



Multiple Barrier Approach to Drinking Water Protection and Treatment



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Oregon Department of Environmental Quality



Drinking Water Protection in Oregon

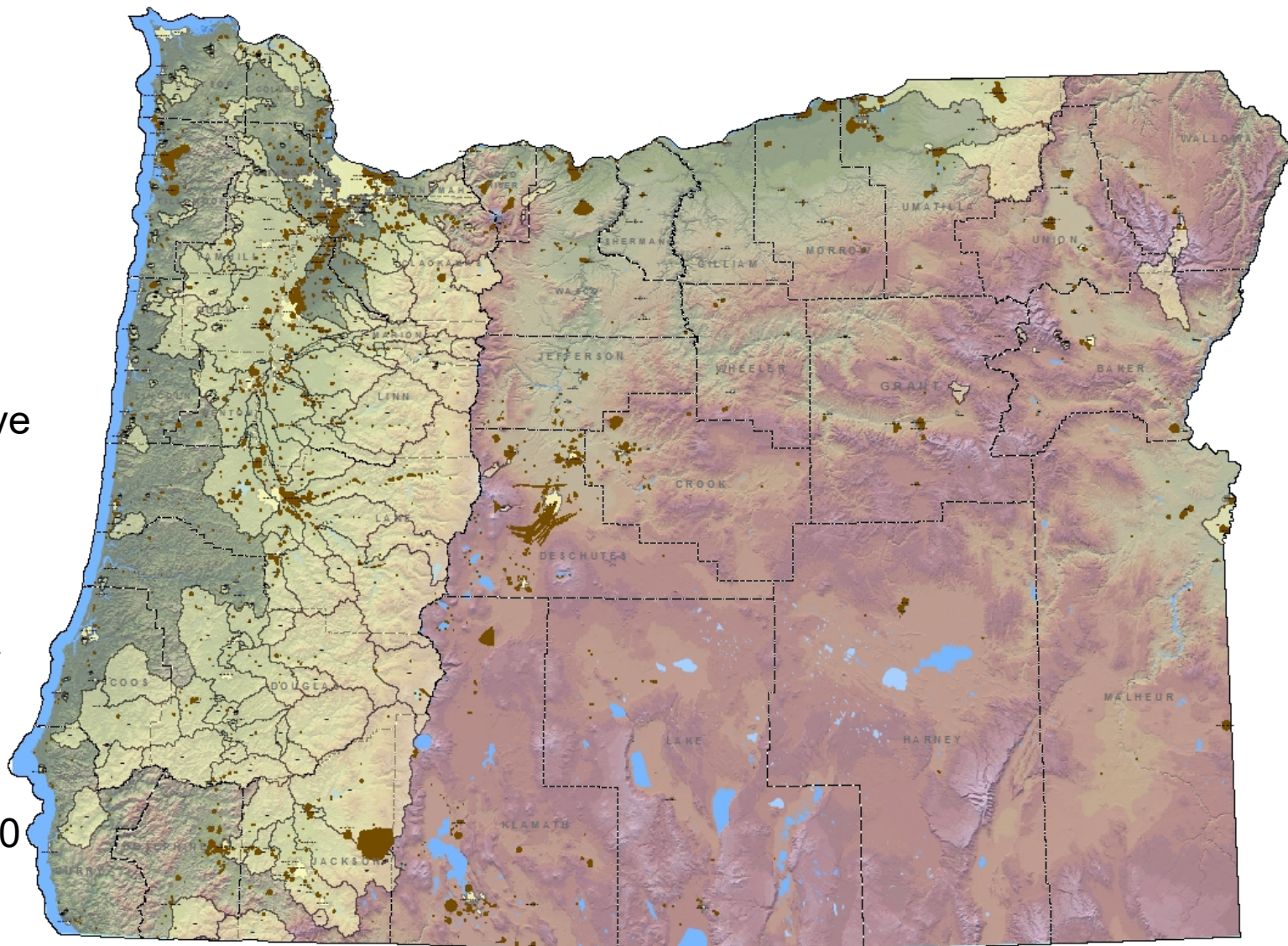
- Oregon Health Authority regulates finished drinking water
- Dept. of Environmental Quality regulates ground and surface water quality
- DWP is a joint program between OHA and DEQ focused on public health
 - OHA funds drinking water protection staff at DEQ
 - Interagency communication & coordination
 - Both produce Source Water Assessments
 - Protection planning, PWS assistance, & funding

