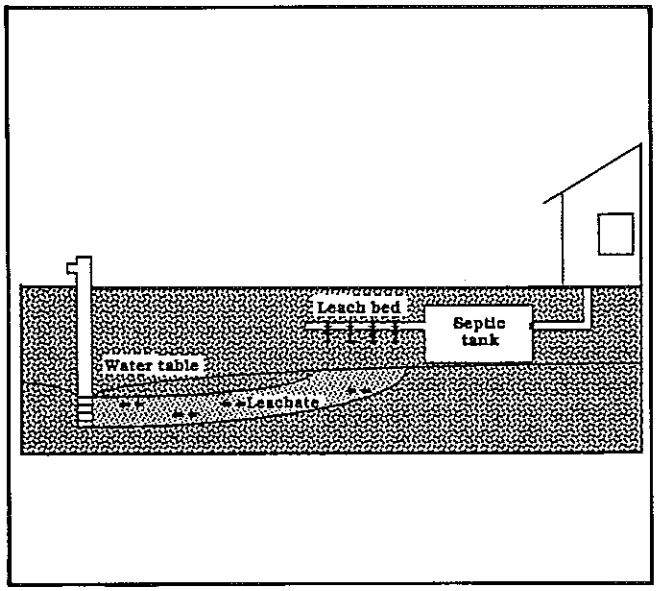
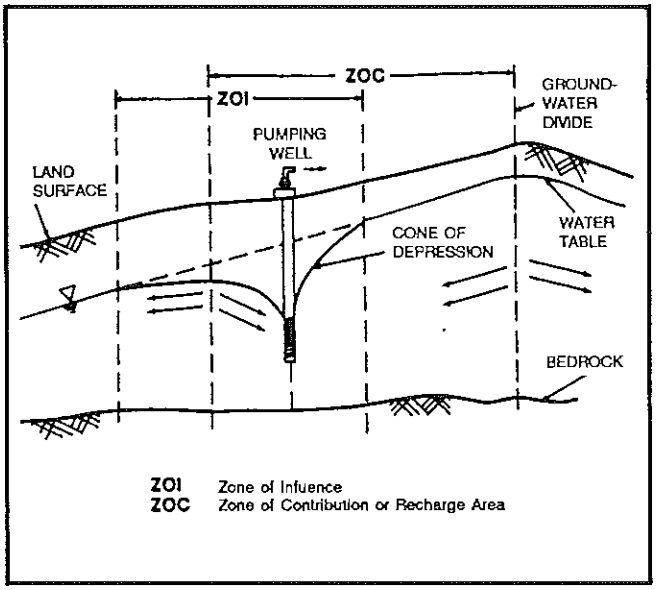
CCPC
BULLETIN

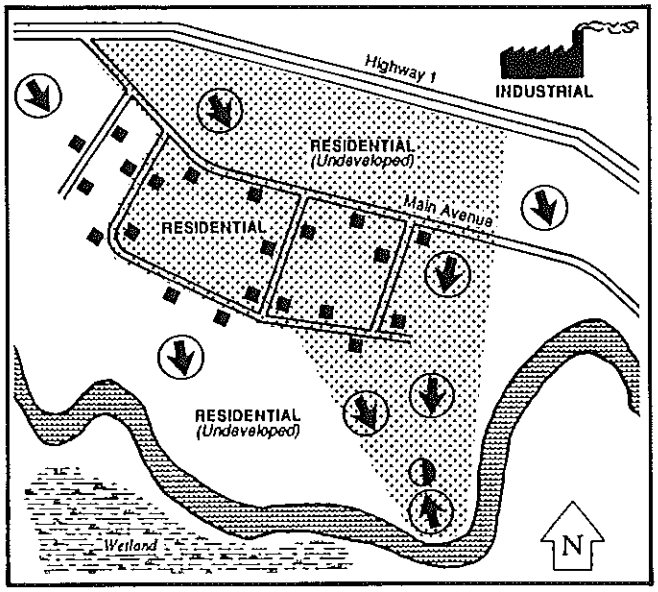
PLANNING BULLETIN #43

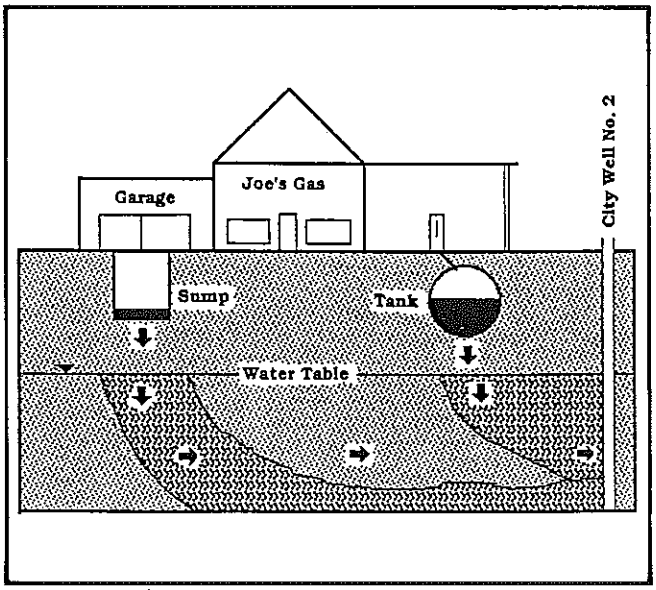
CHESTER COUNTY PLANNING COMMISSION

NOVEMBER 1991









AN INTRODUCTION TO WELLHEAD PROTECTION FOR CHESTER COUNTY MUNICIPALITIES

TABLE OF CONTENTS

Cover Illustrations from: "Wellhead Protection Programs: Tools for Local Governments", EPA, 1989. "Development of a Ground-Water Management Acquifer Protection Plan", Wayne A. Pettyjohn, Oklahoma State University, EPA Contract #68-03-3416, 1989.

Introduction

This planning bulletin has been prepared for municipal officials (including supervisors, managers, planning commission members, and other elected and appointed officials) as well as persons involved with public water supply facilities (authorities, municipal departments, and private companies). The purpose of the bulletin is to make municipal officials and water suppliers aware of the actions which should be considered to safeguard existing public water supply wells and to protect ground water resources for the future. The term given to this particular program of action is wellhead protection.

The goal of wellhead protection programs is to make sure that wells are not contaminated as the result of activities on the land surface (i.e., land use). Wellhead protection actions as defined in this bulletin are planning actions which involve the careful management of certain types of land use activities in and around public water supply wells to prevent water quality contamination. Wellhead protection should be understood as only one element of a municipality's total water resources management program.

As the population of Chester County approaches the 400,000 level, there are already on record a variety of well contamination problems in many municipalities. Chester County has 9 Federally-designated Superfund sites already identified, plus 87 more sites on the CERCLIS (Potential Superfund Sites) List. And even these lists for the most part do not constitute a complete inventory of leaking underground storage tanks or various other types of contamination problems. Furthermore, the problems may worsen. Wells of varying size and importance exist throughout the County in virtually all 73 municipalities. New public and private wells are being drilled and permitted every day. Development, though slowed for the time being, has occurred far more rapidly than many thought possible and no doubt will continue. The problem is that in the vast majority of municipalities, little attention is being given to the compatibility of land use plans and zoning ordinances with public water supply wells and their respective aquifers.

Federal agencies such as the Environmental Protection Agency have developed substantial resources to assist municipal governments in establishing appropriate and cost-effective wellhead protection programs. This planning bulletin is designed to help get this information into the hands of municipal officials who need it through:

1. alerting Chester County communities to the wellhead protection problem; and
2. indicating resources available to deal with this problem.

The bulletin is structured around several basic questions. If the answers to these questions are positive, municipal officials should be alerted to the fact that they should be prepared to take some sort of wellhead protection action. Water suppliers, both public and private, should be critical allies in this effort. Though water supplicrs are removed from land use management per se, it is their wells that serve the public and that are at stake.

The Wellhead Protection Problem

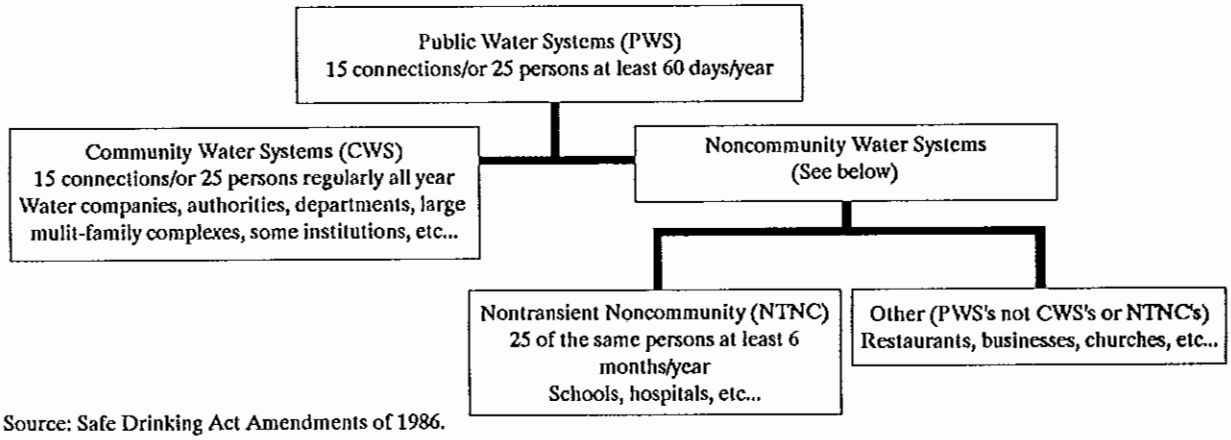
Because Chester County relies substantially on wells for public water supply, a program which protects these wells has obvious importance. Furthermore, the issue of wellhead protection involves the impacts of land uses and related activities on water supply wells. Because Pennsylvania municipalities hold the power to regulate land uses and related activities, wellhead protection therefore becomes an important municipal concern in Chester County. For a variety of reasons discussed below, wellhead protection is more critical in some municipalities than in others.

