Wellhead Protection: A First Line of Defense - Why it still matters in 2026

Presented to

Source Water Collaborative/Groundwater Section

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The Groundwater Association

Why Wellhead Protection?

- WHP originated with 1986 Safe Drinking Water Act amendments.
- Some states took similar approach earlier, e.g., CA, NJ, VT
- Sets procedures to protect *public water supply wells* from contamination before it happens.
- 76% of U.S. community systems (>37,000) use groundwater — 96% small and under-resourced.
- Many community groundwater systems discovered chemical contamination in 1970s, some became Superfund sites
- Changed circumstances – more urbanization/chemicals/drought

Question:

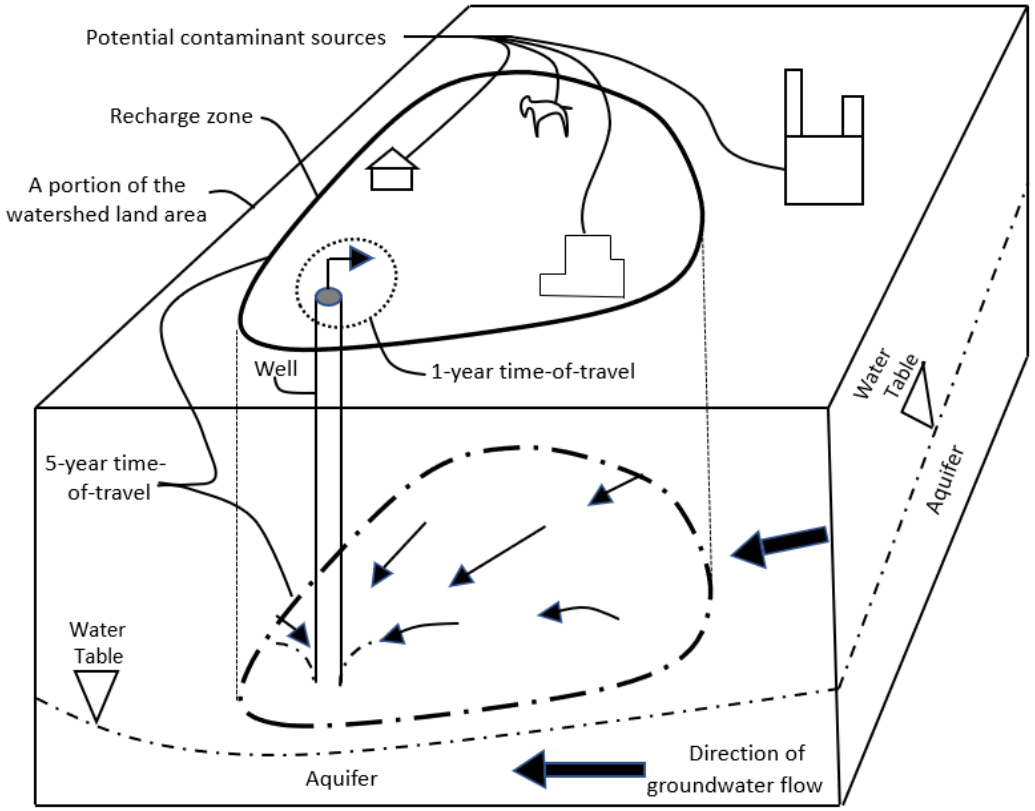
"Have you worked with a system serving fewer than 10,000 people?"