The Dalles Drinking Water Protection Workshop



Over 2,500
public water
systems serve
85% of
Oregonians

Public Water
Systems
serve >25
people or >10
connections





Drinking Water Protection in Oregon

DEQ oversees water quality regulation under Clean Water Act

- Issues point source permits
- Creates WQ standards
 - MCLs included as default WQ standards
- Issues Total Maximum Daily Loads (TMDLs)
- Groundwater protection authority under state law
 - Can create Groundwater Management Areas (GWMAAs)
- Works with federal land management agencies (USFS, BLM)



Drinking Water Protection in Oregon

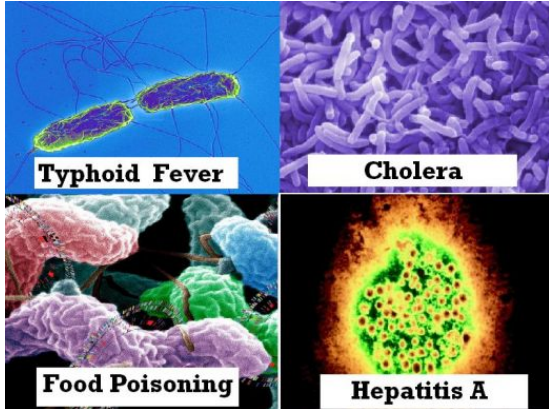
Oregon Dept. of Forestry has regulatory authority on non-federal forestlands Forest Practices Act

- Practices must meet water quality standards
 - Ongoing riparian rulemaking/evaluation
 - Updated road rules (wet weather hauling, drainage, etc)
- Oregon Dept. of Agriculture regulates agricultural & rural residential lands
 - Agricultural Water Quality Management Act (SB1010)
 - Area rules should be protective of water quality & meet standards
- Oregon Dept. of Geology and Mineral Resources
 - Permitting for surface mines and administers water quality permits at mine sites (WPCF 1000 and NPDES 1200A)
- DEQ coordinates & works with these agencies



Drinking Water: Source Water Quality

- Generally, healthy aquatic systems provide better drinking water
- Polluted & degraded systems are riskier or dangerous
 - Algae blooms introduce toxins & bad tastes
 - Due to nutrient pollution & warm, stagnant water
 - Sediment pollution inhibits filtering of water sources
 - Pathogens (disease organisms) cause direct harm & mortality
 - Toxic metals & compounds can lead to acute & chronic health implications