Wellhead protection means more than the simple physical protection of the "head" of the well. The wellhead protection concept certainly includes the pumping equipment itself and various other elements developed during well drilling and construction, but also includes protection of the ongoing supply of water which is the purpose of the well. In most cases, wellhead protection focuses on water quality--preventing contaminants from entering the well's water supply or zone of contribution, although the concept of wellhead protection certainly includes making sure that the supply of water itself--water quantity--is not reduced.

A classic example of a wellhead protection problem might be the gas station with a leaking underground storage tank located next to a municipal well. Other examples include zones of malfunctioning septic systems which contaminate well water, used oils and degreasers from auto repair shops, detergents and solvents in dry cleaning operation, contaminated runoff from material storage areas in industrial parks, and others. These sources of contamination are serious when individual wells are impacted, but the effect is worsened when the well provides water to a public water supply system. As a result, wellhead protection programs are especially important when these larger wells exist in a community.

At the outset, clarification of the term "public" is in order. The wellhead protection programs discussed in this planning bulletin are consistent with the Federal (EPA) and State (DER) programs as established by the Safe Drinking Water Act Amendments of 1986. "Public" water systems are quite specifically defined (Figure 1) and include many types of water systems which the layperson would not assume to be classified as "public." Wellhead protection programs developed pursuant to the Safe Drinking Water Act Amendments of 1986 must be consistent with this definition of "public," although municipalities can certainly extend wellhead protection to include individual residential wells as well.

Figure 1
Terminology for Water Systems



Source: Safe Drinking Act Amendments of 1986.

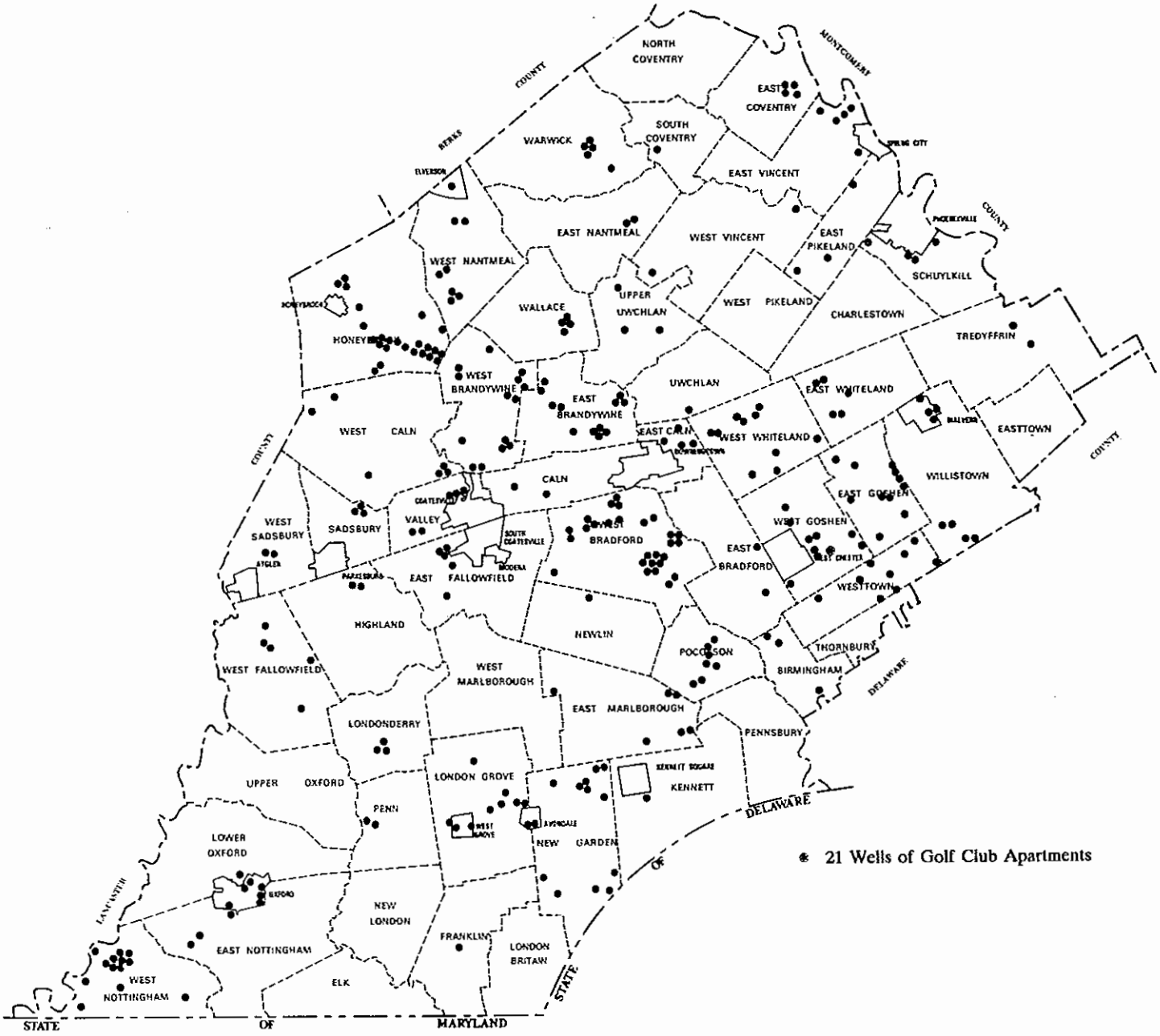
In most cases, wellhead protection on the municipal level need not be a matter of enormous difficulty and complexity. The essential concept behind a wellhead protection program is to direct the most potentially contaminating land uses away from the most heavily utilized aquifers and wells. In so doing, wellhead protection programs are preventive in nature and infinitely more cost-effective than attempting to remediate ground water contamination problems after the fact. Although Chester County has its share of existing wellhead problems, continued growth of most types of land uses appears to be inevitable. Consequently, municipalities have the ability to avoid wellhead problems in the future. For all of these reasons, the Chester County Planning Commission urges each of its 73 municipalities to consider the seriousness of the problem now and in the future, together with the need to integrate wellhead protection into their land use planning tools and techniques. Hopefully, this Planning Bulletin will help municipalities make these wellhead program decisions.

Question 1: Does your municipality rely on ground water and wells? Remember: just because wells may not be owned directly by the municipality or a municipal authority does not mean that your residents and businesses do not rely on wells.

Reliance on ground water and wells can take several forms. Most obviously, some Chester County municipalities have municipal authorities which own and operate water systems supplied by wells. Less obviously, some municipalities rely on private water company systems such as the Philadelphia Suburban Water Company, Citizens, or Utilities Group Services. These systems are substantially, and sometimes exclusively, well-based. Although there may not be municipal ownership or involvement with the water system in these cases, the water systems are nevertheless "public" systems and citizens of the municipalities' and businesses are reliant on wells. Also less obvious are the substantial number of private and public institutions, schools, health care facilities, mobile home parks, homeowners' associations and residential subdivisions, and other land uses which exist throughout the County with their own well-based water systems, all of which are included under the definition of "public" water supply systems as per the Safe Drinking Water Act 1986 as Amended. There are, of course, literally thousands of individual on-site wells providing water service to private residences, businesses, farms, and other types of establishments. In short, there is substantial reliance on ground water in some form in most Chester County municipalities. Figure 2 illustrates a portion of the public water supply wells in Chester County (wells which are part of community and noncommunity nontransient water supply systems).

Another important aspect to consider in ground water development is the growth and development which will occur in the future. Will reliance on ground water increase as communities further grow and develop? Will new wells be developed for public water systems? Are private onsite wells being developed for new residential and nonresidential uses? If problems are to be prevented, this question of future well use must be taken seriously.

Figure 2
Larger Public Water Supply
Wells in Chester County



Source: Chester County Planning Commission, 1991.

Question 2: Are there geological factors which should be considered when developiug a municipal wellhead protection program? Given different hydrogeological settings, should some level of wellhead protection be provided across the board? Do some municipalities have particular hydrogeological conditions requiring special wellhead protection measures?

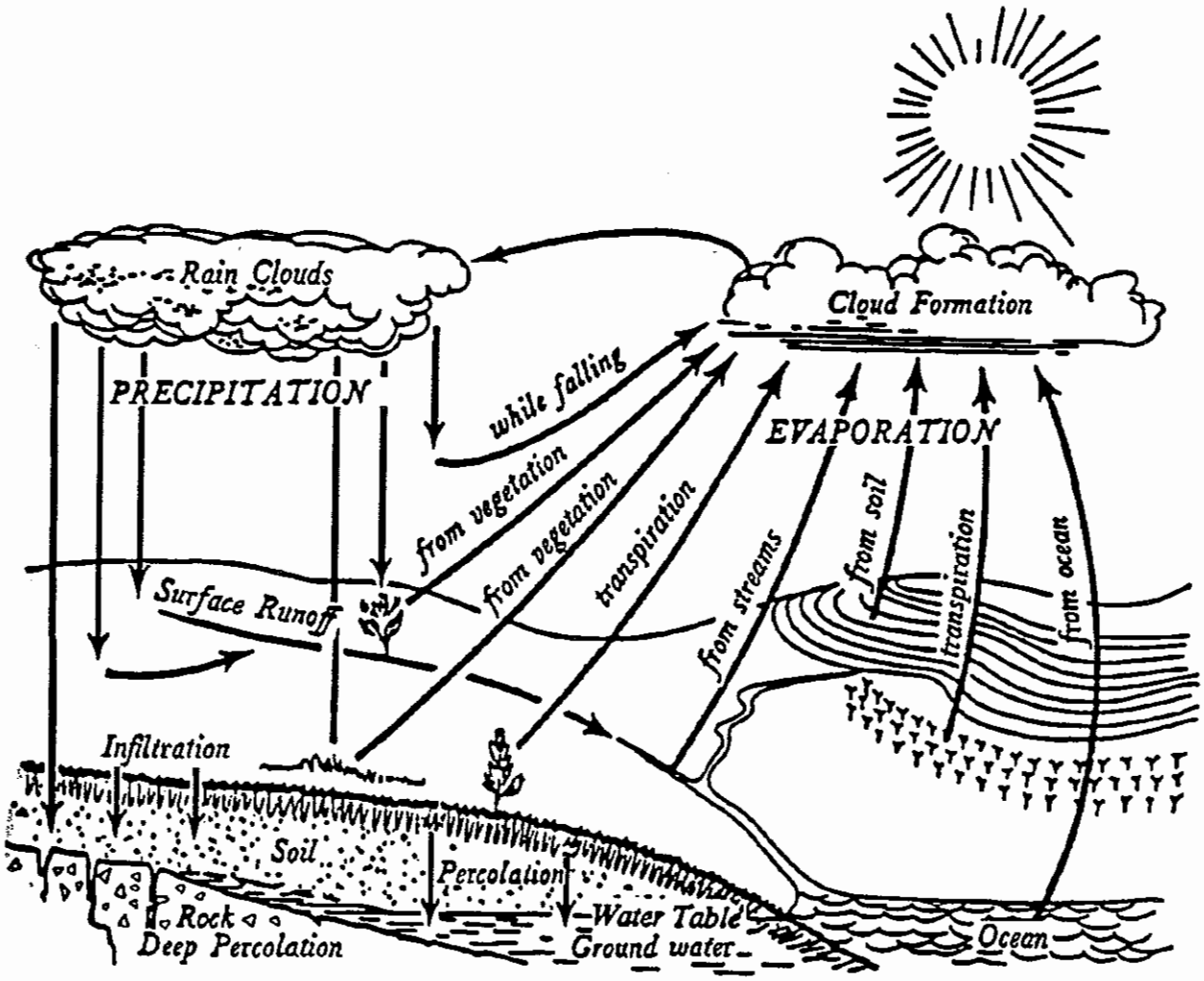
There are several basic statements which need to be made regarding Chester County's geology and groundwater flow systems in order to fully appreciate the importance of wellhead protection programs for municipalities within the County. Generalizations regarding soils and underlying geological formations and ground water movement are potentially very dangerous. Groundwater flow depends very much on geology, and the geology in Chester County is neither regular nor predictable. Nevertheless, some basic truths do exist and need to be understood.

