

Applying GIS in Public Water System Source Protection in Oregon

**It makes better sense to
prevent the pollution
from getting into source
water
then to build water
treatment plants
to try and remove the
pollutants.**

TOP TEN detections of drugs in 200+ U.S. public water systems (UL Laboratories , D. Leeke, 2009; unpublished)



Cotinine –Nicotine metabolite- 57%

Galaxolide –Synthetic fragrance- 53%

Carbamazapine –Anti-convulsent/mood stabilizer- 46%

DEET –Insect repellent- 41%

Nicotine –Tobacco- 34%

Gemfibrozil –Cholesterol medication- 31%

Paraxanthine –Caffeine metabolite- 27%

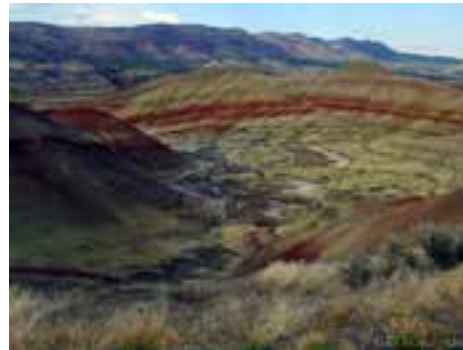
Sulfamethoxazole –Antibiotic- 24%

Acetaminophen –Analgesic, antipyretic- 20%

Caffeine –Coffee, tea, soda- 19%



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Topics

- **Regulatory Integration**
 - Ø Safe Drinking Water Act
 - Ø Clean Water Act
- **Analysis with GIS**
 - Ø Potential contaminant sources approach
 - Ø Types of PCSs in Source Water Assessments
- **Applying GIS results**
 - Ø Real life example
 - Ø Tualatin basin

ESRI User conference 2014,
San Diego, CA



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Acknowledgments

Oregon Department of Environmental Quality

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Gene Foster, Mngr.

Oregon Health Authority

Drinking Water Protection Program

Tom Pattee, Groundwater Coordinator

Shawn Stevenson

Russell Kazmierczak

Karen Kelly, Mngr.



State of Oregon
Department of
Environmental
Quality

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Overview; drinking water in Oregon

Mapped Public Water Systems

- community,
- non-transient non-community,
- transient non-community (partial)

Surface water; 230+ systems

Groundwater; 1800 + systems



By source:

- 30% groundwater (only)
- 30% surface water (only)
- 40% combination

By distribution:

- 75% from public water systems
- 3600 public water systems
(>3 connections)
- 25% from private wells
- approx. 350,000+ private
wells

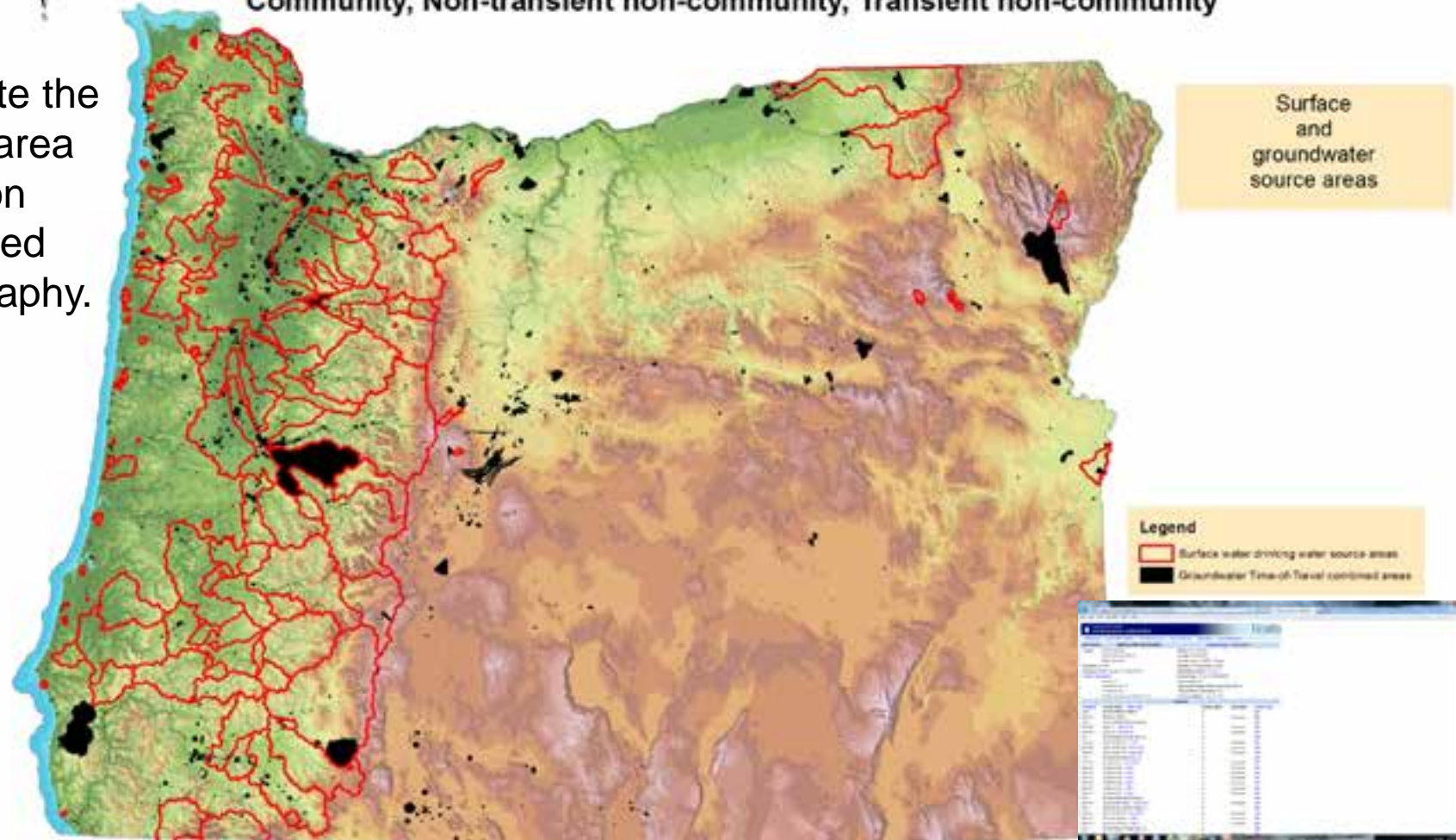
Overall Goal:

Protect public health and minimize treatment costs.

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Oregon's Public Water Systems; Community, Non-transient non-community, Transient non-community



Delineate the source area based on watershed hydrography.

Delineations focus effort in a defined area , but what is in my water?

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Converging issues to consider regarding drinking water risks

- Treatment technology limitations
 1. best technology cannot remove all contaminants
- Required monitoring cannot provide full coverage
 1. frequency, timing, local applications
 2. Ex: >900 registered active ingredients in OR; water systems monitor for 13
 3. additional testing expensive
- New compounds/chemicals to address
 1. “emerging” contaminants:
 - new ways of sample analysis*
 - lower detection limits
 - expanded measurement capabilities at labs
- Unknown synergistic public health effects
- Climate change will intensify storms/more damage



From: Bing images



From: US EPA

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Integrating the Safe Drinking Water Act and the Clean Water Act

GIS can be used to identify & analyze
the potential contaminant sources in the area.

Clean Water Act (CWA)



Safe Drinking Water Act (SDWA)

- Ø Use the power of
The Clean Water Act
&
The Safe Drinking Water Act
- Ø Use GIS!
- Ø Then use technical assistance.



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Integrating the Safe Drinking Water Act and the Clean Water Act

Safe Drinking Water Act & Clean Water Act integration in action;

Prevention, Restoration, Technical Assistance, & Regulation

Oregon's Drinking Water Protection program is considered a national example for how to integrate SDWA with the CWA.

Advantages:

- ∅ Provide information / data exchange
- ∅ Demonstrate shared goals
- ∅ Cross-program prioritization
- ∅ Nested program implementation



Use both SDWA & CWA to find protection strategies.

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Integrating the Safe Drinking Water Act and the Clean Water Act

Clean Water Act; Oregon's *beneficial uses* by rule

State designations are key—aquatic life and public health

Clean Water Act standards apply to all source waters
above intakes

**when met, standard treatment should be enough for safe
drinking water**

Cross-walk: MCLs (SDWA) vs. WQ
criteria (CWA)

25 MCLs have no WQ criteria in
Oregon

3 MCLs are more stringent than WQ
criteria

Clean Water Act Tools:

Ø 303(d) Listing

Include Drinking Water criteria in
queries for Integrated Report

Ø TMDLs

Ø Water Quality Standards

Ø NPDES Permits

Ø Nonpoint Source/CWA 319 Grants

Ø Clean Water State Revolving
Fund

Enact risk reduction by applying rules!

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Integrating the Safe Drinking Water Act and the Clean Water Act

Oregon's Potential Contaminant Source Approach; Drinking Water Protection and Restoration

The regulatory tools exist in the Safe Drinking Water Act and the Clean Water Act.

Now find the potential contaminant sources in the drinking water source area.

GIS is the answer!

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Types of Potential Contaminant Sources in Source Water Assessments

Water Quality program permit sites and other sources:

- Ø Source Information System (SIS) database
NPDES & WPCF industrial, domestic, and general permits
- Ø Storm water (MS4) discharge permits
outfalls, retention basins
- Ø Underground Injection Control (UIC) permit
Class V UICs, storm water, wastewater, injection dry wells, sumps,
- Ø Biosolids
- Ø Harmful algae blooms (HABs)



Legend

- Ø NPDES permit sites
- Ø WPCF permit sites
- Ø MS4 permit sites
- Ø UIC permit sites
- Ø Other permit sites

OR Water Quality Effluent Outfalls & 2010 Water Quality Assessment Results



- Ø Metal mining (dredging)
- Ø Permitted outfall locations
- Ø Water Quality Limited OR Streams 2010:
303(d), TMDL needed, TMDL approved,
Habitat modification, Flow modification

