WELLHEAD PROTECTION

Planning Tools & Strategies

A Reference Guide for Local Governments

Protecting Drinking Water Through Land Use Management

Alaska Department of Environmental Conservation | Division of Environmental Health
Drinking Water Program

This guide provides an overview of planning tools available to local governments for protecting Wellhead Protection Areas (WPAs). Tools are organized into two categories: **Regulatory Options** — legally enforceable mechanisms — and **Non-Regulatory Options**, which rely on voluntary measures, community participation, and education.

Part I: Regulatory Options

Legally Enforceable Land-Use Management Tools

1. Zoning Ordinances

Description

Zoning ordinances are comprehensive land-use regulations that guide how areas within a community develop. Many local governments use zoning to restrict or regulate certain land uses that may pose threats within the WPA.

Land Use Practice

A community incorporates WPA-specific overlay zones into its existing zoning ordinance, designating tiered protection areas (e.g., Zones A, B, and C) with progressively less restrictive land use requirements as distance from the wellhead increases.

Considerations

Zoning ordinances are a foundational and widely accepted tool for WPA protection. They must be grounded in a clear rational basis connecting land use restrictions to groundwater protection goals. Amendments require public hearings and legislative adoption, and enforcement depends on consistent application by local planning and zoning staff. Ordinances should be reviewed periodically to reflect changes in the WPA boundary or new contamination threats.

Example

A community establishes a WPA overlay district within its existing zoning code. Within Zone A (the innermost area), only passive recreational uses are permitted. Zone B allows low-density residential development with restrictions on impervious surfaces, while Zone C permits most uses subject to design and operating standards that minimize contamination risk.

2. Special Permitting

Description

Special permitting is used to restrict uses within WPAs that may cause groundwater contamination if left unregulated. This tool ensures potentially harmful activities are reviewed before approval.

Land Use Practice

A community adopts special permit thresholds for various structures and uses within the WPA. Special permits are granted only when applicants demonstrate that groundwater quality will not be compromised.

Considerations

Special permitting offers an organized method of separating compatible and incompatible land uses in sensitive areas. It requires case-by-case review to ensure equal and fair treatment of applicants. It also requires amendments to zoning ordinances and consistent enforcement through inspections and site visits.

Example

A community requires all new commercial uses within the WPA to obtain a special permit. The permit process includes a plan review to identify potential groundwater impacts and may impose conditions such as secondary containment for fuel tanks.

3. Large Lot Zoning

Description

Large lot zoning reduces the impact of residential development by limiting the number of homes that can be built within a WPA.

Land Use Practice

A community "down zones" an area to increase minimum lot sizes for residential development.

Considerations

Large lot zoning is a recognized authority of local government. However, it must be justified with a rational connection between minimum lot sizes and resource-protection objectives.

Example

A community increases the minimum lot size for residential parcels to 5 acres within the WPA.

4. Transfer of Development Rights (TDR)

Description

TDR programs transfer development potential from sensitive areas inside the WPA to designated receiving areas outside the WPA. This ensures protection of critical land while still allowing growth elsewhere.

Land Use Practice

A community provides a transfer option in its zoning ordinance and identifies both sending (WPA lands) and receiving (non-WPA lands) areas.

Considerations

TDRs are effective and widely accepted planning tools but require significant administrative oversight and ordinance amendments. They are often not suitable for communities lacking adequate administrative capacity.

Example

A property owner within the WPA seeks to develop a gravel pit. The community transfers development rights from its own nearby parcel outside the WPA to the landowner, ensuring the WPA parcel remains undeveloped.

5. Cluster Zoning & Planned Unit Developments (PUDs)

Description

Cluster zoning groups residential development within a portion of a property while the remaining land is preserved as open space. PUDs follow similar principles. These tools help communities maintain open space while still allowing development.

Land Use Practice

A community may allow cluster development as an option within its zoning ordinance and designate areas where it is permitted.

Considerations

Cluster zoning is well-accepted and is used to increase density in some areas while maximizing open space in others.

Example

A contractor proposes residential development in WPA Zones A and B. The community approves the project on the condition that housing is clustered only in Zone B, leaving Zone A entirely undeveloped.

6. Subdivision Ordinances

Description

Subdivision ordinances regulate land that is divided into two or more subunits for development or sale. They are used to protect WPAs where ongoing development pressures pose contamination risks.

Land Use Practice

A community develops subdivision requirements specific to the WPA. These requirements may include density limits or open space mandates to prevent contamination and promote aquifer recharge.

Considerations

These rules only apply when a parcel is subdivided. They may have legal implications or be interpreted as regulatory takings if not carefully designed.

Example

A community adopts a subdivision ordinance preventing any development in Zone A and allowing only low-density residential development in Zone B.

7. Site Plan Review

Description

Site plan review regulations require developers to submit plans for approval before construction occurs within a designated area. This ensures compliance with zoning rules and WPA-specific protections.

Land Use Practice

A site plan review requirement must be included in either a zoning or subdivision ordinance and must be completed before construction begins.