ICT Project



Oregon DEQ



Middle Columbia/NE Oregon: Potential Contaminant Sources



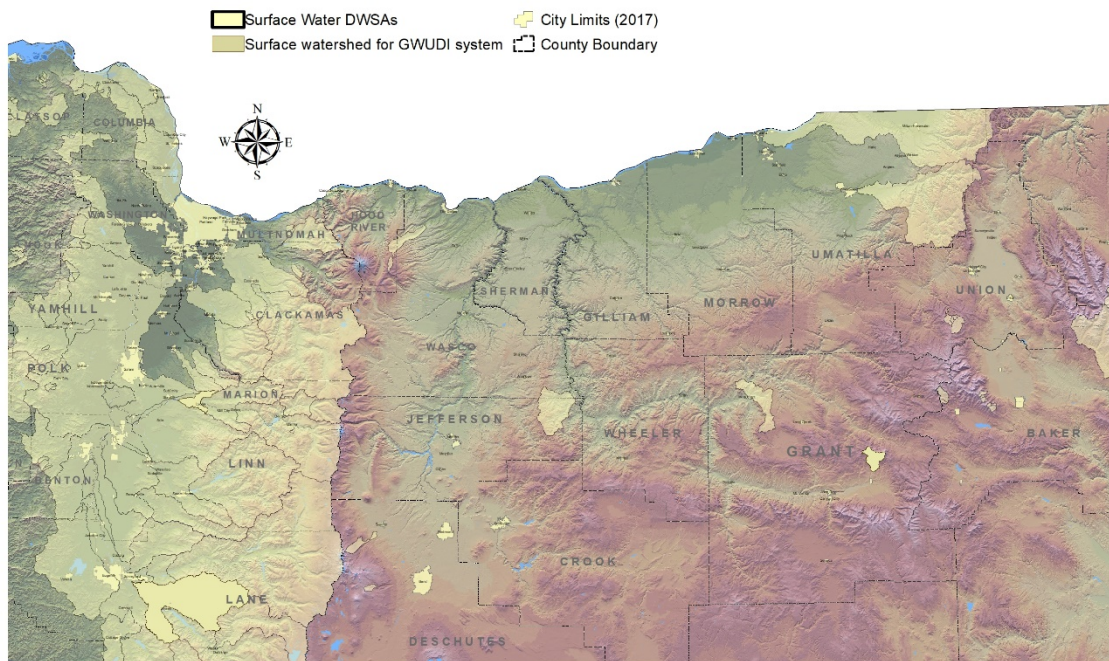
C. Murphey/The Daily Astorian

- Agriculture
- Forestry
- Wildfire
- Mining (gravel & minerals)
- Residential Uses & Development
(urban, suburban, rural land uses;
incl. sewer/septic, fuel/oil,
hazardous materials)
- Transportation (roads, railroads,
marinas)
- Recreation (OHVs, hiking/camping,
boating)

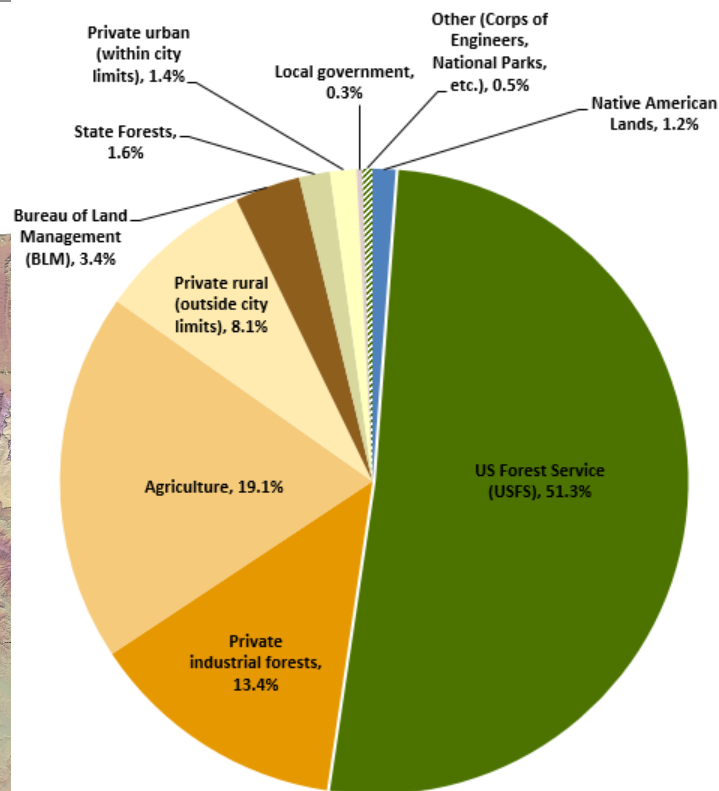


Land Uses for NE & North-Central Oregon Public Water Systems using Surface Water

Drinking Water Source Areas for Public Water Systems Using Surface Water



Approximate Percentage of Land Use/Ownership within Surface Water Drinking Water Source Areas in North-Central & Northeast Oregon



Drinking water source areas supplied by surface water comprise a total of 11,857 sq.mi of north-central and northeast Oregon.



Climate Change & Management Interactions



- Climate change resulting in higher temperatures, drier summers, & lower summer/early autumn flows
 - Can interact with temperature & flow changes from management
- Wetter winters with more intense storms increase erosion & flood risks
 - Can interact with management effects to increase erosion & landslide risks



DEQ

Treatment Types & Limits

- A given treatment technology has limits on raw water quality
- Regardless of source water quality, must meet SDWA MCLs
- When source water meets CWA standards, conventional treatment should be adequate to meet all Safe Drinking Water Act requirements.