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Types of Potential Contaminant Sources in Source Water Assessments

Other Oregon
DEQ permit
databases
and
programs:

Oregon DEQ Permitted Sources



Legend

-  Environmental clean up sites
-  Hazardous waste sites
-  Solid waste sites
-  Dry cleaners
-  Drinking water source area; surface water

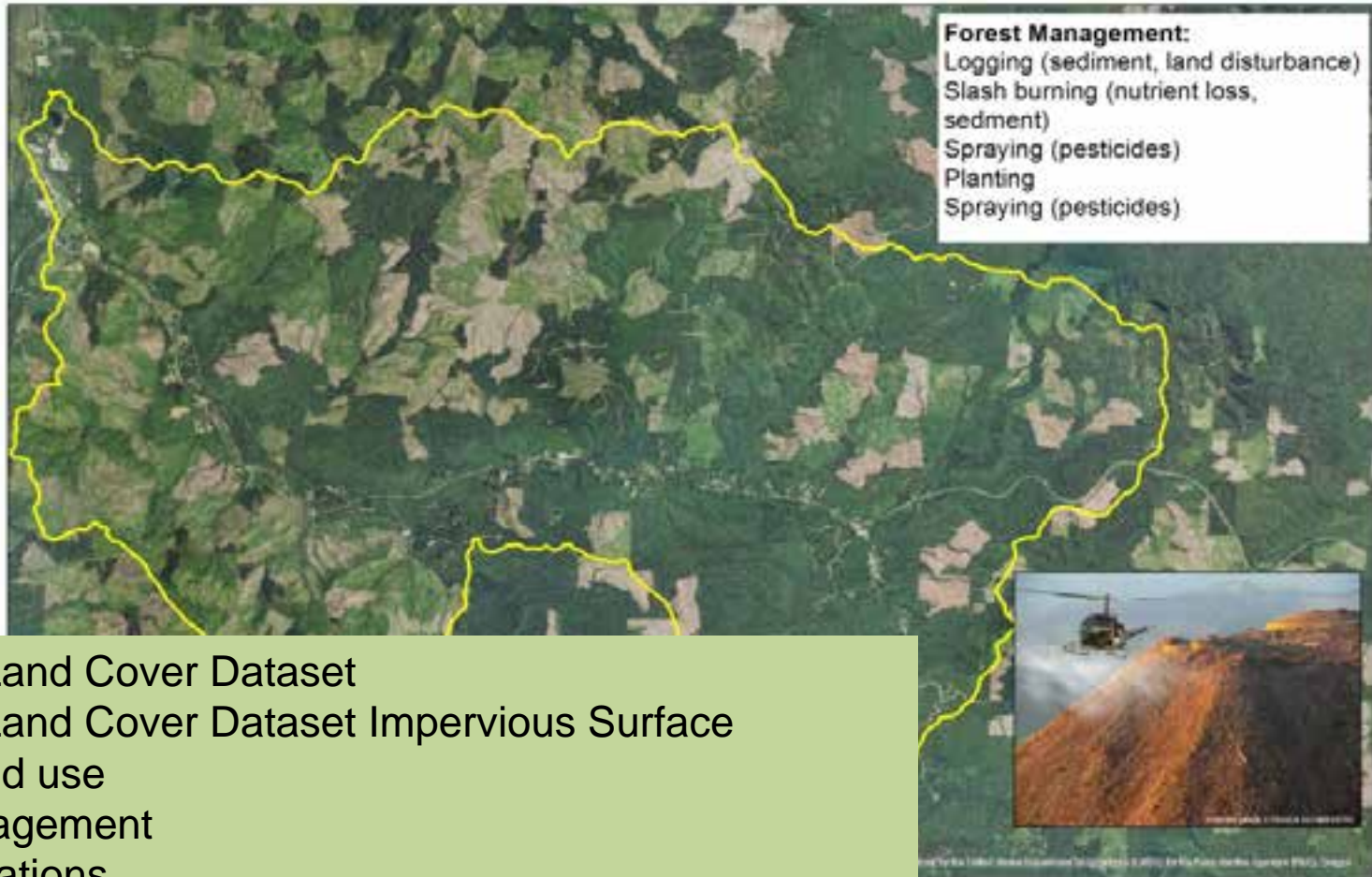


- Ø Environmental Cleanup
- Ø Underground Storage Tanks
- Ø Leaking Underground Storage Tanks
- Ø Hazardous Waste permitted sites
- Ø Solid Waste permitted sites
- Ø Dry Cleaners
- Ø Emergency Response

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Types of Potential Contaminant Sources in Source Water Assessments

Land Use:



- Ø National Land Cover Dataset
- Ø National Land Cover Dataset Impervious Surface
- Ø County land use
- Ø Land management
- Ø School locations
- Ø Willamette Basin Effective Shade
- Ø Oregon Average Monthly or Annual Precipitation, 1961-90

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Types of Potential Contaminant Sources in Source Water Assessments