Unlike areas elsewhere in the country, the Piedmont setting and reasonably humid climatic zone in Chester County means that a reasonable amount of our precipitation each year infiltrates into the ground and replenishes our reasonably productive aquifers, a basic and critical principle of the hydrologic cycle (Figure 3). With the exception of that component given up to evapotranspiration, the precipitation which infiltrates into the ground becomes ground water. Ground water moves vertically by gravity as well as laterally. In most cases in Chester County, ground water discharges to the land surface at lower elevations and becomes the essential water which feeds stream systems between storm events. This continuing ground water discharge--stream base flow--is the very lifeblood of stream systems.

In most areas of Chester County, precipitation which infiltrates into the ground travels only a few hundred feet vertically and perhaps a few thousand feet laterally at maximum before emerging as surface water of some type, in contrast to other parts of the country where ground water may flow vertically and laterally for many miles--even hundreds of miles. In Chester County, the connection between that which is on the surface and that which is under ground is relatively direct. The aquifers being exploited are relatively shallow. Depending upon the specific geological formation, most public water supply wells provide substantial yields at a depth of perhaps 200 or 300 feet. The directness of this interconnection is manifested in the fact that it doesn't take too many days without rain for most Chester County stream observers to notice declines in stream base flow throughout the County. A generalized geology map for Chester County is presented in Figure 4.

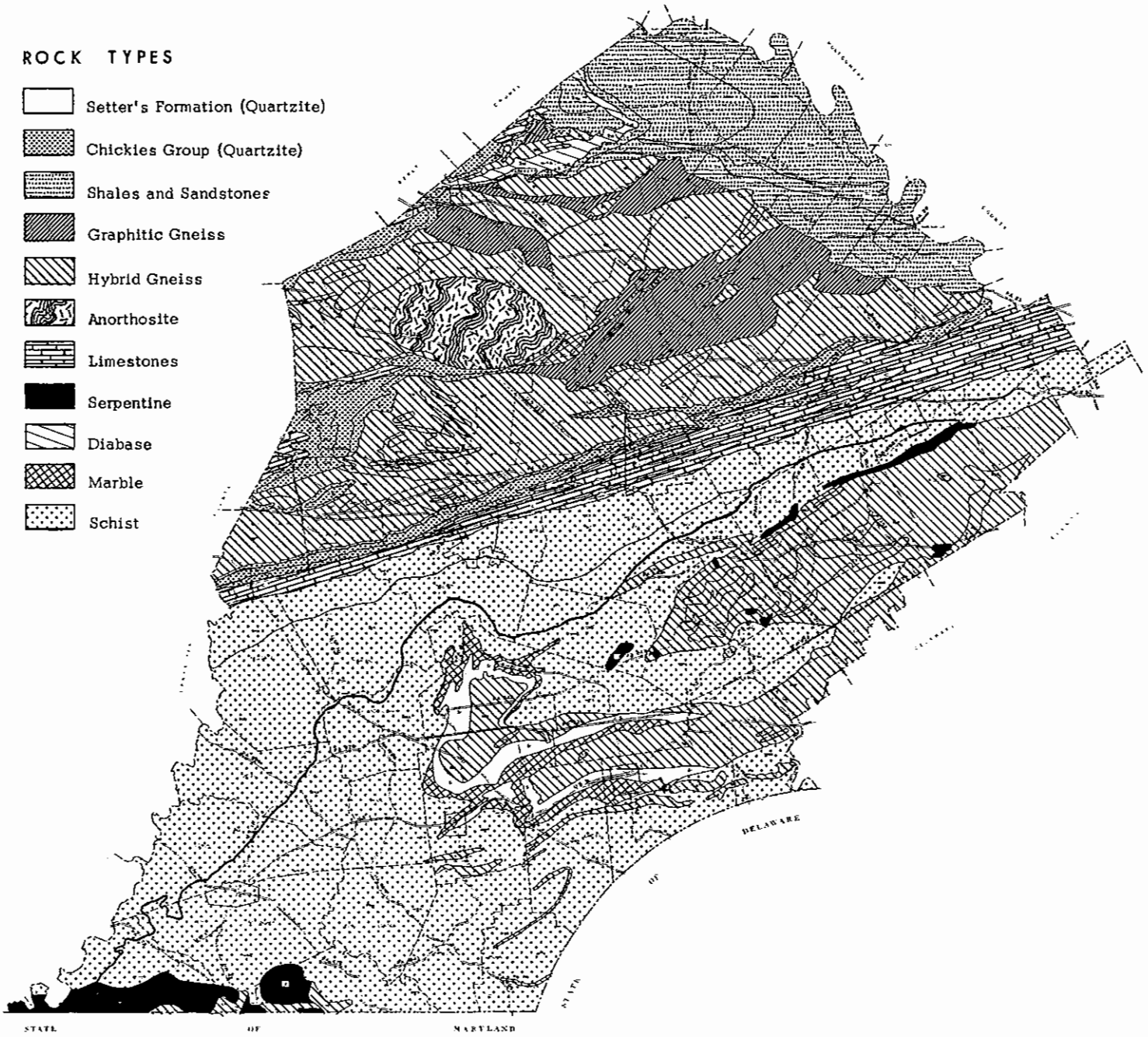
This hydrogeological context has all important ramifications for wellhead protection programs on the municipal level. Because of the relatively direct interconnection between the land surface and ground water, a management program with a localized or municipal focus makes sense. Of course, relationships do exist regardless of municipal borders. Impacts do extend beyond municipal boundaries here. Most notably, in the limestone formations of the Chester Valley, ground water is known to move greater distances through elaborate systems of solution openings created in the limestone over the years. In these particular formations, special, more elaborate and more stringent wellhead protection provisions should be considered. Fractures in the dense crystalline formations also complicate wellhead protection in Chester County. In fact, given the tremendous complexity and localized variability characterizing so much of the geology, site-specific acre-for-acre predictions of how water on the surface moves into and through the ground can be very uncertain. In other words, if a municipality intends to rigorously restrict land uses and place heavy limitations on property, background hydrogeological investigation probably will be necessary to demonstrate that water on acre x in fact recharges well y.

Figure 3
The Hydrologic Cycle



Source: Yearbook of Agriculture, US Dept. of Agriculture, 1955.

Figure 4
Generalized Geology of Chester County



Source: Chester County Planning Commission, 1963.

Question 3: How does a well become contaminated? How can a wellhead be adequately protected?

In order to understand how wells become contaminated, some basic concepts relating to ground water, hydrogeology, and the development of wells are necessary. Such a discussion can get mired in technical complexities very quickly, with experts arguing the merits of sophisticated multi-dimensional ground water simulation models that rely on elaborate computer programs. This planning bulletin, however, has more modest objectives.

Under natural conditions, ground water in an aquifer is in a state of dynamic equilibrium. Recharge is equal to discharge. Figure 5 shows in very simple terms the ground water flow system typical here in Chester County. Lines called equipotential lines show locations where "head" or water pressure or force is equal in intensity. When a well is developed and pumping begins, the natural state of equilibrium is disturbed. The withdrawal of water from the well causes drawdown of water levels in a zone around the well. Figure 6 shows this area as the zone of influence, which is often referred to as the cone of depression. In many cases not all of the water within the zone of influence/cone of depression flows to the well itself. Some water may continue flowing into the stream or point of discharge. Over simplications notwithstanding, this reality of ground water flow and well operation means that when water is pumped out of the ground and not returned in some manner, water available for stream's base flow declines.

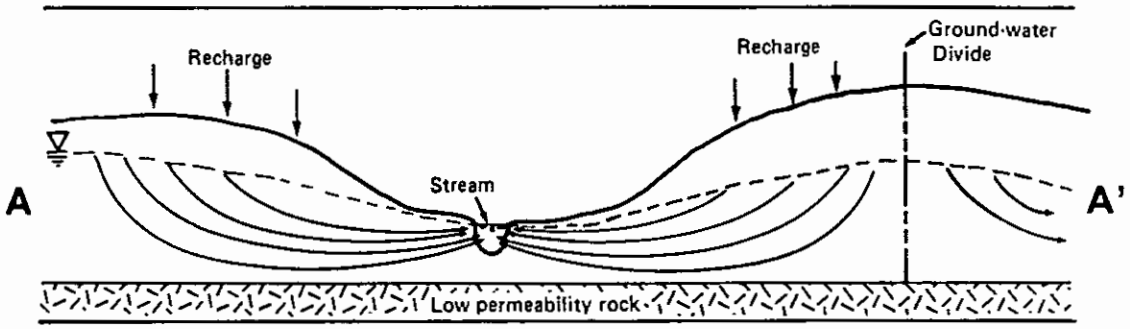
The pumping of the well also causes some of the water which formerly flowed into the stream to flow back into the well itself. The area which actually recharges or supplies water to the well is called the zone of contribution. Figure 6 shows the differences between the zone of influence and zone of contribution. In very homogeneous hydrogeological conditions, the zone of influence and the zone of contribution may be the same area, although in reality such a situation rarely occurs.

