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An Evaluation Of Overlay For Wellhead Protection



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An Evaluation of Overlay Zoning for Wellhead Protection

By

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Abstract

Overlay zoning is inherently flexibility, and therefore is a valuable tool to prevent additional land use activities that may pose a risk to wells for public water supplies. To successfully implement an overlay zone, communities address issues concerning development pressures, current land uses, delineation of the zone, and scientific verification.

Several case studies illustrate the importance of public participation and a careful research effort to protect a public water supply. These research efforts include an identification and prioritization of risk and concise definition of goals.

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Introduction

This study examines how effective overlay zoning may be as a tool for wellhead protection programs. First, the paper deals with the advantages and disadvantages of this comprehensive tool. Second, legal considerations relevant to successful usage of overlay zoning are examined. From this information, a criteria is set forth where overlay zoning is the most appropriate tool for wellhead protection. Finally, case studies illustrate these criteria and are followed by recommendations. The case studies are representative of wellhead protection programs in several regions of the United States.

About half the United States population relies upon groundwater as a drinking water source. Public drinking water supplies constitute thirty-eight percent of all groundwater withdrawals (USEPA, 1977). Regulation of these public water supplies has shifted from at the tap standards to protecting at the source. Protecting groundwater at the source is essential because once contamination is detected, it is expensive to clean up, and the drinking water may never be fully restored. Monitoring land use activities that may potentially contaminate an aquifer is significant to communities that rely upon groundwater as their sole source of drinking water because they depend upon both good quality and quantity of water from the aquifer.

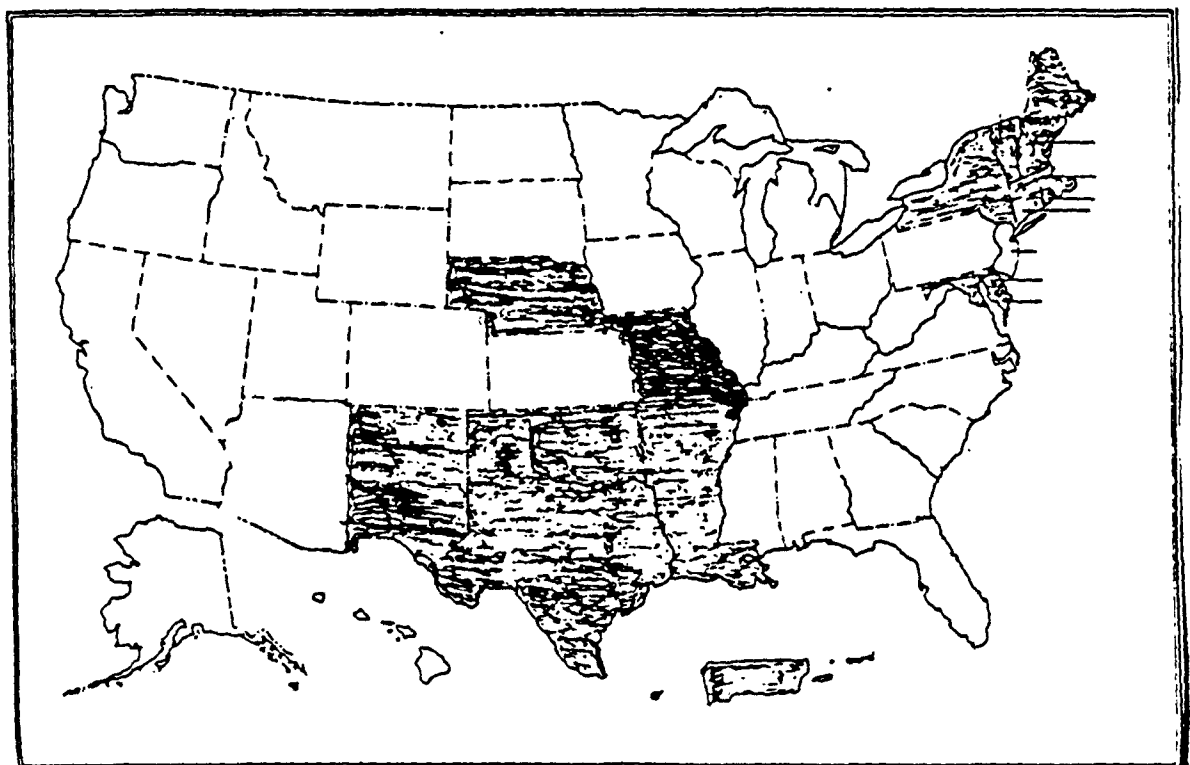
Groundwater pollution can not be seen so it is particularly elusive to the public, and yet it has been estimated that less than one gallon a week of leaking material can shut down a one million gallon per day well (Miller, 1984). Groundwater remediation is generally far more expensive than protection, and in thirty-five Minnesota cities groundwater remediation expenditures were over \$67 million, and in all cases "prevention was more cost effective than groundwater cleanup" (Freshwater Foundation, 1989). Similarly, before instituting a groundwater protection program to protect its spring, Clarke County, Virginia hired an engineering firm to conduct a cost-benefit analysis. The firm assessed the projected cost of treatment, developing alternative water supplies, and protecting the water supply spring. The cost-benefit ratio was found to be 3 to 1 or greater in favor of a groundwater protection program. In the event of contamination, replacing the spring would be seven times more expensive than protection.

Wellhead Protection

The 1986 Amendments to the Safe Drinking Water Act require that States adopt wellhead protection programs for existing wells serving community water systems and new wells as they are developed (D'Itri, 1987). These Wellhead Protection (WHP) Programs address guidelines and requirements that localities must follow when protecting public wells. "At a minimum, each State's Wellhead Program must:

- Specify roles and duties of State agencies, local government entities, and public water suppliers with respect to the development and implementation of WHP Programs;
- Delineate the wellhead protection area (WHPA) for each wellhead, as defined in subsection 1428 (e), based on reasonably available hydrogeologic information on groundwater flow, recharge and discharge, and other information the State deems necessary to adequately determine the WHPA;
- Identify sources of contaminants within each WHPA including all potential anthropogenic sources that may have any adverse effect on health;
- Develop management approaches which include, as appropriate, technical assistance, financial assistance, implementation of control measures, education, training, and demonstration projects that are used to protect the water supply within WHPAs from such contaminants;
- Develop contingency plans for each public water supply system indicating the location and provision of alternate drinking water supplies in the event of well or wellfield contamination;
- Site new wells properly to maximize yield and minimize potential contamination; and
- Ensure public participation by incorporating processes for appropriate involvement in WHP Program elements (Lew, 1989).

Figure 1 States with Wellhead Protection Programs



Source: (Flanagan, Erin; Groundwater Protection Division.
EPA, personal communication. October 1991)

Although wellhead protection programs address only public water supplies, private wells that share recharge areas benefit from regulatory actions addressing public wells. Most importantly, these programs generate a heightened sense of public awareness.

"Wellhead protection may be broadly defined as a program that reduces that threat to the quality of groundwater used for drinking water by identifying and managing recharge areas to specific wells or wellfields" (USEPA, 1991).

Seventeen states have Wellhead Protection Programs. The largest number of EPA approved programs is in the Northeast followed by the Southwest region in the Texas area (Figure 1). These states are eligible for federal funds to support their programs if Congress appropriates money in the future. Many states without Wellhead Protection Programs have provided technical assistance and policies that encourage voluntary protection programs. For example, Virginia promulgated a technical advisory board to recommend wellhead protection strategies. According to Lew (1989), nearly all states have some form of groundwater protection plan.

Differential management within Wellhead Protection Areas is a major component of wellhead protection programs. Less stringent regulations are imposed in zones around the well according to the distance and time of travel to the well. Some prevention or remediation of pollutants occurs so that areas further away from the well generally pose a less immediate threat. Regardless of the overlying materi-

al, the area closest to the well may be susceptible to contamination. Unconfined aquifers are "in direct vertical contact with the atmosphere through open pores" (Dunne, 1978). Confined aquifers are overlain by impermeable material. Still, natural and anthropogenic breaks in the confining layer provide a potential for contamination. For instance, karst aquifers composed of limestone formations often contain fissures, caves, and springs. In fact "pig bristles from carcasses dumped in sink holes have appeared in tap water miles away" (Dinovo, 1987). The well itself may be treated as a potential source of contamination to the aquifer particularly if it is not constructed properly. Regardless of the type of aquifer, the most stringent management zone is nearest the well to keep out contamination from microbes such as Giardia and E. coli. These microbes live for a limited amount of time, and the time of travel from outside of the protection zone to the wellhead is longer than the life span of the microbes.

I. Advantages of Overlay Zoning

There is a clear relationship between land uses and groundwater quality (South Tacoma Plan, 1985). Some communities have used overlay zoning as a tool for wellhead protection programs. "An overlay zone is a specific geographic area that is subject to special regulations in addition to any of an underlying zone (the basic zoning

district)" (Dean, 1991).

Overlay zoning is inherently flexible when special legislative acts permit its use to extend over municipal boundaries. The format may be tailored to the area so that only the wellhead areas are targeted and development options may be found outside the overlay zone.

A. Land Use Restrictions in Overlay Zones

Within overlay zoning districts, planners may impose a variety of restrictions on land uses such as requirements that limit the volume and location of septic tanks or designate a minimum lot coverage. By limiting density, the potential for septic tank contamination is reduced. Second, land use prohibitions within the overlay zoning district prevent certain uses such as junkyards, trash dumps, and mining operations. Third, activities may be restricted for selected businesses. For example, the type of chemical used by a business may be the basis for the regulation. Any businesses or industries that produce or store certain chemicals may be required to meet performance standards or comply with registration, monitoring, and/or inspection requirements. Limiting land use density, prohibiting certain businesses, and imposing standards upon businesses may be used in combination. Certain land uses may be prohibited in areas nearest the well. In the outer most zones a few prohibitions may be combined with performance standards.

B. Regulation of Groundwater in United States

The past history of contamination incidents demonstrates the need to upgrade groundwater protection efforts. Groundwater contamination of public wells in Cheshire, Connecticut and Provincetown, Massachusetts resulted in costly remedial actions. Cheshire, Connecticut invested a combined cost of \$2.2 million in water treatment facilities for two wellfields (Adams, 1988). The town of Provincetown, Massachusetts has spent \$1.4 million to clean up groundwater contamination from underground storage tanks; the final direct and indirect costs are estimated to reach \$25 million (Groundwater Hazard, 1985).

Many new environmental regulations have gone into effect but these regulations do not cover all potential sources of contamination. Currently, industry is heavily regulated, but accidents do occur. Spills of hazardous materials contribute significantly to groundwater contamination. Regulatory programs cover a small volume of hazardous materials. Enforcement of some regulations may not be comprehensive. Due to limited resources, inspections of hazardous waste generators are prioritized based upon size of operation and amount of hazardous waste (Aquifer Task Force, 1989).

Regulation of the polluter through existing or additional laws is an alternative to overlay zoning and may include specific health department restrictions on the use

of septic tanks, underground storage tanks or farm practices (D'Itri, 1987). Source controls do not take into account the cumulative nature of pollutants. "Those threats that individually pose the greatest threats to nearby wells may not pose the most significant threats to the community's groundwater resources; less hazardous activities that cumulatively discharge a greater amount of pollutants may in fact, pose greater risks to the aquifer" (Jaffe, 1987). Rock County, Wisconsin could have adopted source control measures to address localized threats. However, county planners discovered that cumulatively pesticides and fertilizers posed a greater potential long term risk than underground storage tanks (Hollman, 1991). Rock County adopted land use regulations because they can provide protection for all potential threats. Florida is considering incorporating source control regulations with locally administered well-head protection programs.