State-wide soil types - Used to evaluate susceptibility to PCSs

∅ Surface water/erosion, hazards/land & soil sensitivity

- Sensitive soil setbacks

∅ USDA Natural Resource Conservation Service
(Universal Soil Loss Equation)

§ Composite sensitive areas
high runoff potential,
high erosion potential,
high permeability

§ Highly Erodible Land classes
agricultural soils (low slope)

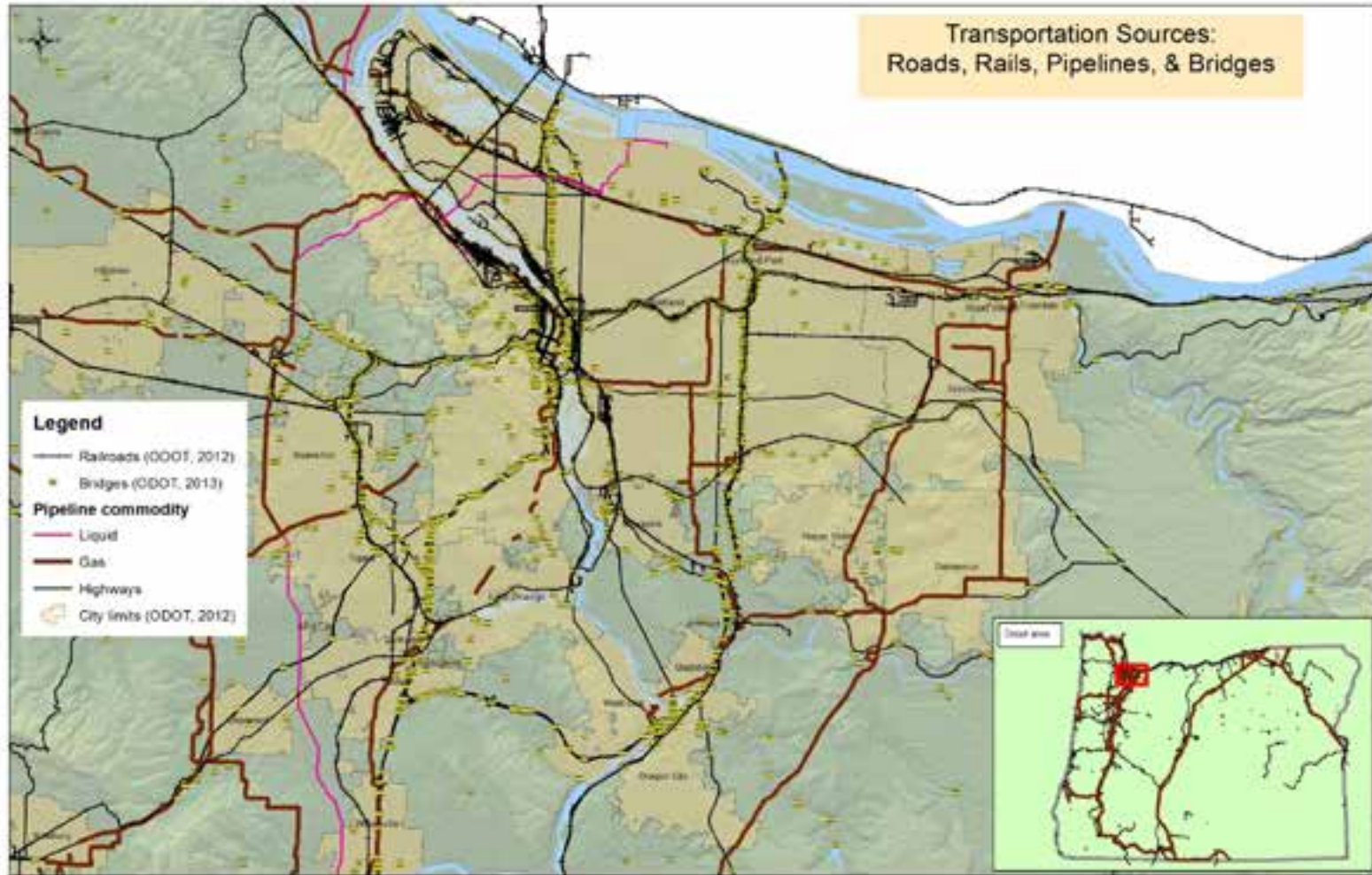


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Types of Potential Contaminant Sources in Source Water Assessments