An important dimension not as yet discussed here is the dimension of time, which, in turn, relates to rate of flow, distance traveled over time, and the zone of transport, which is that area which contributes flow to a well within a given period of time (e.g., by definition, all ground water within the 5-year zone of transport area can be expected to reach the well in no more than 5-years under a set of assumed conditions). Unfortunately, the diagrams here cannot do justice to the dynamic workings of the ground water system and to the concept of constant movement and flow within this system. Nor is the vast complexity of the physical environment fully acknowledged, including the tremendous variation in climate and precipitation patterns, aquifer considerations such as extent of confinement, differences in behavior of different types of contaminants, and a host of other factors. Nevertheless, these concepts and the essential system are important to understand, if reasonable and effective municipal wellhead protection programs are to be put in place.

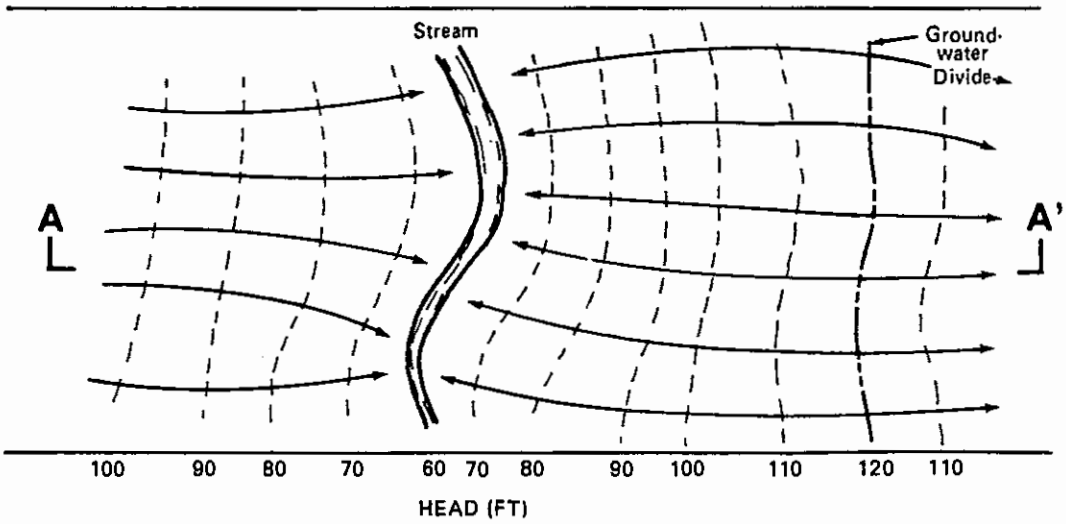
As stated previously, the objective of wellhead protection is to prevent contaminants from reaching wells. In reality, this simple objective is a challenge to implement. First of all, even the concept of contaminants is somewhat unclear. Contaminants include:

> inorganic chemicals: nitrate from septic systems and agricultural areas; chloride from road de-icing, heavy metals from urban sources

Figure 5
Groundwater Flow System (Stream Valley)
Under Natural Conditions



(a) VERTICAL



(b) PLAN VIEW--"FLOW NET"

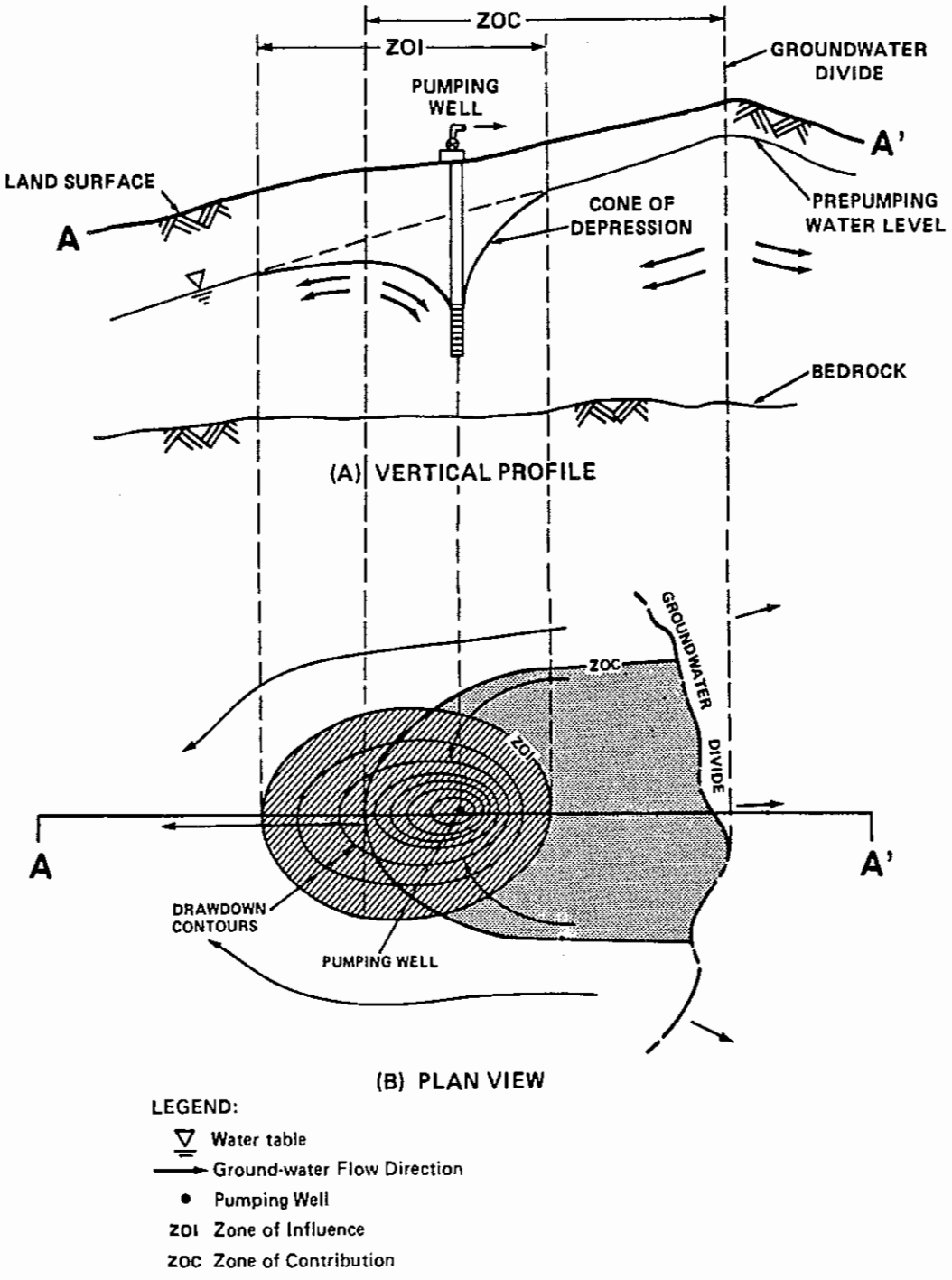
LEGEND:

- Ground-Water Divide
- Equipotential Lines
- Flow Lines
- Water Table

NOT TO SCALE

Source: USEPA Guidelines for Delineation of Wellhead Protection Areas 1987, as based on Driscoll, 1986.

Figure 6
Terminology for Wellhead Protection Area Delineation
(Hypothetical Pumping Well in Porous Media)



Source: USEPA Guidelines for Delineation of Wellhead Protection Areas 1987, as based on Driscoll, 1986.

- organic chemicals: synthetic organics such as hydrocarbons and halogenated hydrocarbons (benzene, toluene, napthalene, xylene, TCE, others) and pesticides (chlordane, DDT, dieldrin, heptachlor, EDB, aldicarb, and atrazine)

- bacteria and viruses: pathogenic micro-organisms, including parasites and enterotoxin-producing bacteria

These many different contaminants have very different physical, chemical, and biological characteristics, making their behavior in ground water extremely variable and complex. Therefore, establishing a fixed 100 ft radius zone of wellhead protection around each well may be inappropriate. Furthermore, different contaminants may behave quite differently in different hydrogeological settings.

Wellhead protection criteria to be selected as the basis for the management program include factors such as:

- time of travel
- distance
- drawdown
- flow boundaries
- assimilative capacity

Criteria selected by a municipality should be sensitive to a variety of technical factors, such as their ease of application, ease of quantification, variability under prevailing conditions, ease of field verification, suitability for the specific hydrogeologic setting, ability to reflect ground water standards, and ability to incorporate physical processes.

A municipality can chose to investigate zones of influence, contribution, and transport with varying levels of technical support and research. Technical approaches include:

- arbitrary fixed radius method
- calculated fixed radius method
- simplified variable shape method
- uniform flow or other analytical methods
- hydrogeologic mapping method
- numerical flow/transport models

These different approaches vary substantially in costs and degree of accuracy, with the more technically reliable methods also being the most expensive. Choices which a municipality makes certainly will be affected by resources available and the local officials' political will to commit these resources to wellhead protection. Choices should also reflect some other common sense factors. The method selected should reflect the seriousness of the wellhead protection problem--how many wells are at stake, how rapidly is development occurring, how vulnerable is the geology--all of which also determine how thoroughgoing the management measures must be. Rural municipalities with few wellhead protection problems need not hire a team of consultants to gather data and model ground water flows using an elaborate computer-based

numerical flow modelling technique. On the other hand, municipalities heavily relying on municipal wells in carbonate formations in rapidly developing, if not developed, areas may well decide to commit to a more sophisticated methodology which will provide a more defensible (technically and legally) basis for a more stringent management program. In short, determining the wellhead protection zone--determining what levels of requirements should be imposed on what areas--is no simple matter and requires a variety of technical and nontechnical inputs.