FIGURE 1 Schematic of a conventional water treatment plant

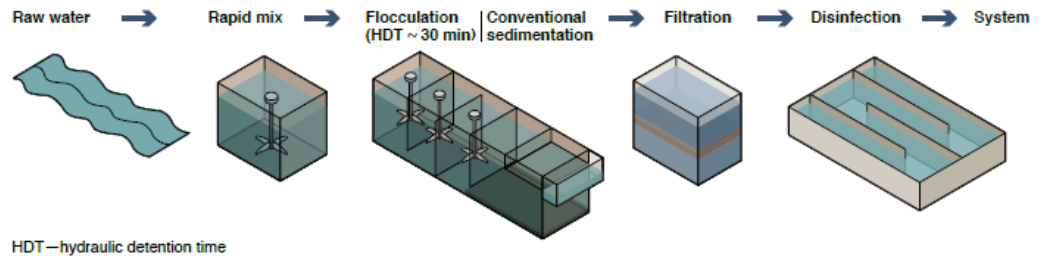


FIGURE 2 Schematic of a dissolved air flotation plant

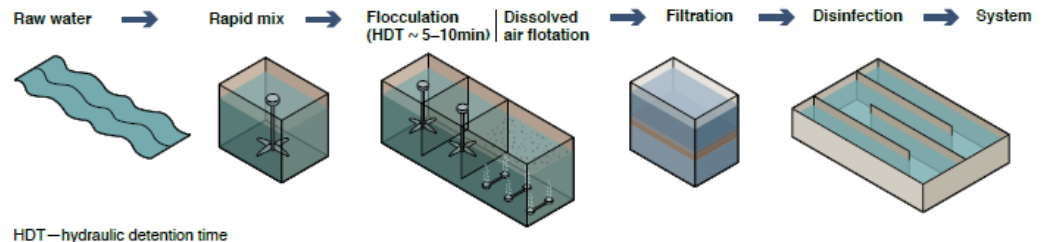
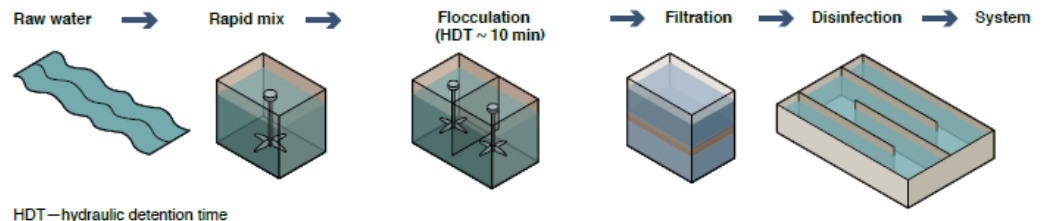


FIGURE 3 Schematic of a direct filtration plant





Treatment Types & Limits

TABLE 1 Raw source water quality pre- and post-wildfire, post-fire water quality for an unburned reference site, and post-fire rainstorm samples

Water Quality Parameter		Pre-fire Routine Monitoring Samples ^a	Post-Fire Reference Site Samples	Post-Fire Routine Monitoring Samples ^b	Post-Fire Rainstorm Samples ^c
Turbidity— <i>ntu</i>	Mean Stdev	3.6 (±4.5)	4.4 (±5.0)	35 (±38)	321 (±291)
TOC— <i>mg/L</i>	Mean Stdev	4.8 (±2.8)	4.2 (±1.9)	4.9 (±1.9)	11.8 (±5.6)
SUVA ₂₅₄ — <i>L/mg-m</i>	Mean Stdev	2.7 (±0.5)	3.3 (±0.8)	3.3 (±0.7)	4.5 (±0.87)
Total phosphorus— <i>mg P/L</i>	Mean Stdev	0.018 (±0.014)	0.013 (±0.004)	0.058 (±0.077)	0.377 (±0.407)
Total nitrogen— <i>mg N/L</i>	Mean Stdev	0.29 (±0.20)	0.27 (±0.10)	0.66 (±0.69)	1.61 (±0.90)

Stdev—standard deviation, SUVA₂₅₄—specific ultraviolet absorbance at 254 nm, TOC—total organic carbon

^aPre-fire water quality is shown for the water intake during routine monitoring (Hohner et al. 2016).

^bPost-Fire samples were also collected following rainstorms.

^cRainstorm samples were analyzed for the dissolved fraction resulting from high particulate matter.



Treatment Types & Limits

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Table 4. Recommended Raw Water Turbidity Range for Various Treatment Technologies.