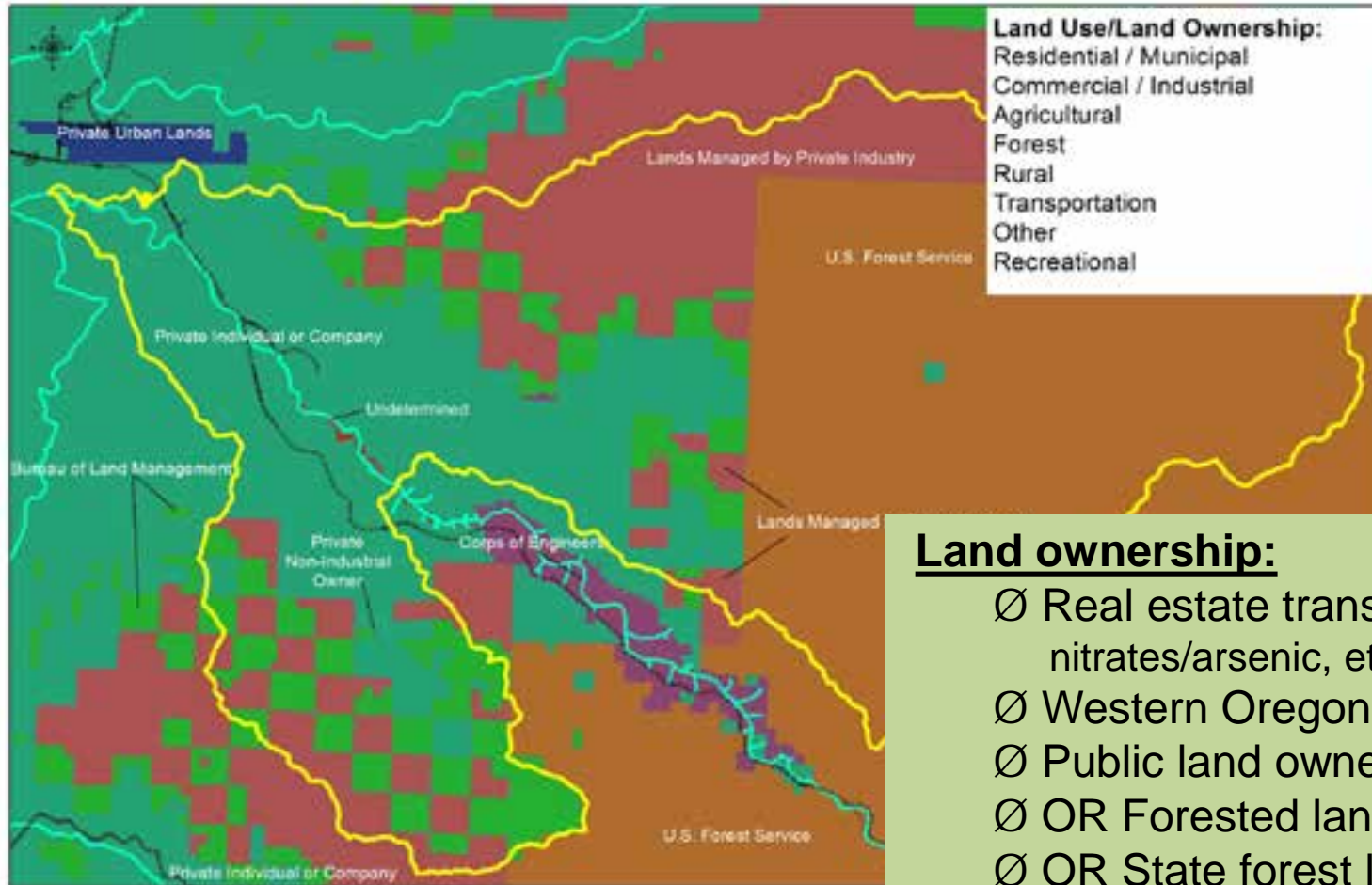
Transportation land uses:

Don't forget
boat
launches &
marinas!



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Types of Potential Contaminant Sources in Source Water Assessments