Qnestion 4: What land uses contribute to wellhead contamination? Is new development, especially that type of development which has contamination potential, expected to occur within the municipality?

As Table 1 illustrates, many different types of land uses can impact wells adversely. Most municipalities in Chester County to varying degrees plan for additional industrial development (heavy and light), auto service stations, agricultural uses, on-site septic systems, and other potentially contaminating land uses and activities in the future. These uses typically are included in the municipal zoning ordinance and map. In most cases, however, these planned zones do not take into account ground water and wellhead protection concerns.

In order to develop wellhead protection programs in Chester County, municipalities should first identify the anticipated land use activities which have potential adverse impact on existing and future wells. The US Office of Technology Assessment has established six different categories of ground water source contamination (Table 1), grouped by the type or source of discharge. These categories are not coincident with land use categories per se, but tend to be associated with certain land uses to varying degrees.

More specifically, EPA lists the following light industrial sectors as of potentially greatest concern in a wellhead protection program:

- agricultural products and services
- mining and quarrying
- highway deicing and maintenance
- textile and apparel products
- lumber and wood preserving
- printing and publishing
- chemical product blending
- leather products
- mineral products: glass and cement
- metal products
- machine shops
- electronics and electronic equipment
- transportation maintenance
- scrap trade and metal container recyclers
- chemical and petroleum storage and sales
- auto repair, service, and parking
- personal: laundry, pest control, photo finishing
- repair services: furniture, welding
- septage services
- amusement and recreation
- educational, medical, engineering labs

Table 1
Sources of Groundwater Contamination

CATEGORY I - Sources designed to discharge substances

Subsurface percolation (e.g., septic tanks and cesspools)
Injection Wells
- *Hazardous waste*
- *Non-hazardous waste (e.g., brine disposal and drainage)*
- *Non-waste (e.g., enhanced recovery, artificial recharge solution mining, and in-situ mining)*

Land application
- *Waste water (e.g., spray irrigation)*
- *Wastewater byproducts (e.g., sludge)*
- *Hazardous waste*
- *Non-hazardous waste*

CATEGORY II - Sources designed to store, treat, and/or dispose of substances; discharge through unplanned release

Landfills
- *Industrial hazardous waste*
- *Industrial non-hazardous waste*
- *Municipal sanitary*

Open dumps, including illegal dumping (waste)
Residential (or local) disposal (waste)
Surface impoundments
- *Hazardous waste*
- *Non-hazardous waste*

Waste tailings
Waste piles
- *Hazardous waste*
- *Non-hazardous waste*

Materials stockpiles (non-waste)
Graveyards
Animal burial
Aboveground storage tanks
- *Hazardous waste*
- *Non-hazardous waste*
- *Non-waste*

Underground storage tanks
- *Hazardous waste*
- *Non-hazardous waste*
- *Non-waste*

Containers
- *Hazardous waste*
- *Non-hazardous waste*
- *Non-waste*

Open burning sites
Detonation sites
Radioactive disposal sites

CATEGORY III - Sources designed to retain substances during transport or transmission

Pipelines
- *Hazardous waste*
- *Non-hazardous waste*
- *Non-waste*

Materials transport and transfer operations
- *Hazardous waste*
- *Non-hazardous waste*
- *Non-waste*

CATEGORY IV - Sources discharging substances as a consequence of other planned activities

Irrigation practices (e.g., return flow)
Pesticide applications
Fertilizer applications
Animal feeding operations
De-icing salts applications
Urban runoff
Percolation of atmospheric pollutants
Mining and mine drainage
- *Surface mine-related*
- *Underground mine-related*

CATEGORY V - Sources providing conduit or inducing discharge through altered flow patterns

Production wells
- *Oil (and gas) wells*
- *Geothermal and heat recovery wells*
- *Water supply wells*

Other wells (non-waste)
- *Monitoring wells*
- *Exploration wells*

Construction excavation

CATEGORY VI - Naturally occurring sources whose discharge is created and/or exacerbated by human activity

Groundwater - surface water interactions
Natural leaching
Salt-water intrusion/brackish water upconing (or intrusion of other poor-quality natural water)

Source: USEPA Wellhead Protection Programs: Tools for Local Governments, 1989.

The light industrial sectors tend to represent growing sectors of both the US economy as well as the economy of Chester County, in contrast to the more traditionally defined heavy industrial uses such as steel production. Many of these uses are being accommodated and will continue to be accommodated in the many industrial parks which increasingly are being renamed "high tech" parks, business centers, or research parks. Regardless of the name, such land uses can have potential adverse effects. Furthermore, EPA acknowledges that even with the considerable number of law and regulations pertaining to hazardous waste management already enacted, the regulatory system has defects:

> "Federal hazardous waste laws and hazardous material control laws and regulations generally include the Resource Conservation and Recovery Act (RCRA), the Comprehensive Environmental Response Compensation and Liability Act (CERCLA or "Superfund"), the Safe Drinking Water Act (SDWA), the Clean Water Act (CWA), the Toxic Substances Control Act (TSCA), and the Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA). Although these laws have imposed controls on a wide range of industries and hazardous material handling practices, they have tended to focus only on the larger manufacturing industries which manage the majority of hazardous wastes and hazardous materials in this country. Other smaller industries and businesses have not been as stringently controlled, either because the Federal statutes focus on industries that manage wastes or materials above a threshold amount or because the materials managed by the smaller industries are not considered "hazardous." Nonetheless, EPA and many States have discovered that these lower quantity or "non-hazardous" materials managed by light industry can still contaminate Wellhead Protection Areas." (USEPA, May 1990, p.2)

An important early step in wellhead protection program development is to assess potential contamination sources within the municipality and then to assign priorities to these sources. A municipality may decide to establish priorities based on degrec of threat, need for management controls, and other localized conditions. If sources do not exist and are not expected to be developed in the future, a municipality need not concern itself with management program elements. Some sources of contamination and related land uses furthermore may pose a threat only in certain geological contexts within a municipality. Wellhead protection actions should be focused appropriately.

An inventory of potential ground water contamination sources should address the dimension of time through an evaluation of historical land uses, existing land uses, and projected land uses. Historical land use analysis may indicate zones of special ground water vulnerability. A municipality, for example, may choose to discourage new well development in areas affected by abandoned landfills and underground fuel storage tanks or in areas previously used for industrial activity. Sources of historical data include old aerial photos, historical maps, tax assessor's records, and community historians. Existing land use information can be obtained through up-to-date aerial photos, tax assessment office records, surveys, RCRA files, CERCLA files, SARA Title III files, Safe Drinking Water Act files, and various other State and local permit program files. Future land use information can be deduced from municipal comprehensive plans and zoning ordinances. Different aspects of past, existing, and future land use may have varying degrees of importance in different municipalities.

Management program approaches are discussed in greater detail below. In order to avoid misunderstanding, however, the point needs to be emphasized here that management does not necessarily translate into prohibition of uses throughout Chester County and its 73 municipalities. Effective wellhead protection programs do not mean the elimination of light and heavy industrial development in Chester County municipalities. A more likely outcome hypothetically might be imposing special performance standards in zones of special vulnerability. For example, if gas stations are to be developed with new petroleum storage tanks buried within the zone of contribution of a public water supply system well, such a storage tank should be required to adhere to the highest of standards, with a certain "protection redundancy" engineered into the system. In some municipalities, certain uses may not be allowed in the most sensitive wellhead protection zones. The point to be made, however, is that wellhead protection need not thwart or have a serious impact on economic development in total. As is true for so many environmental issues, the old adage "an ounce of prevention is worth a pound of cure" is perfectly appropriate when wellhead protection programs are being considered. Managing water resources properly in the long run is the most cost-effective strategy a community can follow. Lack of water or contamination of water supply can have very adverse economic impacts within a community. Contaminated water must be treated to meet Federal drinking water standards. Water treatment increases water costs which are passed on to consumers in the form of increased water rates.

Question 5: Has the municipality taken appropriate steps to incorporate wellhead protection measures into its existing planning and land use management program? What can be done by the municipality to develop an appropriate wellhead protection program? What types of planning tools and techniques are available?