An accident or an accumulation of small leaks can render an aquifer unfit for use (Blatt, 1986). Monitoring is a valuable tool for detection of recognized plumes. However, plumes can be difficult to locate (Brieger, 1985). Regulators may not be able to identify all the significant contaminants in a plume. Over five hundred new synthetic organic chemicals are produced each year, in addition to the approximately 63,000 compounds already in use (USEPA, 1987). Given the number of chemicals manufactured, identification of potential sources of contamination is necessary to iden-

tify classes of compounds that a community might monitor. Monitoring is expensive, and in Littleton, Massachusetts it represented the most costly part of the groundwater protection program (EPA, 1984). Monitoring programs in such areas as Broward County, Florida are designed to "detect trace amounts of regulated substances in wells or in the water table before they reached the levels that would require shutting down wells" (Morgenstern, 1989).

Acquisition of land is the clearest form of control but its use generally is limited to the most critical areas because government funds are limited (D'Itri, 1987). The wellfield supplying water to Dare County, North Carolina is the sole source of drinking water for the county. The government has purchased 300 acres in the recharge area to the well and plans to purchase an additional 600 acres. These additional purchases will protect two-thirds of the recharge area to the wellfield (Sturza, 1991). Steven's Point, Wisconsin is also purchasing land around its wells and is developing a wellhead protection ordinance. An alternative to outright purchase would be the purchase of the development rights. If a local government purchases the development rights, a land owner maintains ownership of the property but is restricted from any development that might contaminate the water supply.

C. Difficulties Communities Encounter

In the communities of Manchester, Connecticut; Chices-

ter, Connecticut; and Lanesborough, Massachusetts several key zoning hurdles are being encountered and are summarized below:

- Communities may be reluctant to support land use controls.
- Existing businesses may wish to relocate where land use restrictions are not as stringent.
- Businesses may feel the regulations cause economic hardship.
- The land use controls may discourage new businesses from locating in town.
- Residents may have misconceptions about the application of protection measures and the potential dangers to their water supply.

Even in instances where most of the overlay zone may not be suitable for development, citizens often do not want to be told what they can and can not do with their land.

In a survey conducted by the planning department of Lanesborough, Massachusetts, citizens were overwhelming in favor of groundwater preservation. Members of the Town Council have not been able to agreed upon a groundwater protection strategy. In the midst of this uncertainty, the community has not agreed upon any proposed ordinance (Bean, 1991). Uncertainty was also a difficulty in Dare County, North Carolina. The inability of state hydrologists to agree upon an adequate radius for protection promoted many doubts in the community regarding what is scientifically justifiable. These doubts were expressed in the numerous public meetings that preceeded extension of the boundaries

for the wellfield protection area (Herdon, 1987). States with Wellhead Protection Programs and technical guidance support provide some uniform standard that may help localities resolve conflicting objectives. Planners in Brookings, South Dakota could not agree upon how much land the wellhead protection area should encompass, so they turned to state guidance documents and finally agreed upon an arbitrary half mile fixed radius as the interim overlay zoning district boundary.

Before adopting wellhead protection ordinances, two communities in Connecticut, Manchester and Cheshire, are waiting for the completion of state guidance documents. These communities intend to coordinate their programs with state objectives and believe that additional state support will facilitate passage of a wellhead protection ordinance. But initial protection plans need not always be deferred until other program requirements are developed. To prevent the possibility of conflicting requirements, Spokane, Washington has used very general underground storage tank requirements that will not conflict with the specificity of additional federal regulations in terms of tank construction requirements.

D. Coverage of Ordinance and Jurisdiction

With the enactment of special legislation, overlay zoning districts may be used on a regional basis to "protect environmental areas that transcend municipal boundaries"

Communities Sharing Aquifers

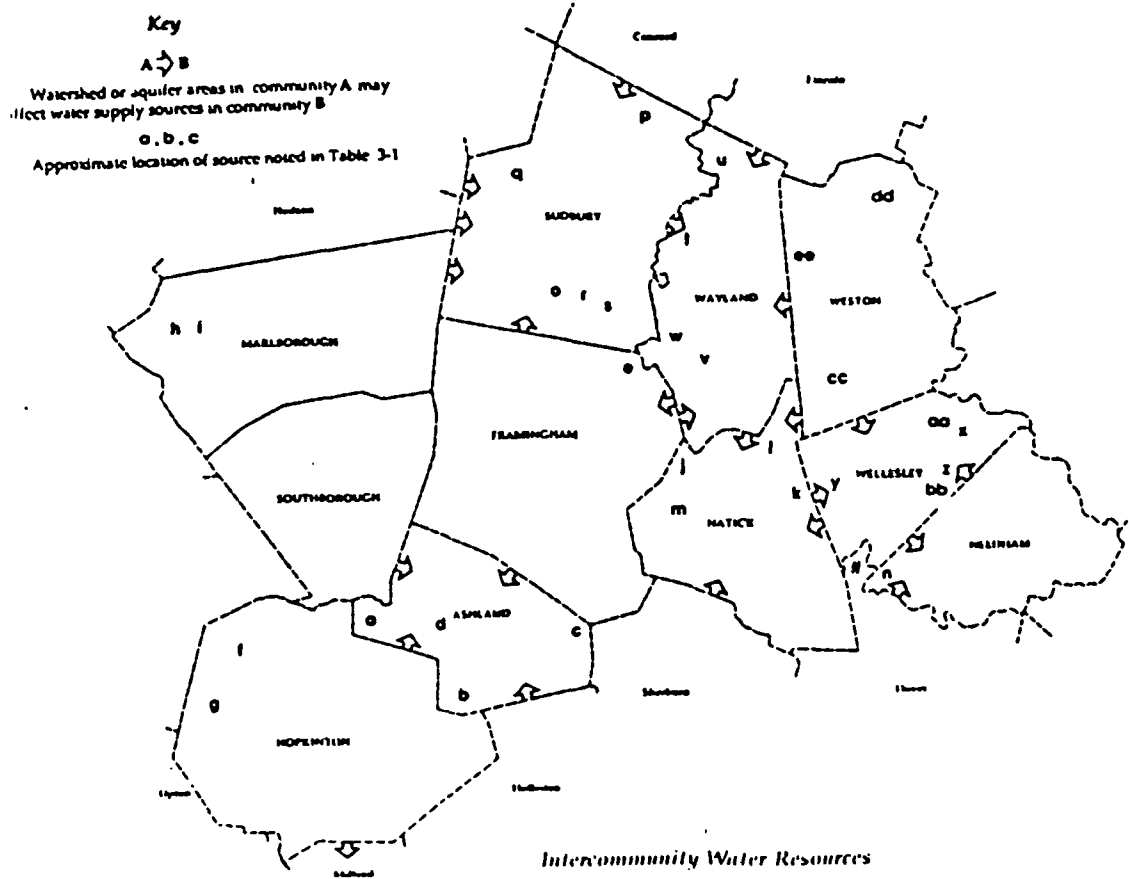


Figure 2 Intercommunity water resources among ~~eleven~~ towns in the Boston, Massachusetts Area (Metro, 1989)

(Blackwell, 1987). Zoning at a regional level is usually "carried out by a body with joint representation." Regional zoning commissions appraise the overall situation and control development for the whole region (Freund, 1968). For instance, the Chesapeake Bay Critical Area entails three countywide overlay zones to preserve the environmental integrity of the Chesapeake Bay (Proposed..., 1987). Also county and city ordinances may sometimes have overlapping zoning authority. For instance, in Brookings, South Dakota the city and county share a three mile joint jurisdiction because these boundaries are contiguous with their common water supply.

In areas where aquifer boundaries are shared by more than one community, overlay zoning may overlap and be difficult to coordinate. A study conducted by the Metropolitan Area Planning Council (MAPC) for eleven communities in the Boston region determined that watersheds or aquifers cross over one or more communities in most of the localities so that protection strategies are essentially "fragmented among the jurisdiction of several communities" (Metro, 1989). Potential polluters from one locality are located in the recharge zones of another (Figure 2). The MAPC has provided a technical study document that defines recommendations for individual communities based upon an areawide approach. They have made significant progress initiating regional cooperation and memoranda of understanding between communities (Metro, 1989).

The Metropolitan Area Planning Council is one of several regional planning agencies that promote regional groundwater protection. Some of these agencies, notably those in Texas and Florida, have the authority to regulate groundwater regionally. Regional protection efforts are particularly important for communities that obtain their drinking water from aquifers that extend over large areas.

Hydrogeological formations may also favor an areawide approach because it may not be appropriate to regulate around individual public wells. In Spokane, Washington planners found that delineating around individual wells would result in an overlay zone 100 x 10 yards that would be difficult to regulate. These town planners chose to protect the aquifer rather than individual wells (Miller, 1991).

II. Wellhead Protection Programs Using Overlay Zoning

Localities develop wellhead protection plans based upon very different initial conditions. An area's current land use patterns, the vulnerability of their wells, and the availability of alternative sources of drinking water all influence the degree and nature of the tools used to protect the community's drinking water.

A proactive approach to wellhead protection prevents contamination in the Wellhead Protection Area before it occurs. Ideally an overlay zoning district designed to protect public water wells would be entirely proactive and thus minimize risks of contamination while maximizing wise use of resources. Overlay zoning is best suited to preventing new land use activities that have the potential to contaminate public wells. Since cumulative land uses may pose a threat to groundwater, communities such as Hopkinton, Massachusetts consider the capacity of the area to support land uses when developing their comprehensive plan.

A. Level of Development

Many communities have prime industrial lands in recharge zones, conflicting land use objectives, and are already heavily developed. In some areas, such as Dayton,

Ohio, the aquifer recharge areas are along the major transportation corridors and prohibiting development in these areas is not feasible.

Often preexisting uses pose a potential threat to groundwater. Many municipalities have realized that regulations should apply to existing uses by requiring that they comply with "requirements designed to minimize the risk of groundwater contamination" (Aquifer Protection Task Force, 1991). Existing businesses that do not conform to the zoning ordinance are usually "grandfathered." Under grandfathering provisions, nonconforming uses are generally allowed to continue as long as they do not expand or intensify their activities.

In the case of Sullivan v. Zoning Board of Adjustment (1984), the court recognized that a majority of appellate courts have upheld amortization of nonconforming uses as a constitutional exertion of a municipality's police power. However, these past decisions have not resulted in consistency concerning nonconforming uses. In the recent case of Northwestern Distributors, Inc. v. Zoning Board of Town of Moon (1991), the Supreme Court of Pennsylvania decided that municipalities can not compel nonconforming uses to make a change in nature or make additions to property as long as these changes are not detrimental to the health and safety of the community. Essentially, treatment of nonconforming uses depends upon a state's zoning enabling legislation. For example, in Massachusetts state law requires that all

zoning bylaws have grandfathering provisions for nonconforming uses. No additional zoning requirements may be imposed upon grandfathered activities. In states with similar state zoning enabling legislation, zoning is a weak tool for regulating existing land use activities that pose a risk to a well.

