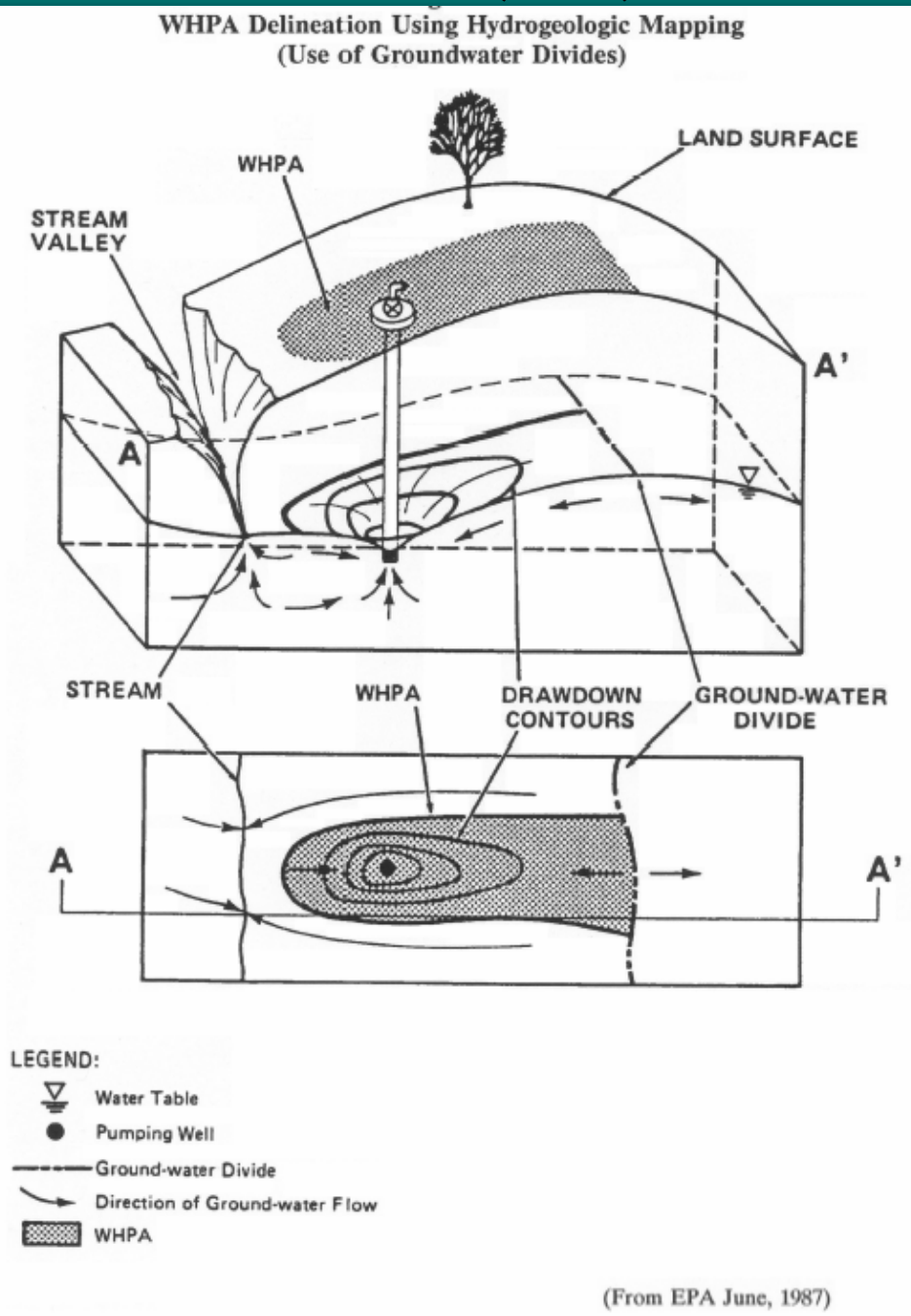
How Does The Source Water Get To The PWS?

urface Water

Ground Water



Zone of Influence (ZOI) & Zone of Capture OR Contribution (ZOC)



Zone of Influence (ZOI) & Zone of Capture OR Contribution (ZOC)

- ZOI is the cone of depression
  - Area around the well where the water level or potentiometric surface is lowered
- ZOC is the area down- and up-gradient that contributes water to the pumping well within some time frame.
  - Contaminants released in the ZOC will ride gw-flow down slope to the well screen.
    - Moving at the average linear velocity of water through the rock/deposit matrix.