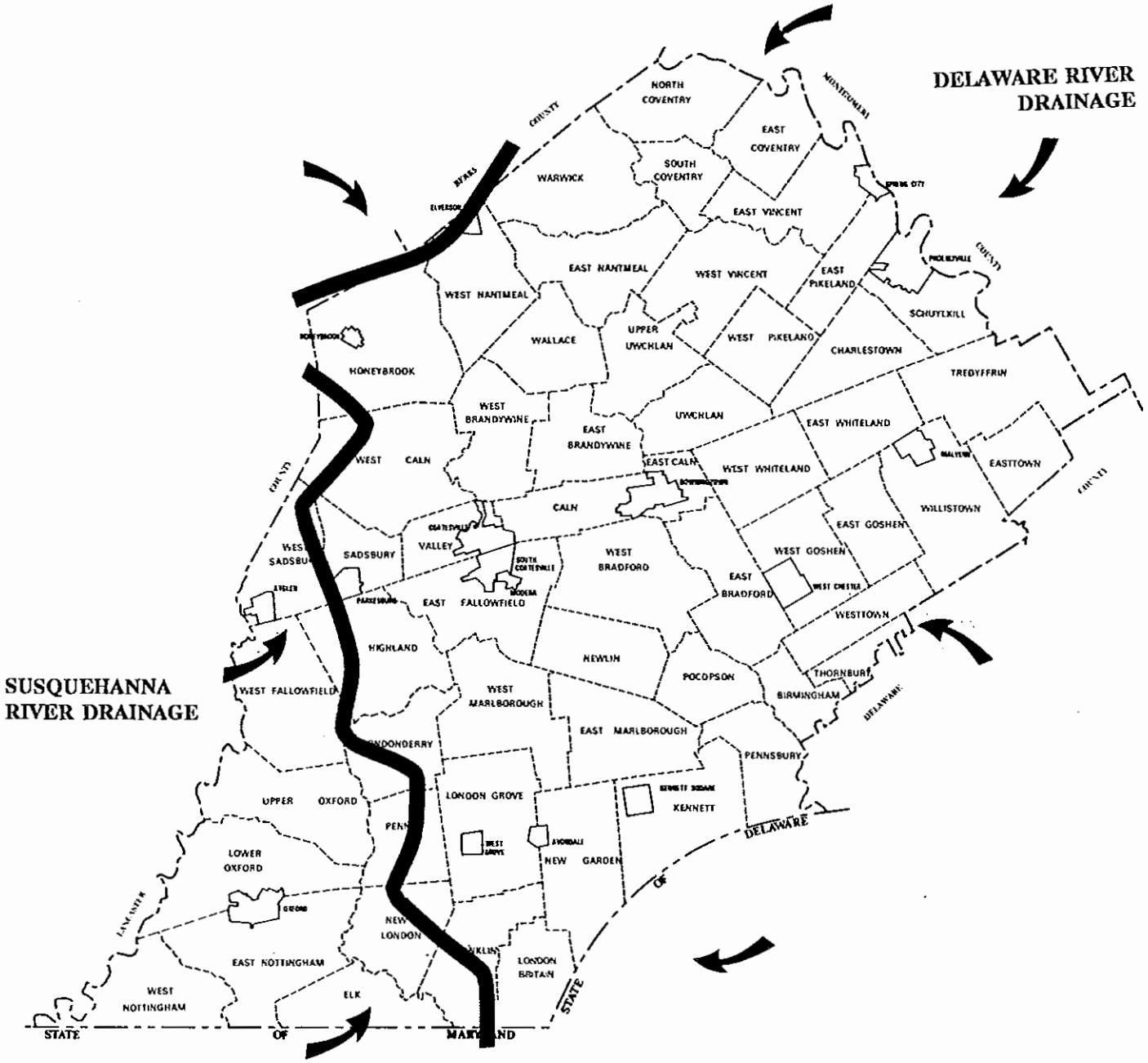
With few exceptions, most municipalities within Chester County do not have adequate wellhead protection program provisions within their existing codes, ordinances, plans, and policies. Although other well development-related programs do exist, these programs in most cases do not provide adequate wellhead protection functions.

The Chester County Health Department (CCHD), one of the few county health departments in Pennsylvania, issues permits for all new wells developed in Chester County. In Chapter 501.6 of the Chester County Health Department's Rules and Regulations, the CCHD establishes a variety of requirements which must be met when new wells are being constructed, including various setbacks from potential pollution sources and construction requirements (casings, grouting, and so forth). These requirements have been established by the CCHD to be applied uniformly across all municipalities within Chester County. These requirements are not sensitive to specific hydrogeological contexts and have no bearing on effective management of land uses after wells have been put in place. Although the CCHD well permitting program is an important program--the only one of its type in Pennsylvania, each municipality is still responsible for incorporating wellhead protection measures into its planning and land use management program.

The Delaware River Basin Commission (DRBC) issues permits for the development of new large wells (expected to produce 100,000 gallons per day or more) within Delaware River drainage basin (about two-thirds of Chester County; Figure 7) and must reconsider these permits every five years. In the special Groundwater Protected Area (about half of DRBC's jurisdiction in Chester County; Figure 8) the permitting threshold for "large wells" drops to 10,000 gpd. Much though not all of this DRBC well permitting program is oriented around water quantity--making sure that wells do not interfere with one another and do not lower the water table such that stream base flow is substantially reduced or eliminated. The Susquehanna River Basin Commission maintains the same sort of well permitting program in the remaining portions of the County (about one-third of Chester County; Figure 7), although has no special "ground water protected area" provisions. These permitting programs are very important, but do not provide the wellhead protection functions discussed here.

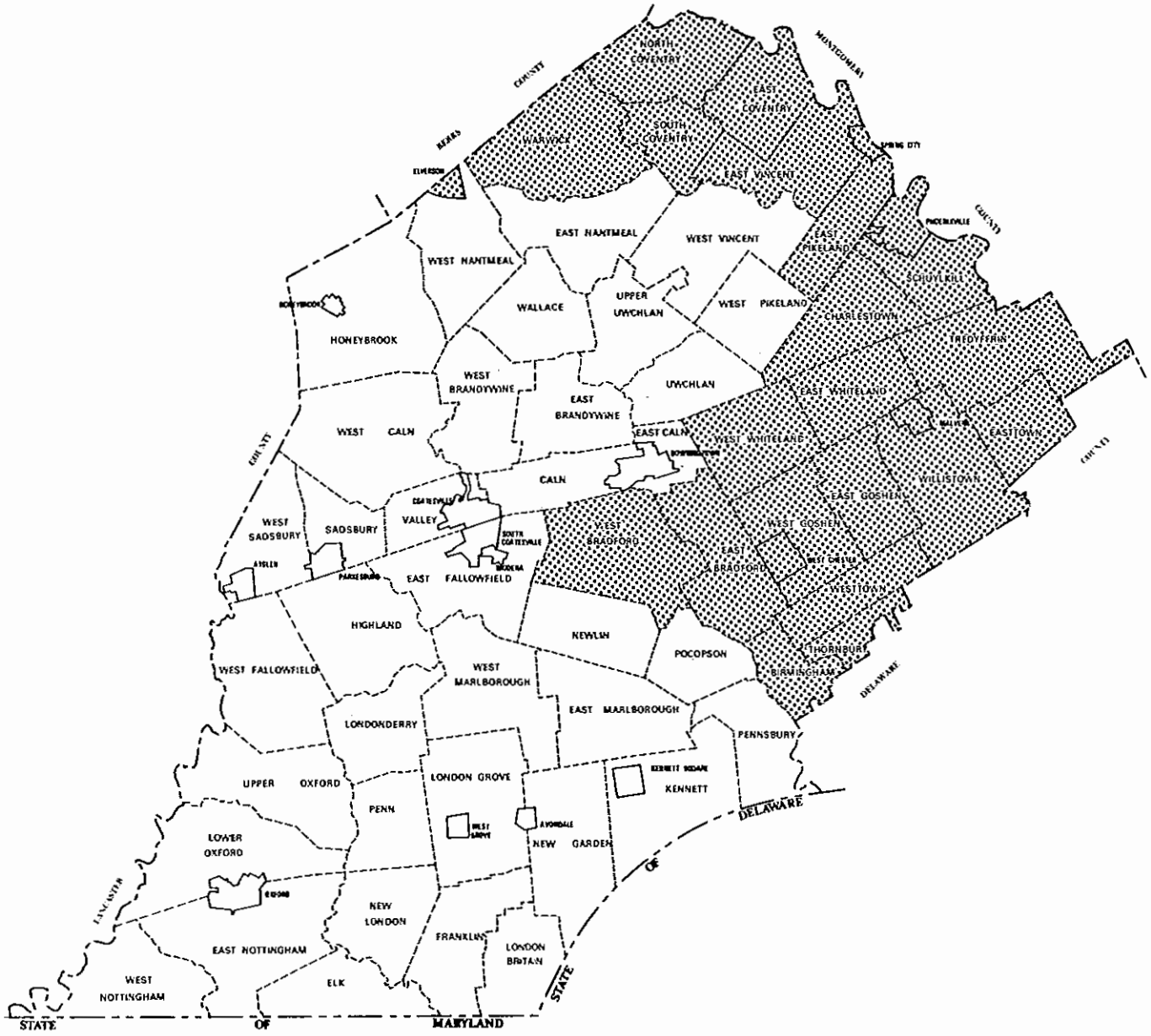
There is no one "right way" for a municipality to undertake formulating a wellhead protection program. Various types of tools and techniques are available to a municipality, all of which are legal within the Commonwealth. A municipality may pick and choose from different options, depending not only on the seriousness of the wellhead protection issue from a substantive or technical standpoint, but also on the fiscal, political, and administrative realities characterizing the municipality. Planning techniques selected should correspond to and be consistent with the municipality's basic approach to planning and zoning.

Figure 7
Delaware and Susquehanna Rivers Drainage Basins



Source: Chester County Planning Commission, 1991.

Figure 8
Southeastern Pennsylvania Special Groundwater Protected Area in Chester County, Pennsylvania



Source: Delaware River Basin Commission, 1991.

Planning and ordinance options available to which municipal wellhead protection programs can be applied include:

- comprehensive or master planning
- zoning
- subdivision regulations
- building codes
- site planning reviews
- design standards/operating standards/source prohibition
- direct acquisition
- monitoring programs
- educational programs

These techniques may be used individually or together. Municipal programs may be regulatory or nonregulatory in nature, as evidenced by the difference between zoning requirements versus a wellhead protection educational program designed to raise the consciousness of residents. Technically speaking, comprehensive planning and zoning really can be viewed as one technique, given the requirement in Pennsylvania that zoning be consistent with and in fact "implement" the municipal comprehensive plan. In fact, the comprehensive planning process really includes most of the specific techniques discussed below, such as different types of zoning, subdivision provisions, special site planning review techniques, and so forth.

Comprehensive or Master Planning

The comprehensive or master plan itself can be used to achieve wellhead protection objectives. The basic comprehensive planning technique, simply stated, is to vary both the amount of development and land use activity as well as the type of land use in accord with wellhead protection objectives. Development of the comprehensive plan, as enabled under the Pennsylvania Municipalities Planning Code, may include "water surveys" designed to guarantee an adequate supply of water for future municipal use--an objective which coincides with wellhead protection as well. A master planning process which takes into account aquifer sensitivity issues, both quality and quantity, in terms of how much of what type of use is planned in various portions of a municipality is an important first step in overall wellhead protection programming. In fact, basic provisions incorporated into the comprehensive plan early in the planning process may satisfy wellhead protection needs if threats to public water supply wells are not considerable. In other contexts, comprehensive plan provisions may have to be reinforced with a variety of subdivision, site planning, educational, and other techniques as discussed below, if an effective wellhead protection program is to be developed. Once comprehensive plan provisions are established, zoning techniques must implement the plan.