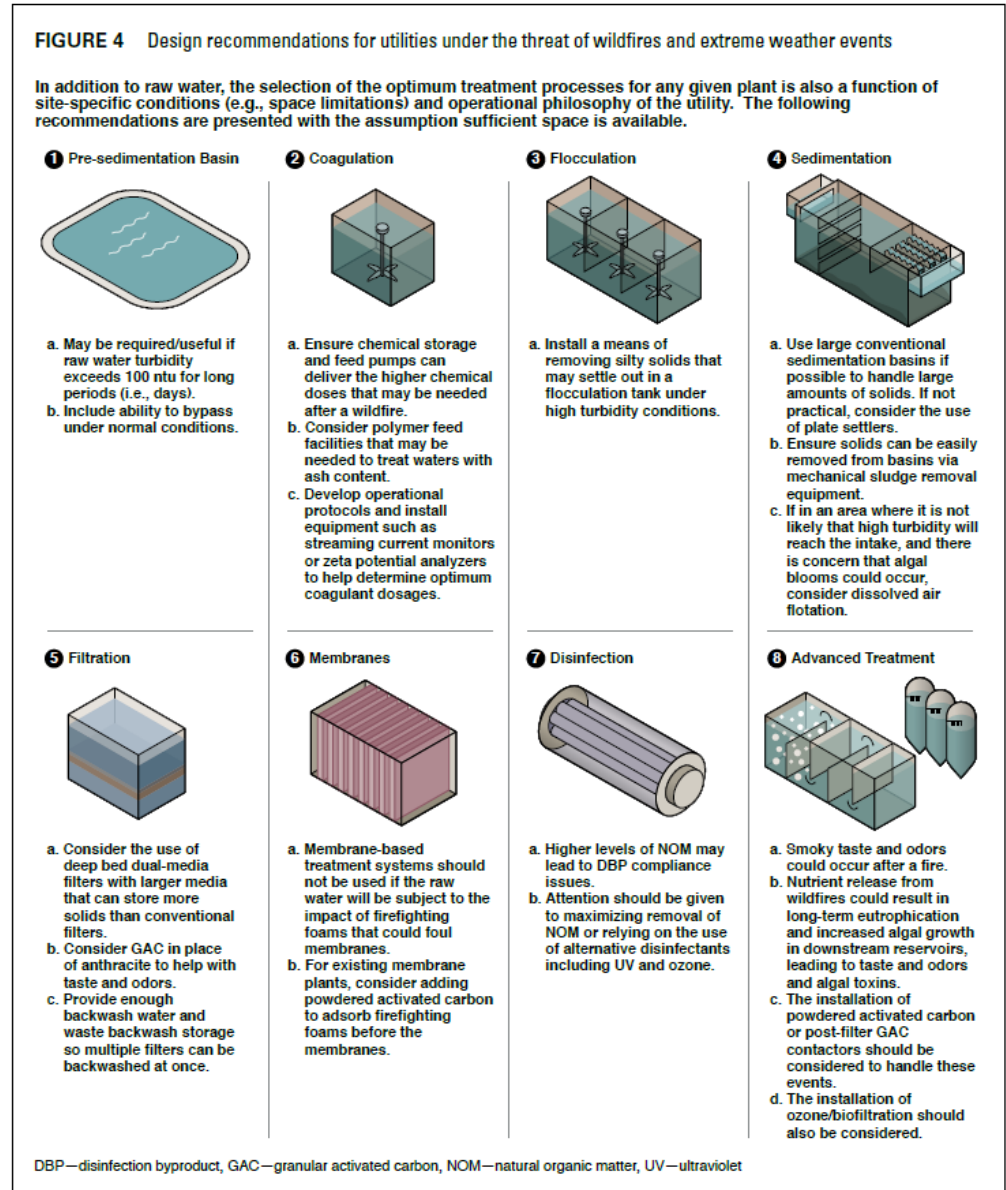
Filtration Type	Turbidity Range (NTU) ¹	Color Range (CU) ¹	Maximum Filtration Rate (gpm/ft ²) ²	General Design Reference
Conventional	Unlimited	< 75	6.0	Kawamura 2000b
Direct	< 15	< 40	6.0	Kawamura 2000b
Pressure Sand	< 5	< 10	3.0	T.S.S 2007 ³
Membrane	See Note 4	See Note 4	See Note 4	USEPA 2005
Slow Sand	< 10	< 10	0.1	Hendricks et. al. 1991; WADOH 2003b
Cartridge/Bag	< 5	See Note 4	See Note 4	USEPA 2003a
Diatomaceous Earth	< 10	< 5	1.0	AWWA 1999; Fulton 2000; WADOH 2003b

¹Water quality limitations are adopted from the DOH Surface Water Treatment Rule Guidance Manual (DOH 331-085) and references cited therein.