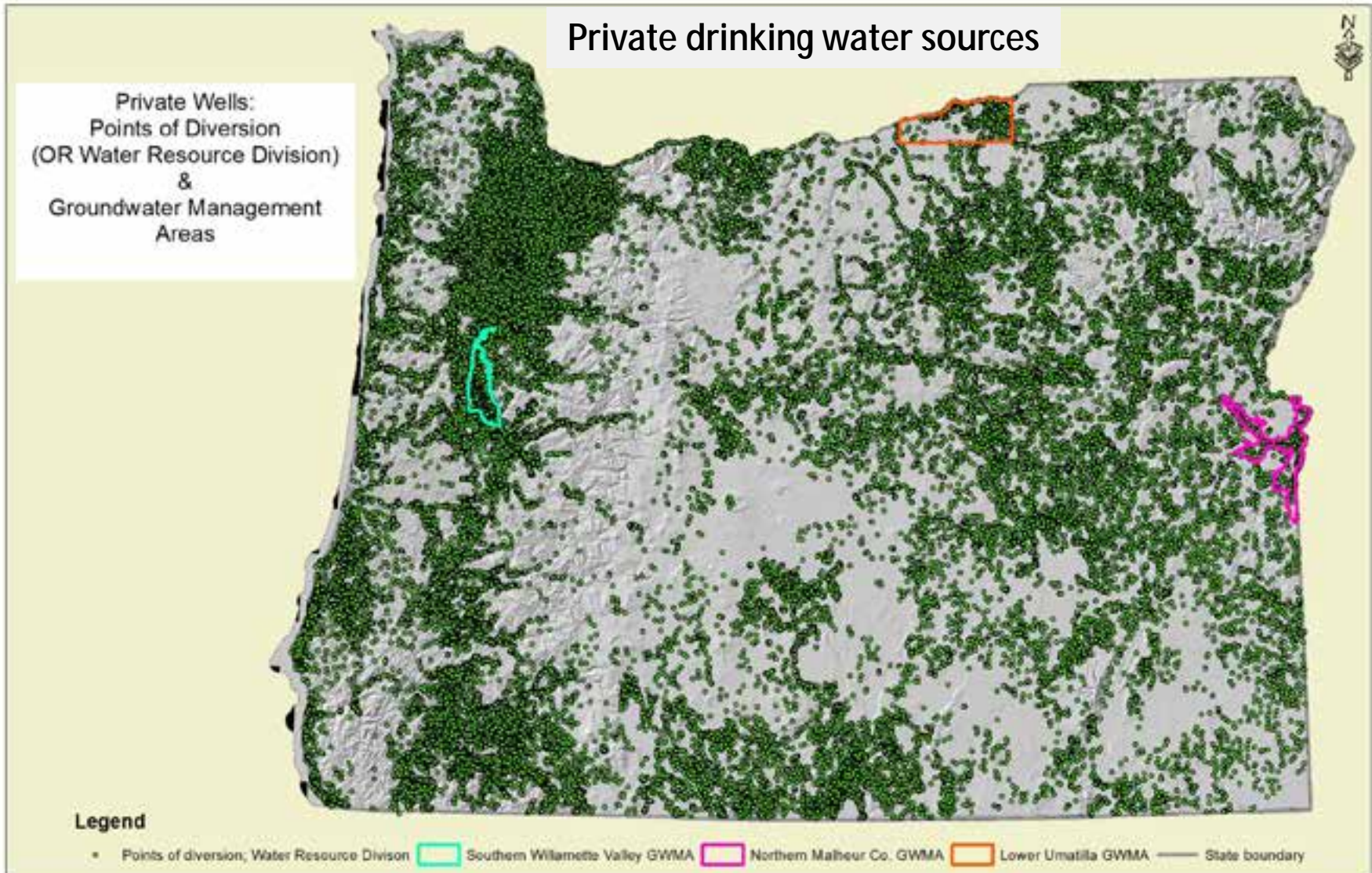


Land ownership:

- Ø Real estate transaction data; nitrates/arsenic, etc.
- Ø Western Oregon forest ownership
- Ø Public land ownership
- Ø OR Forested land
- Ø OR State forest lands
- Ø OR State Park lands
- Ø Native American lands

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Types of Potential Contaminant Sources in Source Water Assessments



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Types of Potential Contaminant Sources in Source Water Assessments

Other Data Sources; Federal, State, Sovereign Nations, & NGOs

Oregon:

- Ø Dept. of Fish and Wildlife
 - Fish habitat distribution, essential salmon habitat
- Ø Department of Agriculture;
 - CAFOs & pesticide use
- Ø Dept. of Forestry
 - Forest ownership / logging locations
- Ø Water Resource Division
 - Water rights, point of use & diversion
- Ø Dept. of Land Conservation & Development
 - Land ownership, development
- Ø Parks & Recreation
 - Wild & Scenic Waterways
- Ø State Lands
 - State forest lands
- Ø Geology and Mineral Industries
 - Landslides, geology, morphology
- Ø Dept. of Transportation
 - Pipelines, roads, rails, & bridges & rails

- Ø State Fire Marshal
 - Hazardous material storage
- Ø US Geological Survey
 - NHD streams & water bodies
- Ø US Dept. of Agriculture (USFS, BLM)
 - Soil Resource Inventory
 - SSURGO
 - STATSGO
 - Roads
 - Wilderness Areas
- Ø Nation Pipeline Monitoring System
- Ø US Environmental Protection Agency
 - Wilderness areas
 - Wild & Scenic Waterways
 - Endangered species
- Ø Bureau of Indian Affairs
 - Tribal lands

Integrating layers leads to informed decisions. Use those ArcGIS tools!