Seven Core Elements of WHP (SDWA §1428)

- Roles of state/local agencies
- Delineation of WHP areas (WHPAs)
- Contaminant source inventory
- Management measures (tech, financial, regulatory)
- Contingency planning
- Proper siting of new wells
- Public participation

Not Prescriptive – Flexibility in Approach

Question: *"Which of these is hardest to keep current in your experience?"*



30 Years Later: What's Changed

- Groundwater use increasing –> 2.7 times from 1950-2015
- Urban development: +15M acres converted to urban /suburban use since 2000, potential recharge changes
- Superfund sites: 406 → 1,340 (1983–2024) – Remediation or Institutional Control? (avg remedial cost range $24-170 Million/site, PFAS could be more)
- 42,000+ active chemicals, including PFAS
- EPA policies favoring stormwater infiltration can affect groundwater quality

(Photo courtesy of Madison Water Utility)

Question: *"What are the biggest concerns today - more contamination or water supply risks from land-use or residual management changes?"*

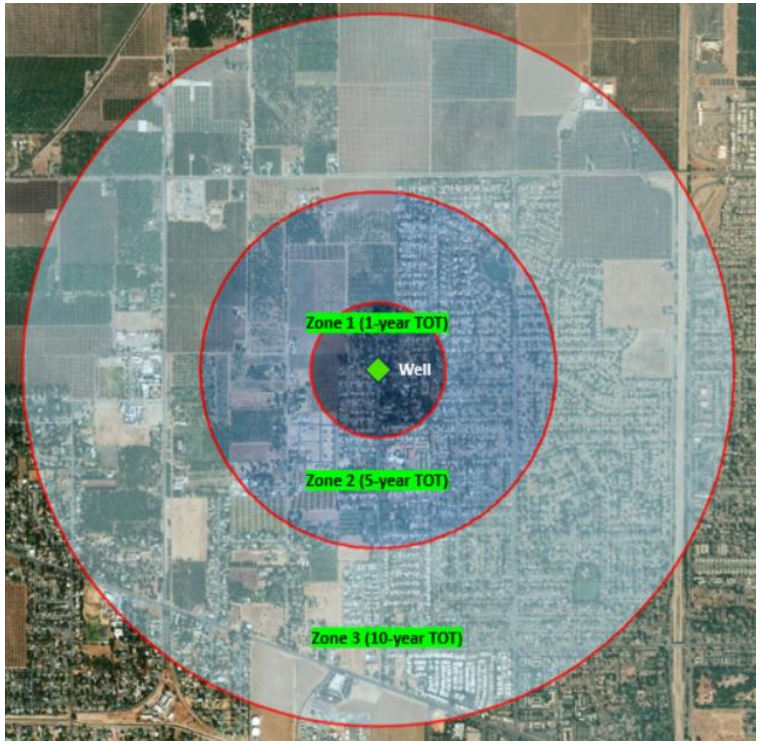
Historical Roots

- Modeled after 1979 European Groundwater Protection Directive
- Authorized in 1986 Amendments to Safe Drinking Water Act
- By 1995, >40 state WHP programs approved by EPA
- *Funding gap:* $20M authorized, $0 appropriated by Congress
- Early benefit–cost estimates: 7:1 (local program)
- Modeling WHPA considers 1) aquifer transmissivity, 2) groundwater flow direction, 3) hydraulic gradient, 4) effective porosity, 5) pumping rates for all wells, and 6) aquifer thickness.

Federal Program Links

WHP tied to other EPA Programs and Regulations:

- **Drinking water monitoring waivers (40 CFR 141.24)**
- **Underground Injection Control (UIC) restrictions**
- **State source water assessments (1997 guidance)**



Federal Program Links (cont.)

And WHP tied to other Federal agencies' regulations and guidance, e.g.:

- USDA conservation programs – Forest plans, Conservation Reserve
- DoD/Army base water systems

Poll: *"Do you coordinate WHP with UIC & other programs' staff?"*

Underground Injection Control and WHP

- Class V wells: recharge + risk if no treatment or other protective actions

- MAR (Managed Aquifer Recharge) sites →
  - Evaluate for natural attenuation & pathogen control
  - Ensure that sources of contamination not nearby

- Saline/brackish aquifers now valuable & used — must avoid being disposal targets in water scarce regions