Treatment Types & Limits

- Upgrade treatment?
Or protect the source?
- Multiple Barrier Approach:
 - Protection and prevention are the first barrier to contamination
 - Treatment processes form additional barriers





Drinking Water Source Protection

- Identify potential contaminant sources & risks
- Use risk-reduction & avoidance strategies to prevent contamination of supplies
- Manage watersheds or source areas w/ practices proven to be low- or no-risk
- Use ecological processes & resiliency to reduce impact of disturbances
- Save money & resources in the long-term
- Provide clean, safe drinking water to ratepayers



Drinking Water Source Protection can be achieved through a variety of approaches

- **Federal agencies** prioritizing municipal drinking water
- **State agencies** implementing statewide programs to reduce public health risks
- **County or city government** using maps of source areas to focus key land use decisions; protect sensitive areas
- **Local officials** implementing protection/prevention activities for high risks; obtaining grants and hiring consultants
- **Landowner/individual** actions, especially within sensitive areas



Assistance to Public Water Systems

- OHA provides funding, engineering assistance, oversight
- DEQ provides technical advice & assistance on watershed management & drinking water source protection
 - Source water protection planning & implementation
 - Site visits & data analysis
 - Facilitate working with landowners & nonpoint source regulating agencies (ODF & ODA)



Planning & Evaluation Tools

- Updated Source Water Assessments and tools
- Surface Water & Groundwater Resource Guides
- Modeling & Analysis of erosion/sediment sources
 - GRAIP_Lite (roads)
 - SWAT (surface & bank erosion & transport)
 - Shallow landslide susceptibility (in progress)

Oregon Public Water Systems Surface Water Resource Guide

For Drinking Water Source Protection

February 2018 Version 1.0



State of Oregon
Department of
Environmental
Quality

Oregon Department of Environmental Quality
Environmental Solutions Division
Watershed Management