Prohibiting existing uses that pose a potential threat to the well is generally not acceptable because it prevents a landowner from using the land as he had intended. In Rib Mountain, Wisconsin if nonconforming uses pose a severe threat to groundwater, they may be phased out and owners must be compensated. Broward County, Florida chose to remove fourteen threatening land activities from the zone in close proximity to the public wells. These land uses were prohibited from this zone because they used one of the regulated substances listed in the ordinance. The county provided compensation totalling \$1.5 million for activities involving "changes in operation to stop use of regulated chemicals" and relocation of businesses (Morgenstern, 1989).

B. Reducing Risks

Complete elimination of risks is rarely the goal of overlay zoning, and it is particularly infeasible in highly developed areas. "Where a community has other goals encouraging development, the attainment of such a nondegradation goal is practically impossible" (Jaffe, 1987). For example, in Rock County, Wisconsin, Dave Hollman (1991) of the

Environmental Health Department commented that wellhead protection may just delay the problem for their county. Rock County is largely agricultural except for two urban areas with a population of 34,000 and 50,000. The entire county area may be considered a recharge area. Groundwater flow is from the rural areas into the central part of the state. Protecting the entire county area is crucial to protecting groundwater in the county, which consists of 100 private wells (Hollman, 1991). Initial steps to protect groundwater may be incomplete but represent progress which should be revisited as resources become available. Preliminary protection measures may include wellhead delineation by an arbitrary fixed radius and conservative protection measures. In most cases, additional hydrogeologic studies and any necessary revisions to the Wellhead Protection Area are initiated as funds become available.

C. Prioritization of Contamination Risks

Communities prioritize the risks to their groundwater differently. For example, a community with numerous small business that each use a small quantity of hazardous materials may choose to exempt many of these businesses from any zoning ordinance requirements because they use a small volume of the hazardous materials. However, the land use plan adopted in Tacoma, Washington notes that "large industries may not be the most likely sources of toxic pollutants but small businesses such as gas stations, dry cleaners,

[and] auto shops" may pose a greater threat. These sources can not be specifically pinpointed but cumulatively they may pose a greater threat from improper disposal. So, these small businesses are included in Tacoma's land use regulations (South Tacoma Plan, 1985).

Several innovative zoning approaches include monitoring businesses using ordinance-defined regulated quantities of chemicals (Spokane, Washington) and the registration and monitoring of all industries using hazardous materials (Stoughton, Massachusetts). Where no potential contaminating businesses are present, some of the ordinances categorically prohibit all businesses using hazardous waste materials and other potentially contaminating threats from the zone of influence.

The risk prioritization scheme used by Rock County involves a scoring of pollution risk factors which incorporate potential loading rate, toxicity, concentration, frequency of discharge, and distance from the source to the public water supply. Hollman (1991) determined that underground storage tanks have the greatest short term risk followed by old landfills that may be on the Superfund list. The greatest long term risk is from pesticides. Once priorities are established, groundwater protection strategies must be spread out uniformly so that the strain of regulation is not a serious economic disadvantage.

D. Public Participation

As noted by Wayne Weikel of the Virginia Water Project, "public awareness is the biggest hurdle in getting wellhead protection started" (Water News, 9/91). For this reason Fincastle, Virginia organized a meeting in which state and federal officials provided information to the community and started a newsletter for local residents and government officials.

Voluntary cooperation is an important goal of public education and is a valuable tool to gain support for an ordinance. For example, Texas enlists volunteers to help them inventory potential sources of contamination. The volunteers are knowledgeable about the area and supplement existing records (Harris, 1991). In Tacoma, Washington a technical advisory committee addressed concerns of the business community (Merry, 1991), and in Spokane, Washington a group of thirty citizens were directly involved in drafting of a groundwater protection ordinance (Miller, 1991).

Compliance may be maintained partially through education. Public education programs may be tailored to encourage proper disposal of hazardous household waste, careful use of pesticides, and maintenance of septic tanks.

III. Legal Considerations of Overlay Zoning Districts

A. Police Power and Regulatory "Takings"

Localities may impose reasonable restrictions upon land uses that could potentially contaminate a public groundwater supply. The purpose of these restrictions is to protect the public welfare which is a recognized police power entrusted to local governments. When developing a wellhead protection program, planners should pay close attention to the legal defensibility and scientific validity of proposed regulations. A great deal of uncertainty surrounds the use of overlay zoning for wellhead protection. As expressed in the Fifth Amendment, the Federal government can not take private property for public use without just compensation. Courts have ruled that the due process clause of the Fourteenth Amendment imposes a similiar restriction on the States.

Within this constitutional framework, zoning is an important environmental protection tool. But prior to 1926, the courts viewed zoning as class discrimination. The case of Village of Euclid v. Amber Realty Co. (1926) set the precedent that zoning was to prevent a nuisance which might be termed "the right thing in the wrong place." Zoning is considered a constitutional use of police power as long as

the restrictions are not arbitrary and unreasonable and have "substantial relation to the public health, safety, morals or general welfare." Overlay zoning allows development options to businesses wishing to locate within a local jurisdiction.

Several cases have addressed the constitutionality of zoning functions that restrict a landowner's use of property. Most land use restrictions fall far short of confiscation; still these lesser invasions of property via regulatory actions may be considered a regulatory "taking" and require just compensation under some circumstances. No consistent body of cases address regulatory "takings". The takings issue has been further complicated because police power functions have been broadened to encompass regulation of the environment and public welfare.

Property may be regulated but when a regulation goes too far it will be recognized as a "taking" requiring compensation. The extent of regulation is left open for determination based upon the facts of the situation. The process of developing land use regulations in Dare County, North Carolina included hydrologic studies but indecision was found amongst the experts. In the midst of this technical uncertainty, the applicability of land use restrictions was unsuccessfully questioned by several landowners. They attempted to prove that the regulation had no scientific basis applied to their property and the regulation would leave them no options for profitably using the land.

Probably the most significant recent case is Pennsylvania Central Transportation Co. v. New York City (1978) which sets forth a three part test to determine whether there has been a "taking. A "taking" may be ruled if any of the following occur:

1. a physical invasion of the property
2. the restriction is not "reasonably related...(to) public benefit"
3. no reasonable return on investment in the property

Some aspects of the "takings" ruling have not changed since the case of Hadacheck Co. v. Sebastian in 1915. The courts established that when the police power is reasonably related to the public welfare, an individual may suffer losses without compensation. In the case of Pennsylvania Coal v. Mahon (1922), Justice Holmes agreed that "some values are enjoyed under an implied limitation and must yield to the police power." But, when the effect of a regulation weighs too heavily on a single individual there must be compensation.

Recently this three part test has been used in two court decisions. Dufour v. Montgomery Co. Council (1983) found no "takings" in an agricultural zoning ordinance that imposed lot size requirements because it was reasonably necessary for public protection of a crucial resource. If a plaintiff can prove that the ordinance deprived him of all beneficial use of property he may be compensated. This was the case with Annicelli v. Town of South Kingston (1983)

where a developer was restricted from development along a shoreline. Furthermore, in the case of First English Evangelical Lutheran Church of Glendale v. County of Los Angeles (1987), the Supreme Court ruled that a county must provide a forum for damage claims for present and past "takings." The defendants claimed that a county ordinance prohibiting construction with an overlay floodplain deprived them of all use of the land. The court dismissed the "taking" issue because the church did not exhaust all legal remedies.

A. Zoning to Protect the Environment

The zoning power of local government has grown to include protecting the environment. For example, the requirement that all lots be at least five acres within the recharge zone for the Biscayne Aquifer because the aquifer supplied drinking water to Dade County, Florida was challenged in Moviematic Industries Corp. v. Board of County Commissioners (1977). However, the court ruled that ecological preservation was a "valid exercise of the police powers as it relates to the general welfare." The court rejected the "taking" claim because development was still allowed and reasonable property use right remained intact.

1. Permit Programs

Permit programs, such as those required under the Coastal Zone Management Act impose restrictions upon land

use activities. In Dare County, North Carolina much debate stemmed from whether or not the Coastal Area Management Act (CAMA) program was a zoning function which might usurp power from the local governments and deprive land owners of their right to use their property. To withstand the legal challenges that ensued, the permit program had to be legally defensible. The use of the permit process has been upheld in the case of Adams v. Department of Natural and Economic Resources (1974). The court ruled that the CAMA program did not constitute a regulatory "taking" unless by denying the permit the landowner is deprived of practical use of property. The landowner has some practical use of his property if alternatives are available. Tom's River Affiliates v. Department of Environment (1976) further explained that a "taking" could not be granted if "reasonable development alternatives were available to landowners." Some local governments have used transferrable development rights to ensure alternatives for landowners.

2. Performance Standards

The specificity of the restriction and the area that it covers is another important consideration when adopting a land use regulation. Land use activities that pose a risk to an aquifer may be banned in the recharge zone or subjected to performance standards. Some land use activities are banned in an immediate zone around well and subjected to performance standards in a designated zone further away from

the well. These performance standards allow uses when certain specifications are met which account for variations in the "impacts of certain uses." Dube v. Chicago, (1956) upheld the constitutionality of performance standards as long as there is no "constitutional infirmity" and there is a "reasonable basis in available information."

Precision standards should employ a scientifically known level of performance and measurement. Precision standards are less likely to be questioned than primitive standards which are based upon nuisance law. Standards that are scientifically defined generally meet Nollan v. California Coastal Commission's (1986) test that land use regulations maintain an adequate "nexus" with governmental land use objectives. The Beaver Bass Co. v. Osborne Borough (1971) case found that zoning ordinances which exclude a particular business from a municipality must display a greater nexus to protection of public welfare as a police power than those that confine a "business to a certain area in the municipality."

Although more likely to be judged as arbitrary, primitive standards have been upheld in several cases such as Dube v. City of Chicago (1955) which banned land uses causing substantial injury to neighboring property values. But in the case of Beaver v. Borough of Johnsonburg (1976) the standards were invalidated because no criteria was provided for local planners to make permit decisions prohibiting certain land uses.

Another important zoning consideration is the impact of regulations on the community. Rezoning an entire area for environmental purposes may be held invalid as it was in the Pine Bush Inc. v. City of Albany case because the town did not consider the cumulative effects of development on the area.

C. Bargaining Process in Planning

These cases show why "takings" are one of the most unsettled areas of the law. Conflicting interests between property owners, (particularly developers) and industries require arbitration. Some communities have provided a forum for incorporation of these concerns into the process of zoning ordinance development. For instance, Tacoma, Washington, after reaching a stalemate with the provisions of the first draft of their overlay zoning ordinance, chose to address the concerns of the business community in a technical advisory committee which helped them when developing subsequent revisions (Miller, 1991).

These differing perspectives are arbitrated by balancing the degree the land use impact against the burden to private property owners. The "degree test", set forth by Justice Holmes in the Pennsylvania Coal case, involves a valuation of public good and individual property rights. Hippler (1987) argues that the degree test constitutes a public nuisance exemption to the "takings" clause. "If a

proper public purpose exists, the state may directly arbitrate among competing property uses using the police power to prevent nuisances." This arbitration process balances concerns of land owners and the objectives of groundwater protection.