The municipal comprehensive plan must balance a variety of planning objectives above and beyond wellhead protection concerns. Some of these objectives may be conflicting. For example, from a wellhead protection perspective, the highly contamination-sensitive limestone formation band which bisects the County up through the Chester Valley suggests that limitations should be placed on future growth and development in order to protect this existing and future source of water supply. This Chester Valley corridor also happens to be the focal point of some of the County's foremost transportation arteries which have attracted and are continuing to attract high density development of all types. To propose low growth or no growth

strategies here for the purposes of accomplishing aquifer management objectives would be unrealistic and ultimately inefficient. In these particular zones, comprehensive planning strategies may be unworkable, with wellhead protection taking a more performance standard approach--how development is allowed to take place.

Zoning

Zoning, a direct outgrowth of the comprehensive plan, is probably the most obvious tool for a municipality to use in wellhead protection programming. All 73 municipalities in Chester County have adopted zoning maps and ordinances of different types which can be amended to incorporate wellhead protection program needs. The simplest and most straightforward approach to zoning is to simply "down zone" areas--in other words, make zones less intense--compatible with comprehensive plan categories. Wellhead protection zones may become large-lot residential zones where minimum lot size is 5 acres or even more. Types of uses may also be restricted. For areas not already developed, zoning approaches may be ideal. Even in areas already developed, zoning strategies may be imposed in order to phase in wellhead protection strategies (i.e., as existing land uses age and site re-use and re-development occur, land use becomes more wellhead protection compatible).

> "If the wellhead area is surrounded by industrial plants, for example, a community could require that no new industrial plants can locate within the wellhead area and that, once their useful lives were complete, all existing facilities must be shut down and decontaminated. Moreover, existing facilities might be barred from expanding their operations." (USEPA, 1989, p. 12)

A variety of specialized zoning techniques also can be used quite effectively:

> Overlay zoning: a special set of requirements and specifications which coincides with a wellhead protection area (e.g., the well's zone of contribution) could be imposed on an existing zoning map, as is frequently done when managing floodplains, steep slopes, and other natural features. Overlay zones need not conform to existing zoning category boundaries. The overlay zone may be defined in terms of types of land uses being controlled (gas stations may simply not be allowed to be built within any commercial zone that also happens to lie within a wellhead protection area). Or the overlay zone may be defined in terms of the intensity of land use (densities of single-family homes relying on septic tanks may be reduced substantially within a wellhead protection zone). Or the overlay zone may trigger adherence to some of the techniques listed below, such as special performance standards, which affect how a land use activity is to occur. For example, farming as a land use category may be permitted within the wellhead protection zone, but use of certain types of pesticides, herbicides, and other chemicals may be prohibited. In overlay zoning, the municipality must delineate wellhead protection zones, typically through the assistance of a consultant or some other source of expertise.

Floating zoning: whereas overlay zones are actually mapped, floating zones are defined by specific conditions and criteria which typically have not been delineated on the municipal zoning map and are defined in writing only. Floating zones can serve to function in virtually the same manner as overlay zones--the specific conditions and criteria establishing wellhead protection areas can be identical. In the floating zone approach, however, the municipality does not assume the responsibility of actually mapping the wellhead protection zones. Of course, the wellhead protection zone criteria must be set out quite clearly. On the one hand, the floating zone can be far less expensive for a municipality to incorporate into an existing zoning ordinance because the burden of delineating the wellhead protection zone is transferred to the developer/owner/applicant. The disadvantage is that the municipality has no direct control over the manner in which protection zones are delineated. If the municipality wants to maintain quality control in the delineation process, the municipality has to hire its own consultant in any case.

Cluster zoning: clustering may be used to load the otherwise permitted amount of development in a concentrated portion of the site, thereby minimizing site disturbance and maintaining the remainder of the site in open space. Cluster zoning tends to be useful in contexts where land holdings are sizable and where a portion of the site happens to fall within a wellhead protection area. Assumed here is that wellhead protection criteria have been established and wellhead protection zones delineated and overlayed onto the zoning map. Planned unit developments are a variation on this clustering theme, though tend to be larger in scale. Municipalities may employ the clustering technique as an option and encourage its use by providing the added incentive of an increase in maximum allowed density on a parcel; this approach is called incentive or bonus zoning.

Conditional zoning: in conditional zoning, certain uses within certain zones are allowed but only as conditional uses, subject to specific conditions established within the zoning ordinance. For example, multi-family residential uses may be conditioned upon use of specific types of waste water treatment systems. Types of industrial facilities may be conditioned upon use of specific types of storm water collection facilities, certain types of substance handling and storage practices, and so forth. A conditional zoning approach tends to require more involvement by the municipality in each development proposal.

Transfer of Development Rights (TDR): this technique, which transcends the category of zoning to some extent, is difficult to implement, yet offers a municipality tremendous potential in the regulation of land use. Because existing value is not taken from land owners, the very serious question of "taking" without "just compensation" is avoided, if the TDR system is properly designed and operated. Tremendous reduction in intensity of land use can be accomplished within a wellhead protection zone.

Several important aspects of TDR need to be kept in mind as a municipality considers its application (this bulletin does not purport to be a comprehensive evaluation of the TDR technique, given its complexity and variability; more detailed information concerning TDR is available from a variety of sources, including the CCPC office). First, development of the system is complex, and administration is difficult. Frankly, it is hard to imagine any municipality instituting TDR for the sole purpose of wellhead protection. However, if the TDR system were to be driven by a variety

of natural resources such as presence of floodplains, wetlands, steep slopes, stream buffers and drainageways, exceptional value habitats, prime farmland, high quality viewsheds, and other values which the municipality sought to preserve/conserve, a TDR approach could be quite successful. Secondly, the TDR concept requires that areas be designated for receiving development rights as well as sending rights. In some cases, TDR receiving zones may be floating zones such as Planned Residential Development zones. Other experts advocate using carefully designated and designed fixed receiving areas--such as the village concepts which have recently gained planning prominence in order to properly articulate and plan for increased growth and development. Thirdly, the municipality must decide if TDR will be mandatory or voluntary. These complications notwithstanding, a TDR approach offers considerable potential.

In all zoning approaches, of course, municipalities must be sensitive to legal issues so that ordinances are not excessively restrictive or discriminatory. Stringent regulations which cause substantial reduction in property values can be deemed to be "regulatory takings" which require municipalities to provide appropriate payment to affected landholders. The zoning techniques listed here, however, can be successfully integrated into municipal ordinances without their being determined to be unconstitutional by the courts. Municipalities opting for a more performance oriented approach such as through clustering may discover that both legal and political difficulties are minimized. In choosing an appropriate approach, municipalities must consider their needs and resources carefully. All else being equal, strategies selected should also reflect strategies already being used by a municipality to accomplish other planning objectives (i.e., the municipality may be using the technique of overlay zoning in other ways such that this approach would be easily incorporated as part of the wellhead protection program as well).

Subdivision Regulations

Although the line between zoning and subdivision regulations can be quite blurred, zoning questions typically focus on how much of what type of land use may occur, whereas subdivision regulations affect how a particular subdivision/land development is to be undertaken. Subdivision/land development ordinance objectives may include measures designed to guarantee that new development is properly coordinated with necessary infrastructure and municipal services, conservation and preservation of the natural environment, and other objectives designed to promote the "general health, safety, and general welfare" of the municipality.

In terms of wellhead protection programming, subdivision/land development techniques can be used in conjunction with the comprehensive plan and zoning provisions. Or in some situations, a municipality may choose to deemphasize comprehensive planning and zoning provisions and focus on subdivision regulation techniques. In most Chester County municipalities, subdivision/land development ordinances regulate the creation of new residential and other types of lots as well as new land developments of a certain magnitude occurring on an individual lot. Minor subdivisions or development of new homes on an existing lot may not be regulated, as may be the case for other types of smaller developments. If this lack of regulation poses a problem from a wellhead protection perspective, techniques beyond or in addition to subdivision/land development regulations should be considered.

The subdivision/land development ordinance itself can establish criteria for a wellhead protection zone or can simply refer to this zone created elsewhere in the municipality's codes and ordinances. The subdivision/land development ordinance should then specify design, construction, and operating standards within the wellhead protection zone. Placement of hazardous material storage containers could be forbidden within a wellhead protection district, for example. Special standards for underground and surface storage tanks (e.g., double-walled) may be established for the wellhead protection zone. Storm water management provisions designed to manage nonpoint source pollutant loadings may be imposed. Low-leaking sewers and special waste water treatment facilities may be specified. Conventional on-lot septic systems may be allowed, but only at reduced densities. More rigorous management program requirements may be specified to guarantee that once septic and other systems are constructed, these systems are properly operated and maintained. More generous open space requirements may be prescribed in wellhead protection districts. These different examples of standards can be categorized as source prohibitions, operating standards, and design standards.

Design standards: design standards are specifications applied to new construction (structures and infrastructure systems such as roads and parking lots, storm water collection systems, road salt storage areas, and others) or modifications to existing land uses. Design standards are developed for potential sources of ground water pollution, such as hazardous materials containment structures or areas, surface water runoff collection systems, large impervious areas such as parking lots and buildings, and other sources. EPA indicates that possible design standards might be as follows:

1. new development is required to apply water quality management practices and/or recharge to the first inch or two of precipitation;

2. hazardous materials containment systems may be required to have back-up systems or other special provisions applied;

3. wellhead protection zones may include design standards which limit maximum impervious coverage, maximum site disturbance, and/or zones of maintained area.

Standards have already been established on the Federal level for the following: underground storage tanks containing petroleum products or hazardous substances, underground injection wells, hazardous waste generators, municipal and industrial solid waste landfills, waste water treatment plants, surface mines, Superfund sites, and facilities managing nuclear material (additional information on these specific standards can be obtained from EPA's Office of Ground-Water Protection in Washington at 202-382-7077, the EPA Region III Office of Ground Water at 215-597-2786 or the Pennsylvania Department of Environmental Resources' Office of Environmental Management at 717-787-5028).

Formulation of design standards does require technical expertise; assistance from Federal, State, and other agencies is available to help municipalities specify technical standards and applicable designs. If a design standard is a performance standard, the standard should be sufficiently specific so that consistent application of the standard is possible across the municipality. Specific standards reduce the likelihood of legal challenges and the difficulty of making compliance determinations, as well as minimize confusion in the development community. If the standard is a technical standard (e.g.,

all underground storage tanks must be double-walled), these technical standards must be directly linked to ground water threats and problems. Adequate use of these standards underscores the importance of using the site plan review process (see below) as part of the wellhead protection program. Design standards should be clearly written and should apply to clearly delineated wellhead protection zones in order to minimize confusion, unnecessary review work, and legal challenges.