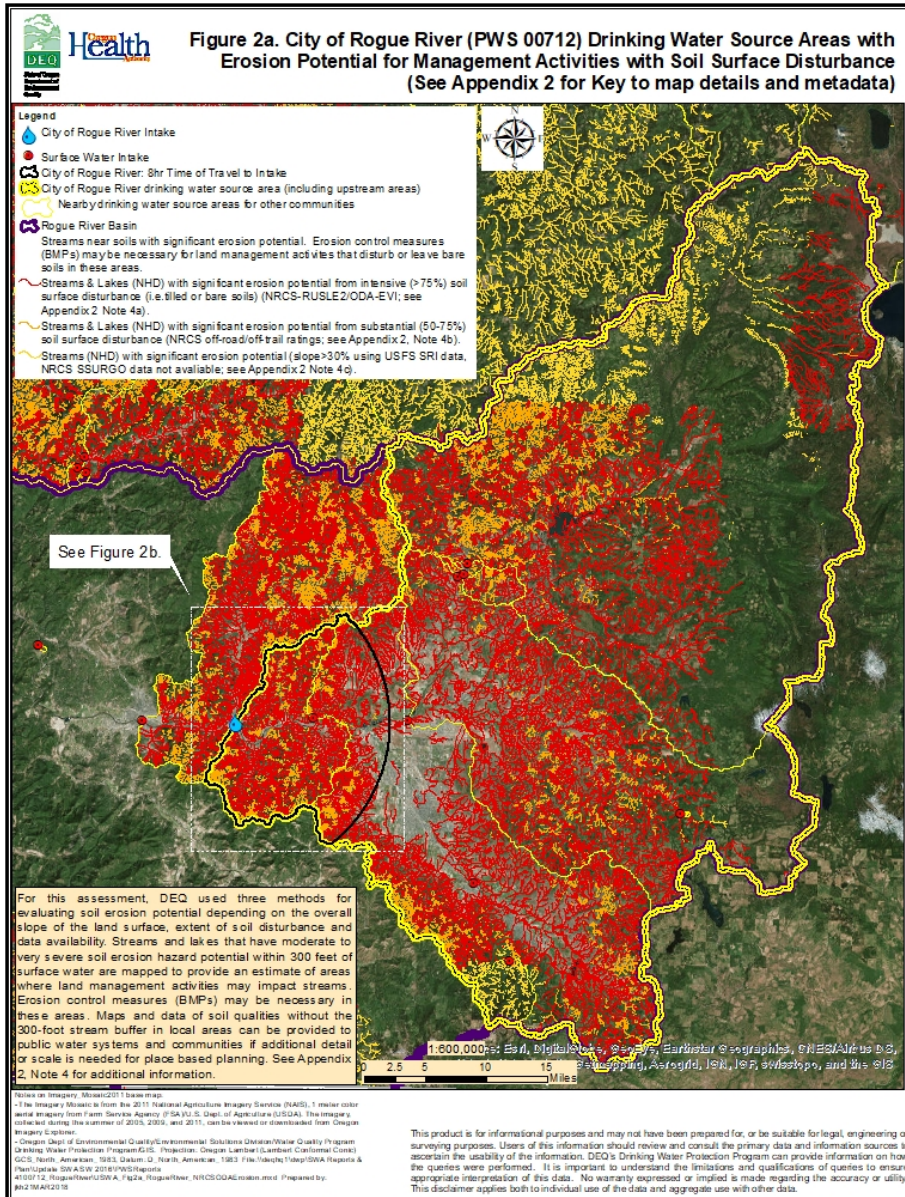


Oregon Health Authority
Center for Health Protection
Drinking Water Services

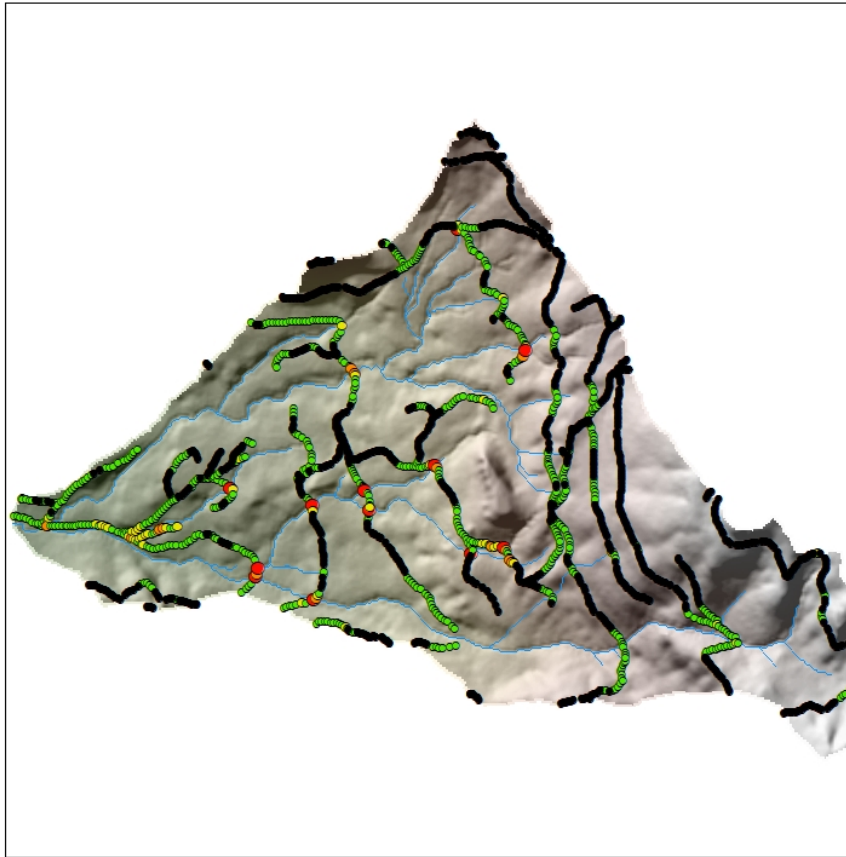
Planning & Evaluation Tools

- Three methods to evaluate soil erosion susceptibility
 - NRCS Off-Road/Off-Trail Erosion Hazard Rating
 - RUSLE2 analysis of Erosion Vulnerability Index
 - USFS Soil Resource Inventory data where:
 - i.e. SRI factors “medium”, “high”, or “medium to high”:
 - "Sedimentation Yield Potential"
 - "Sediment", or
 - "Surface Soil Erosion Potential"