State Laws and Local Ordinances

- Many States with statutes for Source Water Protection; e.g,:
  - CT - Aquifer Protection Act – model ordinance, prohibited uses, best practices
  - VT - Source Protection Plans and Updates
  - WA - Water system plan and Updates
  - WI – WHP Plans for new wells; otherwise voluntary
- Local overlay zoning examples: Brandon, VT; Tumwater, WA; Madison, WI
- Common project reviews: stormwater ponds, geothermal wells, fuel storage upgrades

Question: *"In your experience, are local zoning boards checking before or after projects are approved?"*

Selected Example Communities with WHP

Community	Brandon VT	Tumwater WA		Madison WI
Population (est.)	3,500	25,000		280,000
WHPA Delineation Method	Time-of-Travel (TOT) modeling	6 mo-1 yr TOT	5-10 year TOT	5 yr TOT and 1200 ft radius from well

Community	Brandon VT	Tumwater WA		Madison WI
Above-ground / Underground Hazardous Materials Storage	X	X		Accomplished through Water Utility review of proposed uses and storage of hazardous chemicals within overlay management zones around municipal wells, considering effective hazardous chemical storage/ containment and magnitude/ frequency of use
Specific Chemicals/Processes	X	X	X	
Transportation Routes for Hazardous Materials	X			
Agricultural Chemical Use/Operations	X	X		
Landfills/Land Disposal / Waste Treatment	X	X	X	
Heavy Industrial/Commercial Activity	X	X		

Community	Brandon VT	Tumwater WA	Madison WI
WHP Early Detection Monitoring Wells	**X (municipal requirement; provided for in state regulation)**	**X (municipal requirement)**	**X (municipal requirement)**
Update Source Protection Plans	Every 3 years	Every 10 years	As plan evolves and more information available

Community	Brandon VT	Tumwater WA	Madison WI
Other WHP Aspects	Private drilled wells within the APOD may penetrate clay layer protecting public water supply only if impermeable bond maintained between well casing and clay layer	Restricted uses possible if applying new protective technology and BMPs; Chemical use beyond threshold amounts may require pollution prevention plan	Identification of 5-, 50-, and 100-year capture zone of wells to enable preventative measures to prohibit or restrict future land uses potentially contaminating groundwater

Monitoring for Early Warning

- WHPA perimeter monitoring wells used, e.g., in cities of Dayton OH & Madison WI and States of Ohio & Connecticut
- Detect contamination **before** impacting production wells
- Sanitary surveys (40 CFR 142): good, but often limited to ~200 ft from wells

Question: *"Are you aware of communities using monitoring wells specifically for WHP early warning?"*

Private Wells in WHPA: A Shared Benefit

- Example: Door County, WI utility provided sampling kits to private well owners
- Helps both municipal programs and homeowners
- Data supports broader protection decisions

Community Education and Recognition

- Groundwater Foundation outreach: schools, model kits, coloring books
- Recognition programs improve public awareness and local support
- Circuit rider and technical assistance to under-resourced systems provide training for water system operators
- Informed citizens = fewer land-use conflicts

Updating WHP Programs

- Emerging contaminants not covered in 1990s plans
- Drought creating new demands for quantity protection and supplement
- Funding available via Drinking Water & Clean Water State Revolving Funds
- National tools: DWMAPS (EPA), National Ground-Water Monitoring Network (USGS)

Question: *"Are you working with communities that need to update their WHP plans?"*

Closing Perspective

WHP still critical:

- Supports economic development (safe, reliable supply)
- Protects underserved communities
- Shields against new contaminants and land-use pressures
- Protects groundwater supply for 93 million people in US

Time to reassess: better mapping, new science, updated ordinances

Key Takeaways

WHP = Cost-Effective Protection vs. Costly Remediation

Flexibility in Local Control + State/Federal Guidance = Success

Monitoring, Zoning, Education, and Funding Program Updates Make WHP Sustainable

QUESTION: *“If you had one new WHP tool, what would it be — more funding, better maps, or advanced monitoring technology?”*

Thank You / Discussion

Questions?

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