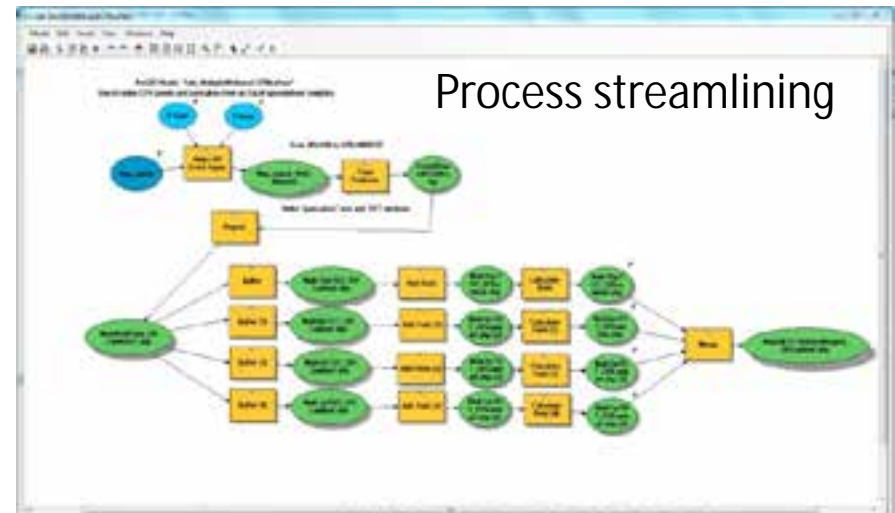
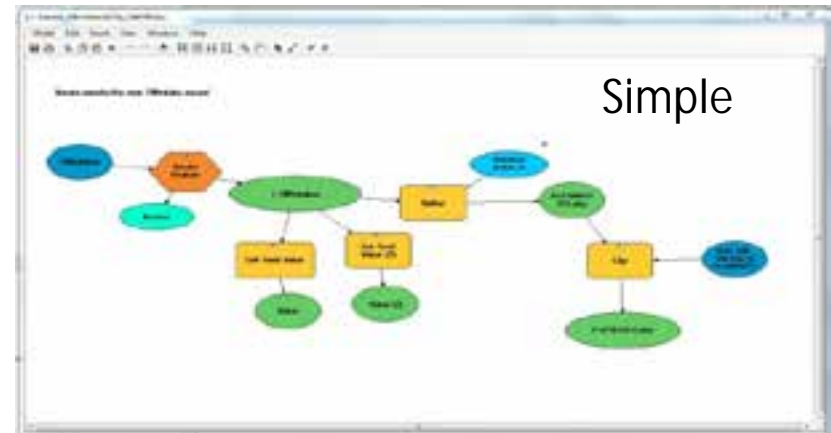
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ArcGIS has powerful tools; take advantage of them!

Model builder:

- Delineate groundwater
- Automate repetitive processes
- Streamline workflow

Complicated model



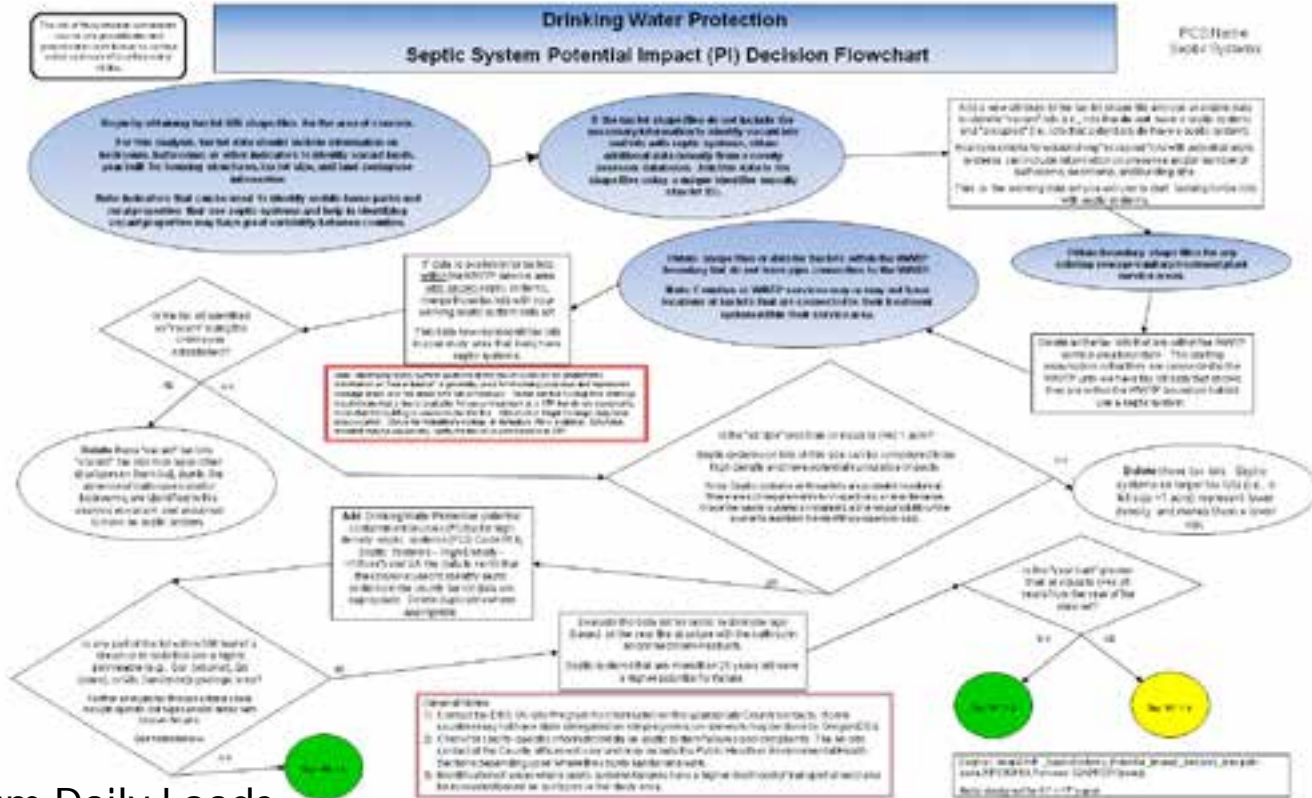


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Analysis results and how they are used.