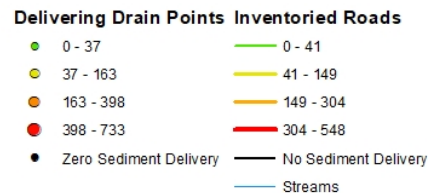
Figure 2a. City of Rogue River (PWS 00712) Drinking Water Source Areas with Erosion Potential for Management Activities with Soil Surface Disturbance (See Appendix 2 for Key to map details and metadata)



Annual Road Surface Sediment Delivery (kg/yr)



0 0.2 0.4 0.6 0.8
Kilometers

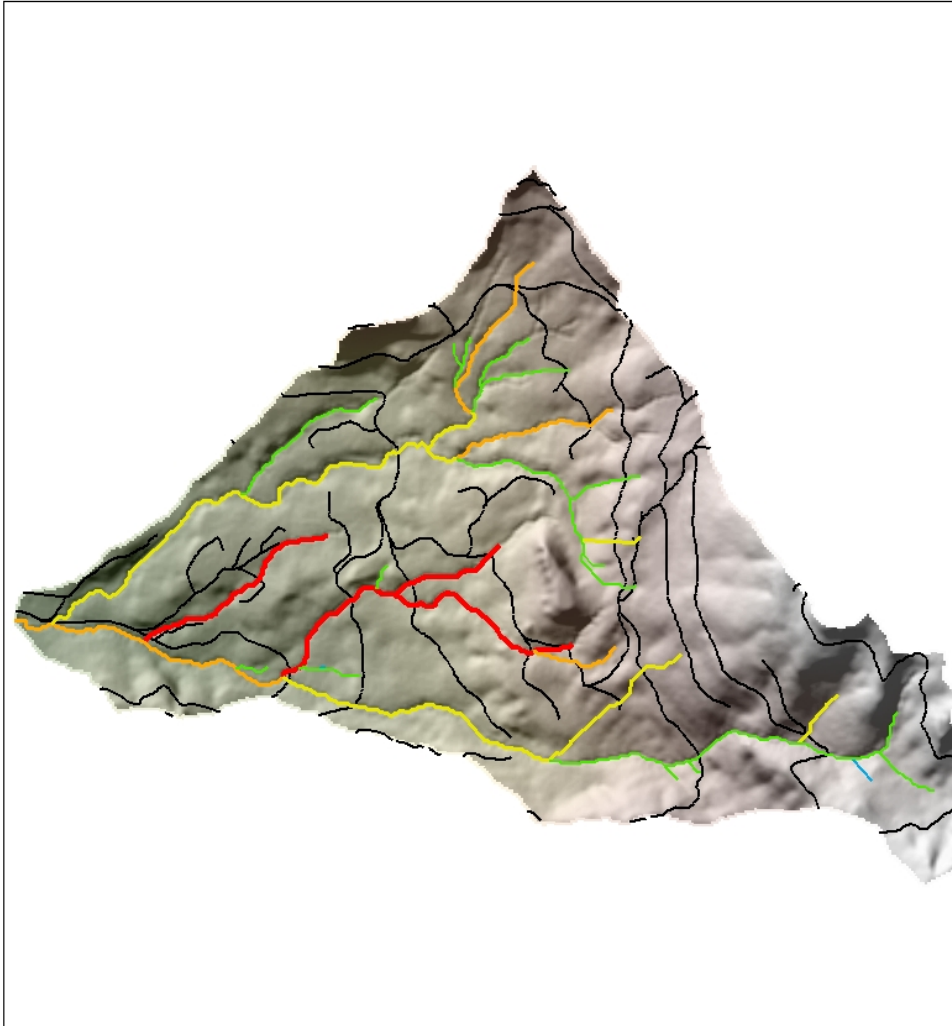


Planning & Evaluation Tools

GRAIP_Lite (USFS method)

- Uses road locations, DEMs, and field data calibrations to predict sediment delivery from roads to streams
- Can do alternatives analysis for new roads, decommissioning, maintenance
- Prioritize maintenance and road decommissioning
- See relative effects of changes

Road Surface Specific Sediment Accumulation in Streams (ton/yr/sqkm)



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- The key is to manage your watershed to:
 - Prevent immediate impacts
 - Reduce overall risk
 - Increase resiliency & redundancy
- Resilient ecosystems are more sustainable: ecologically, socially, economically



Questions?