D. Legal Accountability of Overlay Zones

The use of overlay zoning in wellhead protection programs was recently questioned in the case of Curry v. Planning Commission of Clarke County, Virginia (1991). Developer, Arl Curry, was not granted a boundary adjustment because he failed to meet the overlay zoning requirement. He could not demonstrate that his proposed subdivision would not "adversely affect the water quality of Prospect Hills Spring." He filed a petition against the County claiming that the Commission's decision was arbitrary and capricious and represented a "taking." The court upheld the County's decision to deny a subdivision permit because the subdivision plan failed to meet requirements of the Natural Resource Conservation District Overlay Zoning District. The court did not discover a "taking." The requirements except for the bond requirement are reasonably necessary for county to carry out its responsibilities.

Some of the competing interests in overlay zoning proposals have been questioned in litigation proceedings. Overlay zones impose additional requirements on certain land uses. Henry Bartholemew Cox v. Prince George's County

(1991) questioned whether or not activities receiving exemptions to the basic zoning ordinance could still be subject to the same type of requirements in a overlay zoning ordinance. Cox questioned whether or not density requirements of the Critical Area Program in the Chesapeake Bay were applicable to a building granted an exemption in the Conservation Overlay District. He contended the evidence reasonably met goals set forth in the Bay's Master Plan. The exemption required a factual written justification by an examiner. The court evaluated the decision to determine if a "reasonable mind" would come to that conclusion. The court upheld the exemption and required that a permit be granted for the building. The court determined that according to the purpose of the Critical Area Program, the defined density criteria was applicable to any special exceptions even though the purpose of the Critical Area Program defined the density criteria after the zoning ordinance.

Tohickon Valley Transfer Inc. v. Tinicum Township Zoning Hearing Board (1986) refers to a boundary and definition problem of an ordinance which excluded a trash transfer station from locating in a floodfringe overlay zone. The case defined the exactitude of zoning district boundaries in making land use decisions. In the decision, the boundaries were ruled inelastic and inflexible.

The town modified its zoning ordinance but did not specifically include trash transfer stations as permitted

uses. But the language of the ordinance still included trash transfer stations within the category of junkyards; therefore, trash transfer stations were by definition still an acceptable activity. Because the definition was not ambiguous it was binding.

Tinicum misinterpreted the floodplain provisions and map. Their decision to exclude the transfer station from the floodfringe was ruled arbitrary and therefore had no legal basis. The definition of the floodplain is given as the 100 year flood. Floodway was defined on the zoning map as an overlay district rather than by 100 year flood. The overlay boundaries were distinctly defined. The town had no legal warrant to extend the overlay zoning boundaries which would have prohibited legal activities outside the boundaries defined in the ordinance. The court determined that the transfer station was a permitted use. The court ruled that zoning boundaries must appear as definite lines on zoning maps which can not be "elastic and movable, lest they be used as tools for non-uniform enforcement" Tohickon Valley Transfer Inc. v. Tinicum Township Township Hearing Board, 1986).

In these two cases the definitions given in the ordinances were clear and unambiguous and thus precluded any common definition or interpretive determination. In an effort to remove any additional restrictions on potential development, property owners often question the boundaries of overlay zoning districts and the defined boundaries of

the zone of influence to a well. To ensure that a zoning ordinance is legally defensible, an adequate research effort to determine boundaries of the recharge area is necessary.

Zoning to address environmental concerns is a recognized activity of local governments. Permit programs, prohibitions, and performance standards may be used to achieve this purpose as long as a clear relationship exists between protection of public health and scientifically justifiable regulations.

IV. Case Studies

Public involvement, boundary definition, clarification of regulations, and ongoing evaluatory efforts are common elements in the case studies of Dare County, North Carolina; Stoughton, Massachusetts; and Brookings, South Dakota. The case studies are divided into three sections. The first two case studies of Hopkinton, Massachusetts and Stoughton, Massachusetts illustrate the use of overlay districts as a zoning bylaw and as a general bylaw in accordance with State law. The Brookings and Rib Mountain cases emphasize the initial involvement of public education in developing a successful wellhead protection program. The groundwater contamination potential varies from community to community. So, the last two case studies concerning Dare County, North Carolina and Clarke County, Virginia are included as examples of the combination of programs that may protect a public drinking water supply. The Dare County, North Carolina case study also shows concerns during the development of a wellfield protection program and how different groups responded.

V. Limitations of Overlay Zoning in Massachusetts

Hopkinton, Massachusetts

The town of Hopkinton, Massachusetts has developed zoning bylaws that address protection of the three public wells and wetland buffer zones. Groundwater protection is one component of protecting environmental quality, and Hopkinton's master plan is resource based. Growth projections are based upon amount of development the environment can support rather than projections based directly upon economics and growth data. Residential land uses comprise nearly forty percent of the land use area with sixty percent of the remaining area forested. Industries occupy only one percent of land and pose very little potential threat to the water supply (Hoxie, 1991).

Many surrounding towns have experienced groundwater contamination forcing some towns to look for alternative sources of drinking water. The sources of potential contamination in Hopkinton include road salt, underground storage tanks, wastewater from chronic septic tank failures, hazardous waste, and mining. Existing uses are grandfathered under the provisions of the zoning bylaw.

As a nonconforming use, existing underground storage tanks are not subject to the bylaw. The threat of potential contamination from these tanks is clear, for in an eleven

town region including Hopkinton forty-six percent of underground storage tanks are over fifteen years old (MetroWest, 1989). The town does not currently have records of all underground storage tanks-- only those in excess of 1000 gallons. Only twenty percent of the town is sewerred and septic tank failures occur in some areas including the downtown area. The health department is conducting an education campaign to encourage septic tank owners to pump tanks frequently and dispose of hazardous waste properly.

Groundwater supplies in many of the communities may be affected by neighboring jurisdictions. The Metropolitan Area Planning Council has provided technical assistance throughout the region to coordinate the development of wellhead protection programs. The Council recommends that communities develop memorandums of understanding to formalize long term cooperation between communities.

The Metropolitan Area Planning Council prepared a technical assistance document through funding from the Clean Water Act. Their study provided an inventory of water resources, land uses, potential impacts of new development, and existing regulatory protection tools for Hopkinton and eleven other towns in the region. Based on this information they recommended protection and mitigation measures (MetroWest, 1989). The general bylaw has had a strong base of support, for in 1990 the town passed the water resource protection bylaw almost unanimously.

The Commonwealth of Massachusetts has zoning enabling

legislation that requires zoning ordinances to have a grandfathering clause. Massachusetts requires that nonconforming uses in zoning bylaws not be subject to additional requirements under the bylaw. Based upon the MetroWest Area Planning Council's recommendation, Hopkinton is looking into incorporating Board of Health regulations into its overall groundwater protection scheme. These general regulations could be used for monitoring and regulation of existing uses (Hoxie, 1991). Another town, Stoughton, Massachusetts, chose not to use a zoning bylaw. The general bylaw provides a tool to regulate the many nonconforming businesses that could not be addressed with a zoning ordinance.

Stoughton, Massachusetts:

A General Bylaw

The residential town of Stoughton, Massachusetts, population 25,000, is located in an area of low rounded hills, plains, and valleys in eastern Massachusetts. The town council adopted a general bylaw in 1990 to protect its wellfield, and the Board of Health administers the bylaw. Developed land makes up about forty percent of the town. Residential is the primary use and most of the undeveloped land is forested. In the residential zone, many non-residential uses are permitted including site coverage of up to fifty percent with building areas of up to thirty percent.

Initiation of Program

Groundwater is the sole source of drinking water. The need for groundwater protection arose from a water shortage problems that had been recognized since 1949. Shortages of water in 1979 led to a moratorium on additional connections so all new development relies on private wells. Stoughton has submitted a proposal to expand the wellfield to the state for review. The town has had an agreement with neigh-

boring communities to supply water in water emergencies. In 1980 additional well sites were investigated.

Initial wellhead protection measures were proposed through a zoning bylaw. But because there was little public support the regulations were not adopted. Several maps were drawn up and rejected until a half mile radius was decided upon. No special committees were formed to develop the regulations; the Town Council and the Board of Health drafted the bylaw. According to Phillip Farrington (1991), Town Manager, the development of the general bylaw grew out of the revision process of the zoning bylaw. The bylaw has the dual focus of regulating activities around the public water supplies and establishing storage and handling standards of hazardous materials.

Vulnerability of Aquifer to Contamination

Seven wells located in a significant sand and gravel aquifer provide a safe yield of 2.6 MGD and two future wells have been developed. A proposed well is also included in the wellhead protection program.

Potential sources of contamination include underground storage tanks, septic tanks, road salt, leachate from a landfill, hazardous wastes, and pesticides. Contamination has been noted in some private wells and some low level solvent contamination has been found near a hazardous waste site outside of a half mile zone from the public wells.

Stoughton, Massachusetts Overlay Zoning District

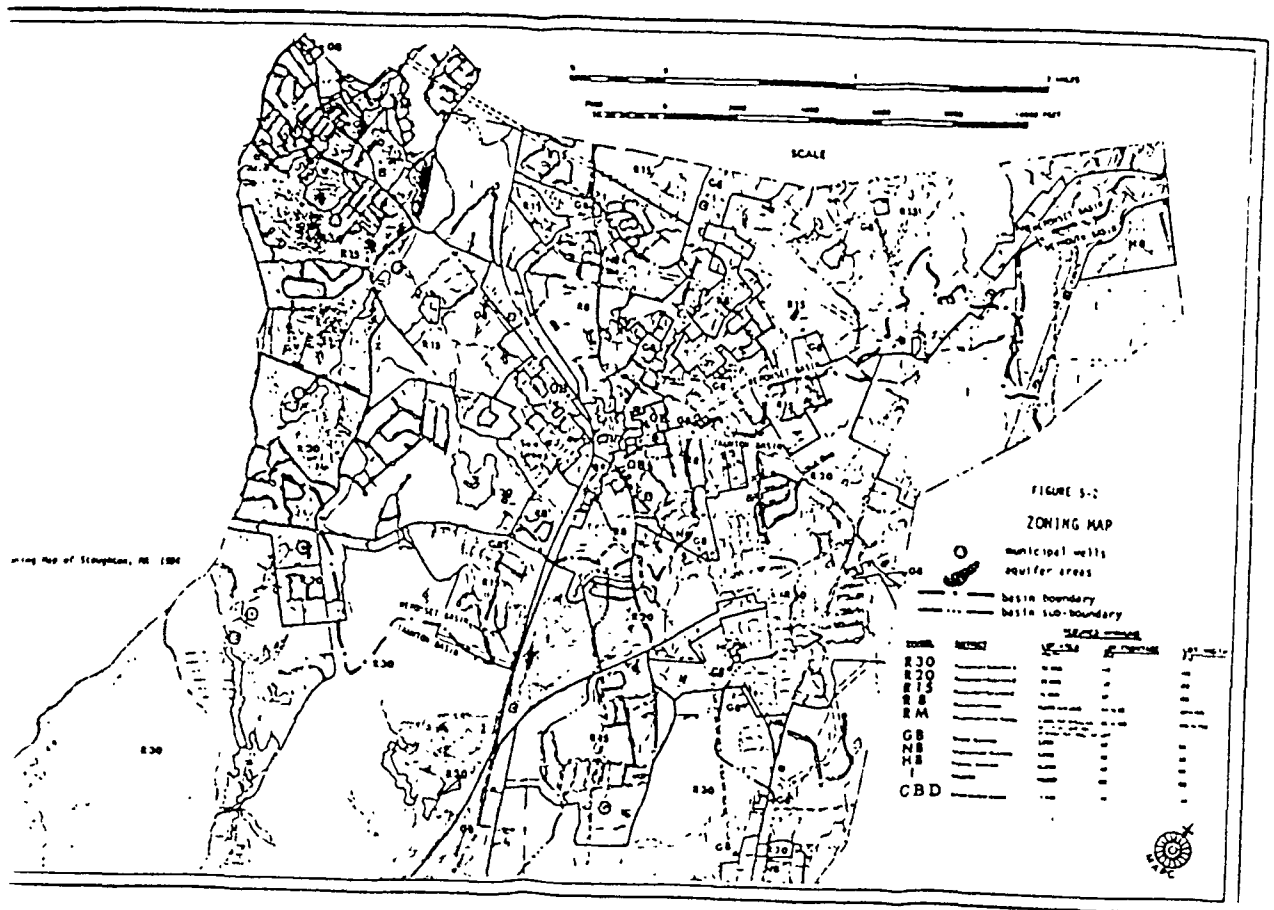


Figure 3 Stoughton Protection Area

Source: Stoughton Groundwater Study, 1987

There are no business or industrial districts within the overlay zone. But there is an industrial district partially in an area for a potential well in the south-central section of Stoughton. The area has many underground heating tanks for residences that are forty or more years old. Two hazardous waste landfills fall outside the half mile radius. In the wellhead protection area risks to the public wells are addressed through prohibitions and performance standards (Figure 3).