Total Maximum Daily Loads
Watershed evaluations
Other DEQ programs
Other agencies.

Share the data!

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Get
results!

Apply the
monitoring
data,
potential
contaminant
source
inventory, &
GIS analysis.

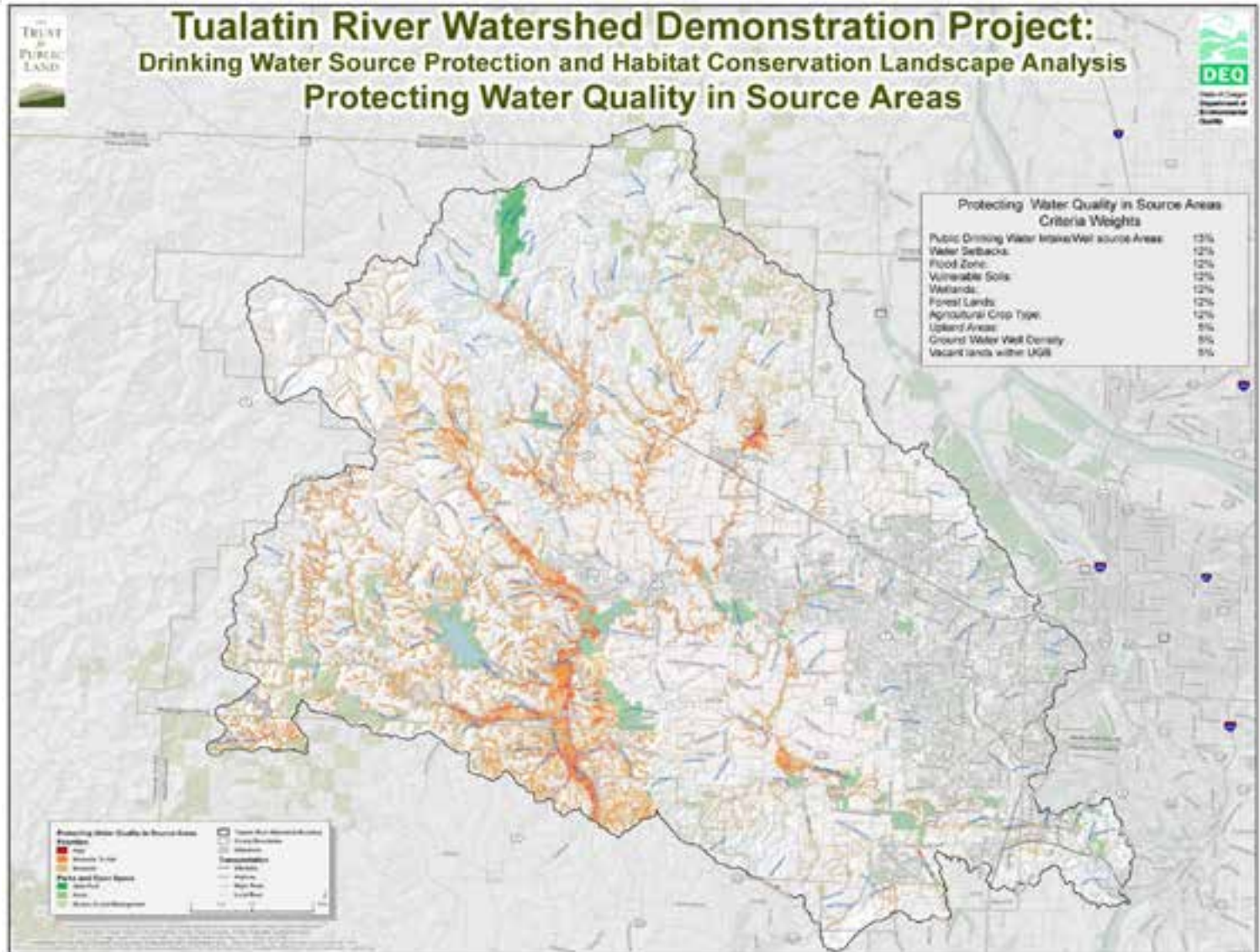


Image from The
Trust for Public
Land.
(Thanks to Bob
Heuer).

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Use the results to:

- ü focus technical assistance for successful protection, restoration, & implementation of protection activities

- ü help identify where to focus available funding

- q Safe Drinking Water State Revolving Fund

- Ø septic systems cleaning & replacement

- Ø pesticide collection events

- Ø educational materials

- Ø land purchase (intake and source protection)

- q State Clean Water State Revolving Fund

- Ø capital improvements; sewage treatment plants

- Ø residential and city sewer & line replacement

- Ø Non Point Sources

- Ø facilitate source area land purchases to protect drinking water

- q Clean Water Act - 319 Grants

- Ø restoration efforts/non point sources

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So we don't end up like this...



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Questions?