Considerations

Successful implementation requires adequate administrative capacity and technical expertise. The less specific the review requirements, the harder it is to apply them fairly and consistently.

Example

A community requires site plan review for all non-residential development within the WPA and for any activity involving storage of more than 55 gallons of hazardous materials.

8. Design Standards

Description

Design standards ensure that new buildings, structures, and infrastructure within the WPA are designed and constructed in ways that prevent risks to water quality.

Land Use Practice

Communities adopt or modify zoning ordinances to include specific design requirements.

Considerations

Design standards apply only to new construction and must be specific enough to allow consistent review. They should be coordinated with operational standards to strengthen protection.

Example

A community adopts zoning provisions establishing design standards for development types and specifying containment requirements for hazardous waste storage.

9. Operating Standards (Best Management Practices)

Description

Operating standards regulate ongoing land-use activities to enhance safety and environmental protection. They reduce contamination risks from day-to-day operations within the WPA.

Land Use Practice

A community amends its zoning ordinance to include ongoing operating standards.

Considerations

BMPs may require technical expertise to administer. They work best when combined with zoning or subdivision regulations and site plan review processes.

Example
A community establishes stringent standards for secondary containment at new hazardous-waste facilities and additional monitoring requirements for existing facilities.

10. Prohibition of Land Uses (Source Prohibition)

Description
These regulations prohibit particular types of hazardous activities or chemical uses within the WPA. They are among the most effective methods for protecting groundwater.

Land Use Practice
A community establishes a list of prohibited uses within its zoning ordinance.

Considerations
Prohibitions are highly effective but can be stringent, especially when harmful activities already exist in the WPA. Implementing them in phases is recommended. They are most effective when part of a larger protection strategy.

Example
A community bans new underground fuel tanks in the WPA and prohibits replacement of existing tanks at the end of their service life while allowing existing ones to remain temporarily.

Part II: Non-Regulatory Options

Voluntary Measures, Education & Community Participation

1. Groundwater Monitoring

Description

Groundwater monitoring involves installing a network of test wells — typically within WPA Zones A and B — and conducting ongoing water quality sampling. This tool helps track long-term groundwater quality and detect contaminant plumes or emerging threats.

Considerations

Groundwater monitoring requires technical expertise, access to laboratory testing, and sufficient funding for drilling test wells, sampling, and analysis. These costs can be significant and must be planned for accordingly.

Example

A community establishes a robust monitoring network by drilling multiple test wells throughout Zones A and B and routinely evaluates groundwater quality to track changes or early signs of contamination.

2. Purchase of Property or Development Rights

Description

Some communities choose to purchase land outright or acquire development rights as a way to fully control how sensitive lands within or around the WPA are used. This allows for long-term protection without relying on regulatory restrictions alone.

Considerations

This strategy can be costly. To reduce expenses, communities often prioritize key parcels for acquisition or seek donations and discounted land sales (bargain sales). Strategic prioritization helps maximize protection within available budgets.

Example

A local government purchases 250 acres within WPA Zone A, restricting public access to safeguard groundwater recharge and prevent accidental contamination.

3. Public Education

Description

Public education involves providing information through brochures, pamphlets, newsletters, meetings, or school programs. Its goal is to explain wellhead protection issues in clear, accessible ways that build public understanding and voluntary support. Educating youth is considered an especially valuable component.

Considerations
Educational programs must be tailored to local needs and audiences. Effective outreach requires time, effort, and sustained engagement to build public support and achieve behavior change.

Example
A community assembles a local advisory committee that includes businesses, interest groups, residents, elected officials, and government staff. The committee develops and implements a robust educational program, including a regular newsletter about public water system issues.

4. Household Hazardous Waste Reduction

Description
These programs help reduce the amount of hazardous waste generated in homes or ensure that hazardous materials are properly disposed of. They are especially useful in communities where household waste entering landfills poses a groundwater contamination risk.

Considerations
Development and operation of these programs can be expensive and require thorough planning, staffing, scheduling, and outreach.

Example
A community creates a hazardous waste collection program with designated drop-off days. Residents bring household hazardous waste to a centralized site, where a licensed hazardous-waste firm handles disposal safely.

5. Water Conservation

Description
Water conservation efforts aim to reduce overall water use and lessen the stress on groundwater aquifers. Lower pumping rates can also slow the migration of contaminants through the aquifer.

Considerations
These programs require dedicated time and resources to educate residents. Results may be temporary if messaging is not sustained.

Example
A community launches a water-conservation campaign by mailing brochures explaining why conservation matters and offering practical tips on reducing water use.

6. Community Involvement

Description
Community involvement activities unite people with diverse roles, values, and interests to work collectively toward protecting drinking water sources. Ideally, communities form advisory groups that

include local officials, tribal leaders, public health representatives, business groups, and water system operators.

Considerations

Community involvement can be cost-effective but requires dedicated leadership and long-term commitment to sustain momentum and participation. It is particularly effective in rural communities and small villages.

Example

A small Native village forms a citizen advisory group composed of local volunteers, tribal representatives, health consortium staff, and the washeteria operator. The group holds monthly public meetings to educate residents about practices that protect their drinking water source.