Priorities

The bylaw does not prohibit all potential threats; the primary objective is to prevent "contamination with hazardous materials" (SGS, 1987). The Department of Environmental Protection (DEP) guidance from the Massachusetts Wellhead Protection Program defined much of the directional support for the bylaw. The bylaw addresses the risk of hazardous materials as the primary focus. Although underground storage tanks are grandfathered, Stoughton recognizes the potential risk from these tanks and has sought funding to assist homeowners in the removal of these tanks. State regulations also address standards and monitoring requirements for all new underground storage tanks. Massachusetts will soon adopt regulations which will designate the maximum lot size for septic tank installation and thus indirectly address the risk of septic tank failures (McCarthy, 1991). Clearly looking at priorities will be necessary to determine which

activities need to be closely monitored.

Participation in Development and Attitudes

Initially a study was conducted by the Metropolitan Area Planning Council to provide technical assistance to Stoughton. Using the Council's study, planners for Stoughton drafted the bylaw. The local officials had a consensus of opinion on the delineation and the needed protection measures. The planning staff was available for public input and they visited organizations and submitted information to other town bodies. The Massachusetts Department of Environmental Protection (DEP)'s written review in support of the bylaw strengthened support for the bylaw. A study of groundwater was conducted under a grant from the Metropolitan Area Planning Council. The strategy of the study was to inventory the water resources, land uses, and sources of contamination to recommend protection measures.

Environmentally conscious individuals played a role in promotion of the bylaw. The active citizenry prompted the adoption of a general bylaw which lacked provisions for grandfathering. Approval of a hydrogeologic study via a town meeting appropriation of \$125,000 was also contingent on approval of the bylaw.

As part of inspections during the development of the ordinance, businesses received feedback on how they would be affected by the regulations. So they knew what to expect

and how to comply and were generally comfortable with the regulations (McCarthy, 1991).

Determination of the Overlay Zone

The interim overlay zone, as recommended by the Commonwealth of Massachusetts, are delineated by a half mile radius around the wells and they include both current and proposed water supplies. A hydrogeological study using computer modeling was completed in 1991 to delineate a zone II or primary recharge area.

Coverage of the recharge area to the wells that may impact them will be more clearly defined by the hydrogeological study. The interim protection area is necessary until financial resources become available. Among the 1,200 public supply wells in Massachusetts, only about 10% have received approval for the zone II determination. In terms of protection these additional delineations are important. Russel Cohen (1990) for the Riverways Program noted in a letter to DEP that since wells near rivers and streams "often receive a substantial contribution from them...it is necessary to keep sources of pollution out of the watershed which contributes water to the wells that is to "minimize all sources of pollution upstream of the wellhead." Furthermore, scientifically verifiable studies are necessary to justify any new designations. In Stoughton's case, many delineation scheme's were rejected until DEP's recommended

half mile radius was chosen as an interim standard.

The neighboring town of Sharon overlaps with the outer boundaries of the recharge area but is primarily residential and poses no perceived threat to drinking water in Stoughton. For any issue outside of its jurisdiction, local officials can work with the state which encourages regional cooperation. The New England Interstate Water Pollution Control Commission provides information across state boundaries and facilitates wellhead protection across state boundaries. The state can set up memoranda of understanding and charters through legislation.

General Bylaw Regulations

The focus of the bylaw is to prevent pollution of the environment from hazardous materials. Figure 3 shows the aquifer protection area. All industrial and commercial establishments within the zone are required to register annually with the Board of Health and include identification, location, and safety plans associated with hazardous materials.

Industries were inspected during the process of the bylaw drafting. Gena McCarthy of the Board of Health saw the inspection program as important to gaining support from businesses who were willing to institute protection measures if they knew how the bylaw would affect them. The Board of Health cannot grant variances within the Aquifer Protection

Zone for any of the prohibited activities. For this reason, the National Association of Industrial and Office Parks, representing the business interest of Stoughton, opposed the general bylaw alleging a zoning bylaw was necessary to provide provisions to industry. Provisions to prohibit auto services and junkyards from the overlay district are included in a separate zoning amendment which grandfathers existing facilities. Another groundwater protection tool used in Stoughton is the implementation of a household hazardous waste collection project.

Enforcement

Stoughton has an environmental enforcement officer who enforces the provisions of the general bylaw and health regulations. Seventy businesses have been registered and legal action is being taken against a small number of violators. Some flexibility on the storage of hazardous waste allows for variances through the Board of Health. The focus is on "education of residents and businesses in the proper handling of hazardous materials." Through annual registrations industrial practices are monitored (Metro). Six monitoring wells have been installed one of which monitors a hazardous waste facility which shares the cost of the monitoring program.

Conclusion

The bylaw is one of the first general bylaws in Massachusetts to combine wellhead protection and hazardous material regulation, and the Attorney General termed it one of

the best general bylaws of the state (Farrington, 1990). Important components of the ordinance include registration, inspection, and monitoring requirements. The comprehensive approach is further enhanced by the continued efforts to amend the mapping of the zone. These efforts focus upon strategies to minimize risks. Supporting regulations to address other risks which may occur from septic tank failure are also necessary.

VI. Preventing Degradation of the Water Supply

Rib Mountain, Wisconsin

Rib Mountain is a suburb of Warsaw, Wisconsin. In 1985 the town adopted one of the first wellhead protection ordinances in Wisconsin. The communities to the north and south of Rib Mountain have experienced problems with contamination of their wells from organic chemicals and nitrate. Rib Mountain draws its water supply from a highly permeable unconfined aquifer recharged directly from precipitation and surface discharges from higher elevations. The town is upgradient from the wellfield which lies near the Wisconsin River. The entire basin contributes to the wells, and so the wells are quite susceptible to contamination. For this reason, regulating "existing sources of potential contamination, in addition to controlling new land uses" is important (Westover, 1991). The town can not control river quality, and so regulation of the cone of depression is necessary to prevent river water influence. A overlay zoning ordinance was established in conjunction with the development of three public water wells and the public sewer system. The purpose of the ordinance is to prevent degradation of the municipal groundwater. The ordinance imposes restrictions on land within the recharge area and prohibits activities that have the potential to pollute groundwater (Wisconsin Geological Survey, 1988). In zone A, the primary recharge zone, essentially all activities that may contaminate the wells

Rib Mountain Overlay Zoning District

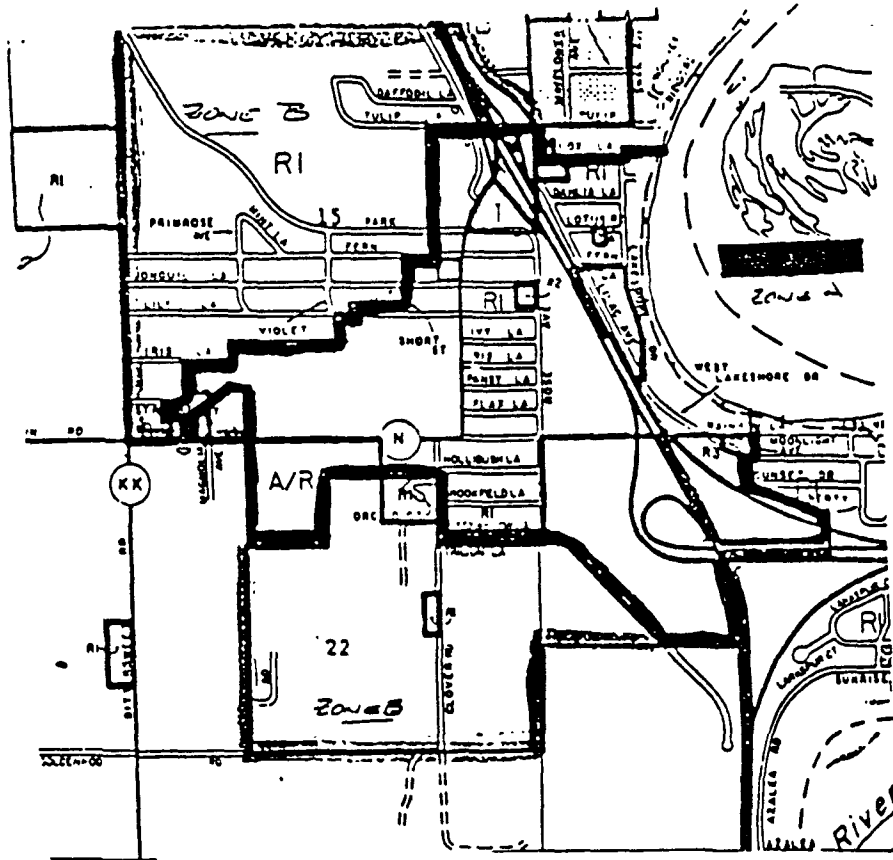


Figure 4 Rib Mountain Recharge Area Overlay District

Source: Wisconsin Geological..., 1988

are prohibited, and in zone B all businesses and industries are conditional (Figure 4). Since 1985, the ordinance has resulted in one occasion where a business was denied a permit to locate in the primary zone (Westover, 1991).

According to the Wisconsin Department of Natural Resources and the County's health department, underground storage tanks currently pose a greater immediate threat to municipal groundwater than any other prohibited activities. County Planner, Joseph M. Pribanich (1985) recommends that the town develop a program for removal and extensive monitoring of underground storage tanks within the zone.

The local government is now considering restricting the use of certain pesticides and fertilizers. Because the area was not heavily developed, the ordinance passed with relatively little opposition or public involvement. Now some development pressures are emerging, and development patterns are being established outside the overlay zone. Information forums are an important part of current public education efforts (Westover, 1991). The process of developing an overlay zoning ordinance involves a research effort, and another community, Brookings, South Dakota has made a commitment to public education as part of its protection program.

Rib Mountain
Recharge Area Overlay Zoning District

Zone A

Prohibited Uses/ Activities:

1. trash dumps
2. asphalt product manufacturing
3. automobile laundries
4. auto service stations
5. building material and production sales
6. cartage and express facilities
7. cemeteries
8. chemical storage, processing plants
9. dry cleaning operations
10. electronic circuit assembly
11. electroplating plants
12. exterminating shops
13. fertilizer manufacturing or storage
14. foundaries or forge plants
15. service garages
16. highway salt storage
17. industrial liquid waste storage
18. junk yards
19. metal reduction, refinement
20. mining operations
21. motor and machinery shops
22. motor freight terminals
23. paint product manufacturing
24. petroleum storage
25. photo studios
26. plastics manufacturing
27. printing and publishing
28. pulp and paper manufacture
29. residential dwelling greater than 15000 ft.
30. septic tank disposal sites
31. sludge disposal sites
32. manufacture or storage of hazardous materials
33. residential or commercial underground storage tanks
34. wood product manufacturing

Conditional Uses

1. animal waste storage areas and facilities
2. large scale irrigated agricultural operations

Zone B

Petroleum storage in UST for commercial, industrial, or residential use is prohibited.

Any business or industry is conditional in Zone B.

Brookings, South Dakota:

The Public Education Commitment

Introduction

Brookings is a trade center in South Dakota with a population of 17,000. Approximately ninety percent of the land within the wellhead protection area is agricultural. Along the outer zone of contribution some light industry and a mobile home court are located. The area is growing rapidly and attracting industries. Development pressures are increasing particularly around the major transportation corridors (Rusten, 1991).

City and county overlay zoning ordinances were enacted in 1986. These ordinances share a three mile joint jurisdiction. The county ordinance was revised in 1988 and the city ordinance is currently being updated.

Vulnerability of Aquifer to Contamination

The ten public wells supply drinking water from a shallow unconfined aquifer composed of glacial material that is very vulnerable to contamination. Although residents of Brookings have not been faced with contamination in their public water system, some of the rural communities around the area have nitrate contamination from nonpoint source pollution (Rusten, 1991). Nearby communities of Volga and Elkton have been forced to develop new water supplies be-

cause of contamination from petroleum and nitrates respectively (Brookings County Planning Commission, undated). Residents of Brookings County widely realize the aquifer is their greatest natural resource. Concerns among farmers led to the ban on fall fertilizer application (Rusten, 1991).

Participation in Development

Government officials drafted and reviewed the county ordinance. Considerable research was done before the ordinance was drafted. In the two months after the ordinance was drafted, the planning department held six public meetings.

An intensive public information campaign was an integral part of the wellhead protection program. The county held twenty to twenty-five public meetings over a period of a two years. Citizens with homes or businesses within the protection zone were sent letters of notification before any public meetings. Because development pressures in the late 1980s were minor, the community has been able to adopt a proactive approach to its wellhead protection program. David Rusten, Brookings County Zoning Officer, (1991) believes the public education campaign was largely responsible for the ordinance passing with no opposition. For Brookings it was a countywide effort to "sell them first about why it is important to protect the groundwater" (Rusten, 1991). Brookings brought in experts from United

States Geological Survey and the Environmental Protection Agency into its public meetings to discuss components of groundwater protection.

Determining the Boundary of the Overlay Protection District

The East Dakota Development District provided technical assistance to the town (Siegel, 1991). According to Rusten (1991), adequate research is necessary to "in fact delineate the boundaries of the aquifer and the time of travel and be able to defend it." He feels more than a year of research and background work is necessary before adoption of an ordinance that can be fit a town's needs.

Engineering studies from the United States Geological Survey which included determination of the time of travel, computer modeling, and drilling information were used to delineate the area to be protected. A map with a reproducible overlay has provided interested parties with easily distinguished boundaries. Determination of the aquifer protection boundary has been easy to differentiate between glacial til and glacial outwash (Minutes, December 16, 1987).

Over the next few years Brookings would like to purchase some of the land in the recharge area. Also the East Dakota Water Development District has asked for a grant that would provide Brookings with access to a Geographic Information System and signs for the boundaries of the

Aquifer Recharging Public Wells in Brookings, SD

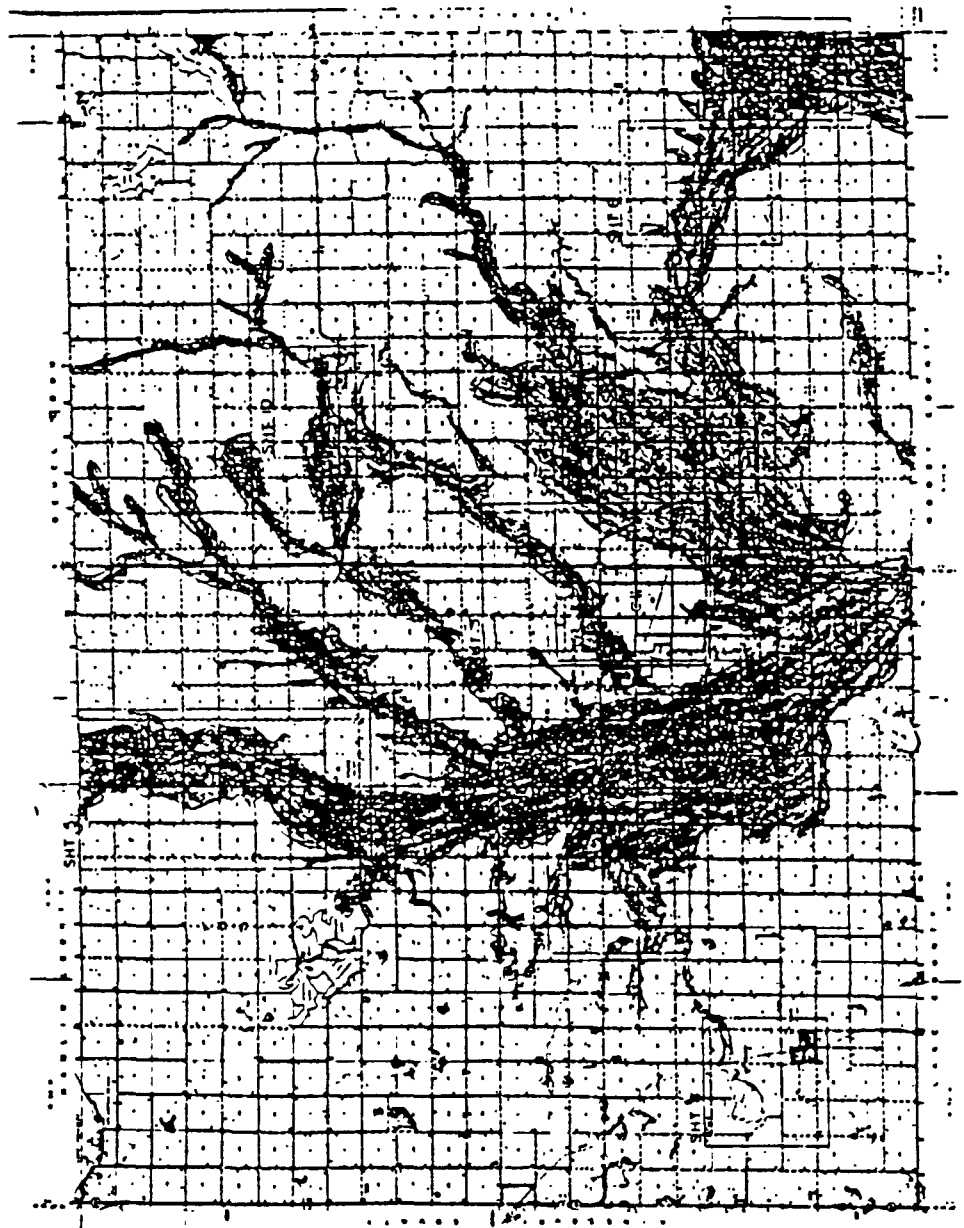


Figure 5 Aquifer supplying water to Brookings, South Dakota
Source: Rusten, 1991

protection area (McGrath, 1991).

Overlay Zoning Ordinance Provisions

The zoning ordinance was adopted from a model ordinance developed by the East Dakota Development District which comprises seven counties. The county ordinance prohibits nearly all uses that pose a potential threat to the wellhead, except for underground storage tanks and agricultural operations which are subject to performance standards. The Wellhead Protection Area is divided into two zones: Zone A, the aquifer critical impact zone (the wellhead protection area) as determined by a ten year time of travel, and zone B, the aquifer secondary impact zone (Figure 4).

Zone A contains a list of prohibited activities, and zone B is an industrial zone that takes into account non-point source pollution from the application of fertilizers. Several test wells are located in the county to detect any pollutants before they adversely affect the public water supply. Nonpoint source pollution is addressed through the farm program and in wetland areas regulations prevent the use of certain kinds of pesticides.

Conclusion

Brookings is an environmentally sensitive area and the purpose of the city and county ordinances is to prevent degradation of the groundwater resource. Brookings use of

overlay zoning for wellhead protection is effective largely due to the ongoing importance of public participation.

Brookings County
Wellhead Protection Area

Zone A

Expansion of nonconforming uses are conditional upon approval by the Board of Adjustment.

Prohibited uses in zone A include:

1. new feedlots
2. disposal of solid waste except the spreading of manure
3. outside storage and disposal of road salt
4. storage of PCBs
5. car washes
6. auto service and junkyards
7. disposal of radioactive waste
8. graveyards or animal burial sites
9. open burning
10. facilities storing, transferring, or disposing of hazardous materials
11. fall application of nitrogen fertilizer except spread of manure

Zone B:

--Application of nitrogen fertilizer in the fall is prohibited.

Performance Standards:

1. secondary containment of stored materials that could contaminate groundwater
2. if petroleum storage is greater than 55 gallons, the tanks must be elevated and have secondary containment
3. approval of county zoning to discharge industrial process water
4. industries that store hazardous material must submit a contingency plan

VII. Variations in the Use of Overlay Districts

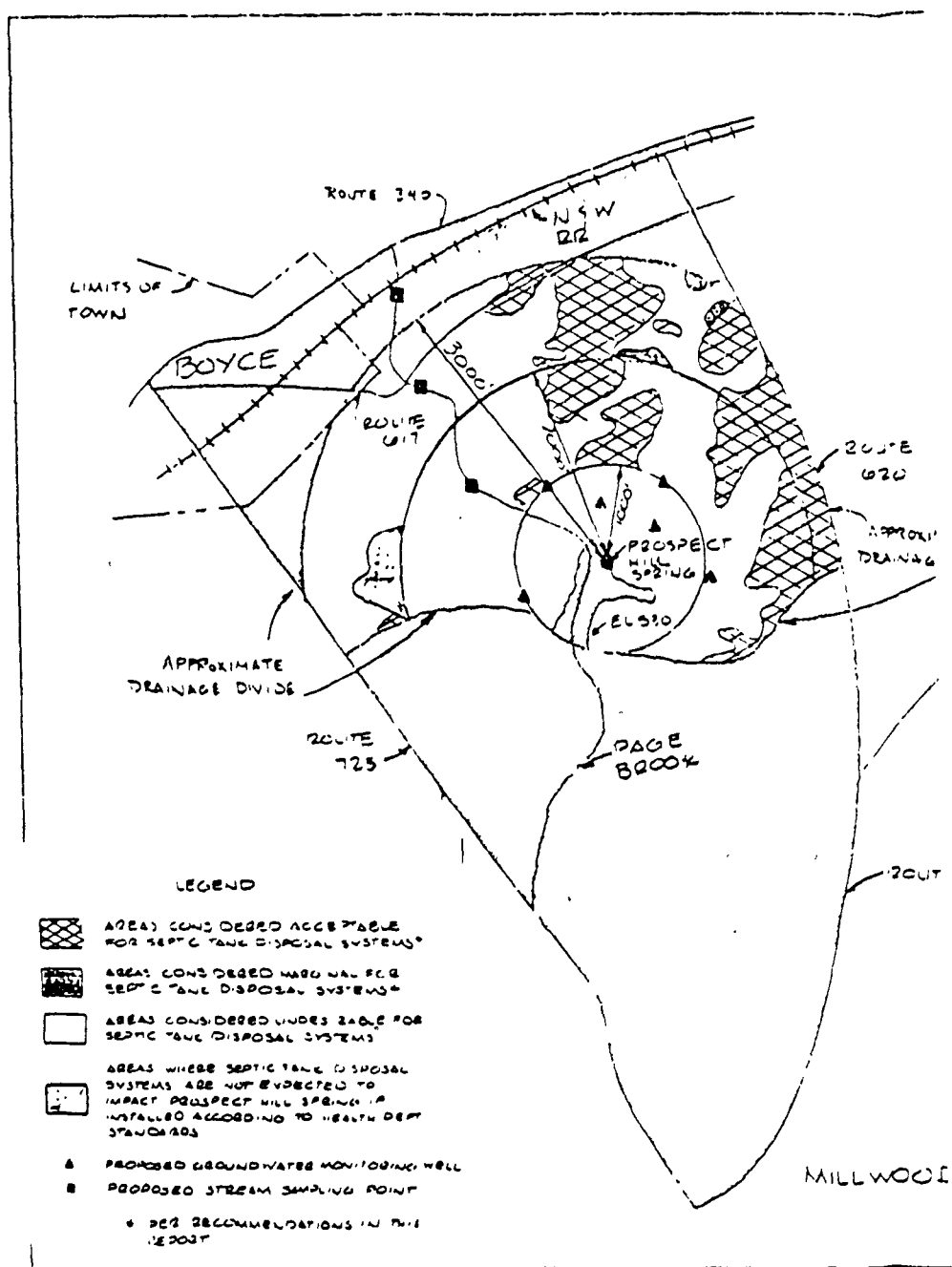
Clarke County, Virginia

Local officials in Clarke County determined that future growth and development could pose a risk to Prospect Hill, the public water supply spring. Due to soil conditions, the most serious potential for contamination can be attributed to septic tank failures. Development in this primarily residential area is feasible in certain locations.

A combination of prohibitions and conditions on development have been imposed within an overlay zoning district. Within the overlay zone commercial drilling, mining, sanitary landfilling, feedlots, and underground storage tanks are prohibited. Agricultural operations are allowed to continue, but they may not expand. Septic tank installation is allowed based upon soil characteristics in the overlay zoning district. The overlay zones have a uniform radi ending at the drainage divide (Figure 6). Septic tank installation is prohibited within the first 1000 foot radius. From 2000 feet to 3000 feet, development is allowed in marginal soil in the recharge area because attenuation of pollution is expected. In all cases residential developments are conditional upon minimum lot areas for septic tanks and twenty percent or less impervious surface.

The objective of the groundwater protection ordinance is to reduce the risk of contamination to the spring, not provide a

Figure 6 Clarke County Aquifer Protection Area



one hundred percent assurance of no contamination. A cost benefit analysis determined that replacing the septic tanks with a sanitary sewer would provide the best protection. But this approach was not economically feasible. The County determined that it would be seven times more expensive economically to replace the spring than to institute the protection program.

Clarke County's approach to protect its groundwater supply is based upon suitability of soil to septic tanks within an overlay zone. This conditional standard addresses the local risk to the groundwater. A local risk can involve several government bodies. The discussion that follows of Dare County, North Carolina addresses groundwater quality through an overlay district that includes both state and local government involvement.

Protecting the Water Supply in Buxton Woods, North Carolina:

A State and Local Approach

Groundwater protection in the area around Buxton Woods in Dare County, North Carolina is integral to the quality of life for a population which has increased over sixty percent from 1980 to 1988 (NC Carolina Community Profile, 1990). Hatteras Island (Figure 7) contains National Park Service land with the largest maritime forest in North Carolina.

On the shores of Hatteras Island, miles of beaches, sand dunes, wildlife, and a lighthouse attract increasing numbers of tourists. Indeed tourism is directly responsible for persistent development pressures. To successfully implement wellfield protection area which included a overlay zoning district, Dare County addressed issues concerning development pressures, boundary determination, and scientific justification of the regulatory strategy.

Consulting hydrogeologist, Ralph Heath (1988) believes "the availability of groundwater may be the single most important factor affecting the ultimate level of growth of the area." According to Ries Collier (1991), park biologist, the risk to the aquifer is profound because all development depends upon it for water supply. There is no question that contamination would be serious, but what poses a threat and what is adequate protection have been the focus of much public debate. The variety of concerns expressed by local and private land owners, the water

Hatteras Island and Dare County

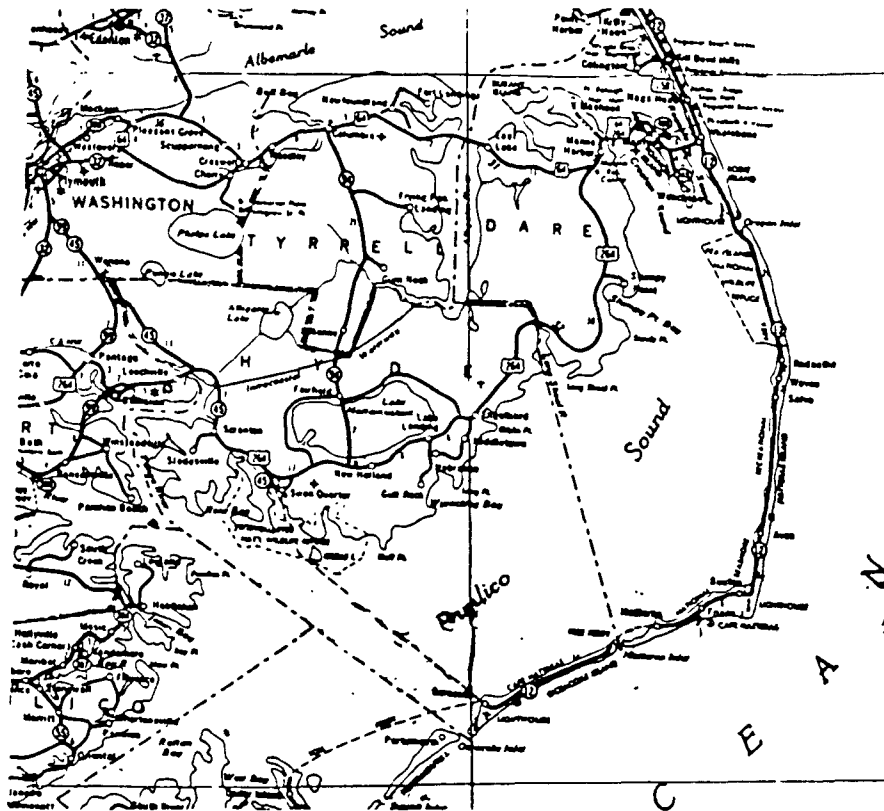


Figure 7--Map of the central North Carolina coast showing the location of Hatteras Island and Cape Hatteras.

source: (Heath, 1987)

utility, and developers illustrate the dynamics between economic development and groundwater protection.

Vulnerability of the Wellfield to Contamination

Four Hatteras Island communities obtain their drinking water from a wellfield of forty-four wells that the private utility, Cape Hatteras Water Association (CHWA) owns (Foster, 1991). Dare County is very dependent upon the private water supply because most of the development is over the salty aquifer. So, it is in the best interest of developers to protect their resource. Run-off from roads and driveways and septic tank failures are major concerns (Anderson, 1987).

The aquifer is susceptible to salt water intrusion. The shallow unconfined aquifer covers a five and a half mile area. Currently withdrawals range from 0.8 MGD to 1.2 MGD in 1991 (Foster, 1991). By using a groundwater time of travel model and taking into account attenuation, a much smaller area may be designated for protection. According to Ralph Heath (1987), at the current usage of 2 MGD, the 1 MGD per square mile recharge flushes out saltwater so that discharge and recharge are equal. He estimates that between 3 and 4 MGD may be withdrawn without saltwater intrusion. However, the Water Authority projects a need of 4.5 MGD by 2000 based upon county growth figures (Heath, 1987). A moratorium is currently in effect until new wells are in service (Foster, 1991).

Designation as a sole source aquifer was not considered adequate protection because this designation would only regulate

Figure 8 Dare County--Area of Environmental Concern

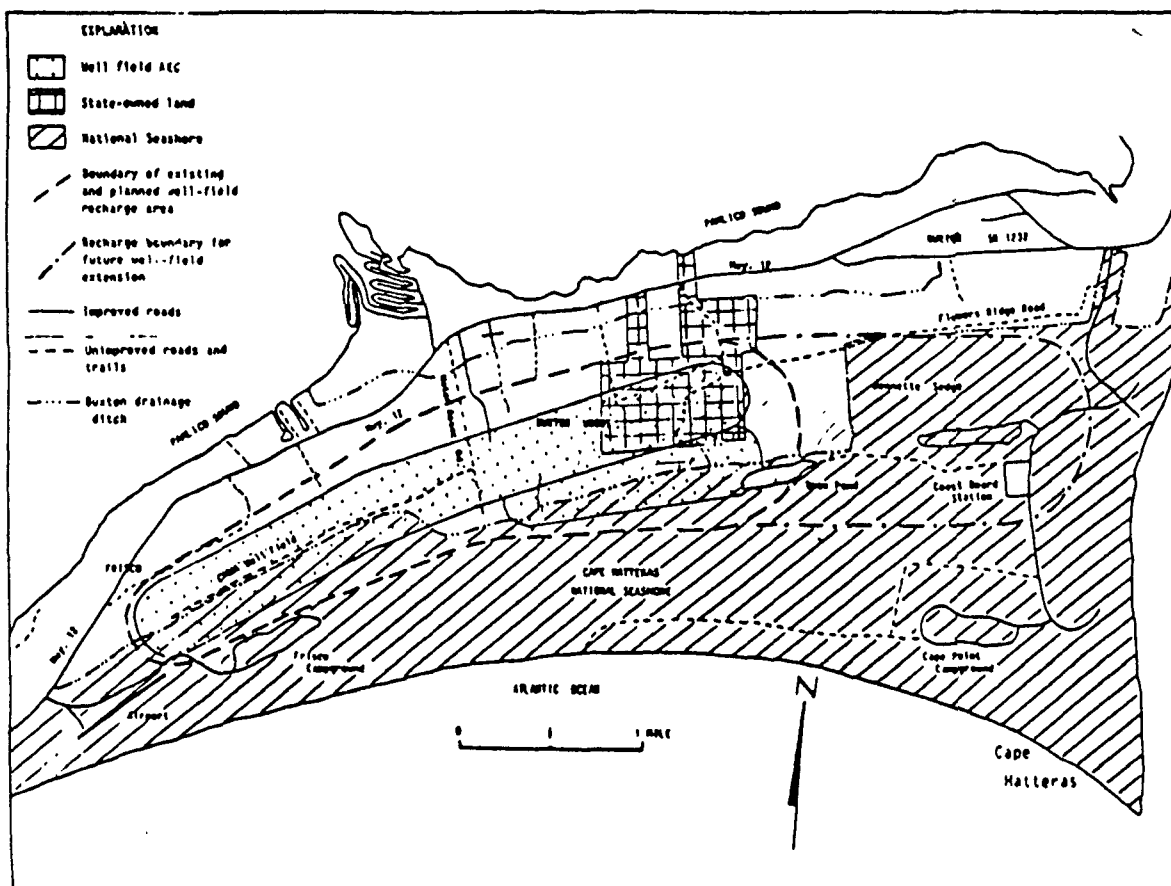


Figure 1.--Map of the Cape Hatteras area showing the well field area of environmental concern (AEC), land ownership, and well-field recharge areas.

Source: Heath, 1988

federal projects and development concerns on the island are primarily private. The local government's zoning regulations specify a special environmental district to protect the water supply, aquifer and public health. These regulations specify setback and density limitations but do not prohibit specific uses. The southern part of the county's groundwater is protected by designation as part of the Cape Hatteras Seashore (Figure 8). As designated by the Coastal Area Management Act (CAMA), an Area of Environmental Concern overlays the zoning regulations of the county and is managed by North Carolina's Coastal Resources Commission. The Area of Environmental Concern protects the water supply of the area. Development may not limit the "quality or quantity of the public water supply" or cause salt water intrusion or toxic discharge into surface water or groundwater. Development in the Area of Environmental Concern must comply with standards granted before receiving a CAMA permit.

Water Service Expansion

The Cape Hatteras Water Association is a private .pn6non-profit organization that has been serving four Hatteras communities for twenty-five years. To expand the wellfield the utility hired hydrogeologists to determine which areas would be the most productive with the least chance of salt water intrusion. To determine a site for the proposed wells, the utility eliminated study areas not meeting CAMA requirements and areas that citizens highly opposed from the study areas. The cost of developing new water wells was obtained from impact fees for new hookups (Fos-

ter, 1991). Development has been a promoting factor for the extension of the wellfield area. According to a Hatteras Island resident, Mark Nash (1987), large high occupancy vacation homes use a great deal of water. A plan for 480 high density dwelling units has been cited as "indirectly responsible for the current need for expanded wellfield protection areas." He proposed limiting development to current wellfield capacity.

Local and state government planners work toward protection of areas designated by the utility as wellfield sites. The Cape Hatteras Water Authority requested expansion of the Area of Environmental Concern to include areas designated by the utility as future wellfield sites. The Coastal Resources Commission approved the new boundaries of the overlay at 1500 feet from the center of the wellfield.

Officials at the Division of Health Services recommended that "septic tanks be prohibited without exception" (Wolter, 1987). But on July 29, 1987, Coastal Resources Commission voted to allow septic tanks in lots platted by July 24, 1987 if no other economical method of wastewater treatment is available and no space is available outside the overlay district for a septic tank. However, a "conditional use standard, which allows septic tanks doesn't help property owners with large, unsubdivided and unplatted parcels of land" (Wolter, 1987).

Hydrogeological consultant, Edwin Andrews III, complained of a "lack of public availability of the complete technical data being relied upon by extension proponents" (Owens, 1987). He suggested that existing septic tanks posed a greater threat than

any future development "that might be prohibited or restricted by the declaration or extension of an AEC surrounding that northern prong" (Owens, 1987).

Determining the Boundary of the Overlay Protection District

The County administers minor CAMA permits for the AEC that are generally less than one acre. The state administers large permits for land uses such as subdivisions. Designating the boundaries of the overlay district was controversial. A consulting firm conducted drawdown studies, and then the USGS completed an indepth study of the aquifer in 1975. The boundary extension was based upon the sub-recharge area, mapped drainage divides, and a safety factor to account for uncertainty of the topographic maps (Cantral, undated).

Three state hydrologists studied the aquifer to determine the distance that the overlay should cover. The hydrologists agreed, but not with certainty, upon a minimum distance of 500 feet. Their inability to agree promoted debate among landowners (Herndon, 1987). Dare County Commissioner, Thomas Gray, stated that "the scientific evidence of adversely influencing the well-field is just simply not shown." David Owens, director of the Coastal Resources Commission, said the state needed more data (Coastland Times, 1987).

Lack of readily available conclusive scientific information prompted much debate. Some property owners hired attorneys and hydrogeologists to prove that their property was not within the

overlay district and that their land uses would not contaminate the public wellfield. For instance, an owner of the Foreman and Blades property used a report from the United States Geological Survey to substantiate his claim that, due to the direction of groundwater flow, any pollutants discharged from his property would not pose a contamination risk to the wellfield (Lovett, 1986). A developer, William Lovett, hired consultants to show that the land he wanted to develop as a golf course was not subject to AEC permitting because it was 500 feet north of the overlay district (Wolter, 1987). Prompted by disagreement expressed by the Cape Hatteras Water Association and by absence of a map of the original overlay designation, the Coastal Resource Commission reversed its earlier determination concerning the proposed golf course development (Owens, 1987).

Dare County Zoning

County zoning regulations on Hatteras Island require minimum lots of 1500 square feet. A Special District, an overlay zone, protect the water supply. This area is zoned for residential development with lots of at least one acre with no more than twenty percent clearing of vegetation cover. According to Ray Sturza, Dare County Planner, the special district was formed in response to pressures by interest groups and to prevent the state from having all control over land use decisions in the Special District which overlays the AEC.

Dare County discourages development that may have an adverse effect upon water quality. The county administers minor CAMA

permits while the state administers large permits for land uses over one acre.

Role of State and Local Government

The Coastal Resources Commission, Cape Hatteras Water Association, Dare County Planning Department, and the National Park Service lead strong roles supporting Dare County's wellhead protection program. In the Area of Environmental Concern use standards apply which prohibit septic tanks unless eligible for a variance. The CAMA program has had a strong impact on the policies of Dare County. The 1987 update to the Land Use Plan and Policies for Growth and Development was funded under the Coastal Area Management Act. Studies to fine tune the program are ongoing. Local government plans to provide ambient and periodically private well testing and supports preparation of a hydrogeological study of Dare County (Sturza, 1991).

Numerous studies are underway to address groundwater withdrawals and the potential impact upon the environment. The National Park Service has played a significant role in groundwater protection and coordinated studies to identify groundwater contamination. The Service is concerned with identifying and mitigating any impacts from water withdrawals. Studies are currently underway to develop base line water quality data and to define the link between surface water and aquifer withdrawals (Collier, 1991).

Conclusion

Groundwater is important to the long term development of Dare County. Both local and state government officials have led important roles in wellfield protection. Justification of the overlay zoning boundaries and contamination sources was necessary to gain support for the regulations.

VIII. The Decision to Use Overlay Zoning

A community's decision to use overlay zoning will depend upon both the developmental objectives and present conditions of the governmental unit. First, land use regulations are particularly important for communities where public wells constitute the sole source of drinking water, and future development is dependent upon an adequate quantity of water. For these communities a high degree of liability may be associated with inaction and a comprehensive approach to groundwater management is preferrable. Second, overlay zoning is appropriate for municipalities where citizens support the need for wellhead protection, and zoning is an accepted governmental function. Third, where government leaders can reach a consensus of opinion concerning groundwater protection objectives, overlay zoning may be a strong tool. To obtain a consistent base of knowledge much research is often needed to identify potential sources of contamination and identify where to impose regulations. Special studies may help planner to prioritize risks and define the boundaries of an overlay zone. Continual evaluatory efforts may be necessary so that the overlay zoning ordinance is legally defensible. Fourth, overlay zoning is particularly suited to communities that are not heavily developed but anticipate growth. In areas that have many

existing businesses, overlay zoning is only effective if the state enabling statute does not limit the regulation of nonconforming uses. If regulation of nonconforming uses is limited overlay zoning is a weak tool for protecting groundwater quality.

IX. Limitations of the Evaluation and Suggestions for Further Study

The case studies illustrate some representative well-head protection programs that incorporate overlay zoning. The case studies were selected based upon available data and documentation from government representatives. The amount of documentation for each case study varies. Some of the conclusions are based upon the subjective interpretations of government officials. The evaluation gives insights as to how useful overlay zoning may be used for communities with a variety of development patterns and contamination risks.

Further research might include a survey that would address questions such as whether localities need technical assistance or regulatory assistance when planning developing overlay zoning ordinances. The survey should determine on a state by state basis whether or not zoning enabling legislation permits the regulation of existing businesses in zoning ordinances. A more comprehensive analysis of case law at the district level would be useful concerning nonconforming uses. A recent case study of a community that did not use overlay zoning would be helpful to contrast with a community that used overlay zoning. Also, a nationwide listing of communities with overlay zoning and the characteristics of each might be useful to communities considering wellhead protection. Lastly, one might determine how long overlay zoning has been a tool for wellhead protection.

x . Recommendations

Communities with successful programs and those developing a wellhead protection program with overlay zoning may wish to consider the following recommendations concerning planning, participation, and monitoring.

1. Community involvement and education are part of an ongoing commitment to wellhead protection. Provisions for revising and assessing wellhead protection programs are important to successful implementation. To select the appropriate tool for wellhead protection and ensure that the reasoning behind the regulations is legally justifiable special studies may be necessary. Studies may determine sources of contamination, prioritize risk to the wells, and justify the dimensions of the overlay zone.

Monitoring and some form of inspections are an important part of ongoing evaluatory efforts. By establishing monitoring wells, a community may be able to locate and stop the movement of contaminants before they reach the public water supply. Registration and reporting requirements are easily coordinated with performance standards and provide information to the locality about land uses. Inspections ensure compliance with performance standards and a better understanding of potential impacts upon wells.

2. The most crucial element for successful development of a wellhead protection program is public involvement and education. Ongoing community participation is necessary for voluntary compliance and cooperation measures. These measures include proper disposal of household hazardous waste, nonpoint source control from pesticide and fertilizer application, proper septic tank disposal, best management practices, and minimization efforts for existing businesses.

Public involvement is part of the bargaining process to address concerns that may conflict between business and environmental concerns. Citizens may be directly involved in the development of objectives for a wellhead protection program or serve in an advisory capacity. Some voluntary efforts may mobilize citizenry to aid in identification of potential contaminating activities.

Public participation is prone to problems unless government leaders have done their research to carefully prioritize potential contaminating sources and identify overlay boundaries. All those people involved with the planning stages need to agree upon the objectives of the wellhead protection program. Coordination of wellhead protection between local, state, and federal governments is necessary to encourage intergovernmental efforts and provide uniform standards for land use regulations.

3. The availability of groundwater may impose physical limitations upon growth of an area particularly for communi-

ties with wells providing the sole source of drinking water. Most master plans use projected growth figures for city planning and expand utilities accordingly. Integrated approaches such as Hopkinton's focus upon an environmental approach to planning, and a variety of regulatory tools may be necessary.

Wellhead protection is part of the total picture of environmental regulation. The coverage of wetland and watershed regulations may overlap with groundwater protection measures. Other programs and regulatory mechanisms may be used to compensate for limitations of overlay zoning where zoning enabling legislation prevents nonconforming businesses from being regulated under zoning ordinances. In some communities such as Stoughton, health regulations can provide performance standards for some existing uses.

Conclusion

Over the long term, the best indicator of a successful use of overlay zoning in wellhead programs may be absence of groundwater contamination. However, many communities are just in the process of developing their wellhead protection programs. With close monitoring in the next few years there will be more information about the nature of these programs.

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