Operating standards: operating standards are similar to design standards, except that operating standards relate to the way in which an activity operates--not to its manner of construction. Operating standards include, for example, best management practices or BMP's for the agricultural and commercial/industrial sectors. BMP's typically define a set of standard operating procedures to be used within a particular industry or commercial activity to reduce potential pollution. Examples include the chemical application practices in the farming community, where large quantities of toxic pesticides, herbicides, and fertilizers are applied to the land and can infiltrate into wellhead protection zones. BMP's include integrated pest management practices, minimizing chemical applications, chemical applications restricted to dry periods when infiltration rates are reduced, erosion and sedimentation controls, and others. Examples of BMP's relating to the handling of hazardous substances at sites such as dry cleaners, auto service stations, industrial plants, trucking and railroad facilities, and airports could include special restrictions on hazardous material handling and storage, limits on or collection systems for the use of road salts and de-icing chemicals, requirements for periodic testing and system checks, and others. BMP's vary by the type land use activity. For example, a variety of BMP's have been developed and adopted specifically for the mushroom growing industry to reduce both surface and ground water quality problems which may be associated with this activity. EPA and other agencies have produced a number of publications which list land use activities posing wellhead impacts and the BMP's which may be used to reduce these impacts. Operating standards are most effective when used in conjunction with design standards.

Source prohibitions: source prohibitions may take the form of either prohibiting the presence and/or use of certain hazardous substances within a specified wellhead protection area or prohibiting land use activities which use these hazardous substances. Land use activities include junk yards, machine shops, landfills, auto service stations, septic systems, various types of agricultural activities, and others (see discussion above). Pollutants of concern here include heavy metals, solvents, petroleum products, and radioactive materials, although both the types of pollutants and their related land use activities may vary from one municipality to another. In source prohibition, as with any other type of standard, a municipality may opt to ignore various types of activities and related contaminants which do not exist and are highly unlikely to occur within the municipality in order to simplify the wellhead protection program, especially in the initial stages of the program. EPA recommends that in undeveloped wellhead protection areas which are quite vulnerable, design and operating standards may have to be reinforced by outright source prohibition. In areas already developed (e.g., where underground storage tanks have already been put in place), source prohibition can only be phased in. New storage tanks may be prohibited, for example, but existing tanks allowed to remain if operating satisfactorily. Replacement tanks, however, would be prohibited.

Site Plan Reviewing

To a large extent, many of the techniques already discussed such as various types of zoning, subdivision regulations, and design standards overlap with and may include site plan reviewing. Site plan reviewing usually is a part of the zoning and/or subdivision and land development ordinance. Site plan review refers to a phase in the total land management process where various standards may be applied. A site plan review process may be relatively unstructured with the wellhead protection objective stated generally, the intent being to evaluate applications within a wellhead protection area on an individual and site-specific basis. Alternatively, the site plan review requirement can be coupled with more clearly delineated standards, source prohibitions, and the like. Virtually all municipalities in Chester County have this site plan review requirement already in place so that incorporation of site plan reviewing as part of a municipal wellhead protection program in some manner would appear to be quite workable.

Drawbacks to heavy and/or exclusive reliance on site plan reviewing in wellhead protection programming are that municipal resources, both administrative and technical, are required to conduct these site plan reviews. Although the burden of proof is placed on the developer/applicant, substantial municipal involvement is required if site plans are to be reviewed with careful scrutiny. Secondly, although an individualized site plan review process offers maximum flexibility and potential thoroughness in wellhead protection implementation, at the same time there may be difficulty in maintaining consistency in reviews from site to site. Furthermore, because of this potential lack of consistency, the potential for legal challenges may be greater. Advantages to site plan reviewing may be that avoiding an approach which prohibits or specifically controls land use may be more politically palatable and therefore more easily implemented by a municipality.

Acquisition/Purchase of Property Rights

From the landowners perspective, delineation of wellhead protection zones and then purchase/acquisition of these zones in some manner is preferable than most other techniques. Here, owners are properly compensated for any reduction in property rights which wellhead protection generates. Obviously, from the municipality's perspective, this approach is most costly and in most cases an option of last resort, if feasible at all. A municipality must decide whether or not to exercise its power of eminent domain in its acquisition program and condemn properties, in contrast to an approach which relies exclusively on voluntary negotiations with respective landowners. The two approaches often have significantly different economic and political consequences. These and other questions can create difficulties, even if substantial municipal monies can be made available for the wellhead protection program.

If full "fee simple" title of wellhead protection parcels is acquired, then the municipality has maximum control over the future use of this land. The acquired land, of course, is removed from the tax rolls. Frequently, such a technique is simply too costly for most municipalities, especially given the rapidly escalating cost of real estate in Chester County. However, if other municipal program objectives can be integrated into the acquisition program such as recreation and parkland needs, then a multi-purpose acquisition program may be workable (i.e., municipalities should be encouraged to integrate wellhead protection objectives into their park, recreation, and open space planning and acquisition programs, all else being equal). This type of direct acquisition approach has been used in Chester County for surface water

sources (Marsh Creek State Park and the County's new Birch Run Dam project at Hibernia Park) and can be used in conjunction with ground water supply as well.

Probably the more feasible approach to a program which includes acquisition and purchase is one in which the full "fee simple" title is not acquired, but some partial interest in the land is purchased. This partial interest may take the form of conservation easements or restrictive covenants. Advantages to this partial approach is that the municipality is not burdened with maintaining and being liable for the property, the property remains on the tax rolls, and municipal resources can be stretched. Conservation easements can be used to protect a variety of resources such as wellhead protection zones, while permitting owners to continue many productive uses of their land. Easements must be carefully developed to make sure that restrictions set forth in the easement fully control all land use activities that potentially threaten ground water. EPA suggests that conservation easements may prohibit certain types of land use development or certain densities of development or may limit certain aspects of uses (i.e., use of hazardous substances or on-lot septic systems). Easements may be acquired for a certain number of years or term or may be acquired in perpetuity and run forever. In some situations, donation or bargain sale of these easements to the municipality or to one of the County's many conservancies may be a viable option.

Use of restrictive covenants is another interesting variation on the purchase/acquisition approach. In this case, the municipality purchases desired parcels outright, imposes a use restriction in the form of a restrictive covenant in the deed, and then resells the property with the deed restriction in effect. Another approach might be to make final development approval contingent upon insertion of restrictive covenant(s) in the property deed(s). Restrictions can be used to prohibit specific land uses, densities, and/or other potentially threatening activities which are the target of a municipal wellhead protection program.

All of these acquisition strategies offer advantages in terms of wellhead protection program implementation. A municipality, for example, can both prioritize lands to be acquired and target those real property interests to be purchased. Within a wellhead protection zone, specific parcels may be especially critical. In selecting the best acquisition technique, municipalities should consider the physical properties of the lands, how much control over land use activities is felt to be necessary to accomplish wellhead protection objectives, as well as the interests and concerns of the private landowner. Funding sources include municipal bonds and local property taxes, as well as increases in sewer/water fees.

Educational Techniques

A different nonregulatory approach to a wellhead protection program can be based on the use of educational techniques such as press releases and press conferences, newsletters and brochures, formation of committees and advisory groups, and sponsoring of public programs and seminars using appropriate speakers, slide shows, video tapes, and other media to communicate the importance of wellhead protection programming. These various techniques can be used to explain the importance of ground water quality to the municipality and its residents, to describe methods of preventing well contamination by residents, businesses, and others in the municipality, to discuss water conservation techniques, and to describe water purification technologies. Such voluntary approaches may be appropriate in municipalities not prepared to enact regulations and can

be the first step in a more thoroughgoing regulatory program. EPA suggests the formation of a local advisory committee, composed of representatives from local businesses, interest groups, local elected officials, and government agencies. The advisory committee can be structured in terms of its role, goals and objectives, program priorities, deadlines for various outputs and products, and so forth.

Educational techniques also can be the basis of continuing programs for water conservation, used oil collection and recycling, household hazardous waste management, and other specific sources of ground water contamination.

Other Approaches

Water Conservation Programs: conservation of water use--reduction in total water being pumped--leads to reductions in a well's cone of depression, its zone of influence, and its zone of contribution. As the result of these reductions, plumes of contamination may not intercept and impact a well. Although sources of contamination are not reduced, conservation does provide an indirect wellhead protection function. Water conservation programs, of course, serve many other important functions in addition to wellhead protection.

Ground Water Monitoring: a municipality can include the element of ground water monitoring as an additional element in an overall wellhead protection program or can utilize a ground water monitoring approach as the cornerstone for the program itself. Monitoring provides data, but does not prevent contamination problems from occurring as other techniques are designed to do. Monitoring programs typically require the services of an expert (consultant) to design a program which addresses issues such as frequency of sampling, location of sampling in both public and private wells, parameters to be sampled, and others, all of which are determined by the overall goals and objectives of the monitoring program. Monitoring may be used as an advance warning system, as evidence that drinking water standards are being met, and as support for other aspects of a wellhead protection program.

The real drawback to municipal reliance on monitoring is the substantial cost involved to both develop and operate the well monitoring system, unless monitoring responsibilities and costs can be passed on to private developers and owners. The Chester County Health Department and Water Resources Authority, in conjunction with the US Geological Survey, already have a monitoring program in Chester County which could be of value in some municipalities. Any monitoring undertaken by a municipality should be coordinated with both the CCHD and CCWRA.

Other approaches include public information/education campaigns, designed to explain the nature and extent of the wellhead protection problem as well as actions which should be taken to prevent problems from occurring. A public information program obviously is a nonregulatory approach and therefore its effectiveness can be uncertain. On the other hand, the municipality's commitment of resources can be minimal. As a matter of fact, a municipality may be able to enlist the services of public interest groups such as the League of Women Voters, the Sierra Club, scout organizations, and others to conduct the information campaign itself. Such an educational campaign can be used in conjunction with a variety of other wellhead protection initiatives.

Linked to educational campaign efforts are household hazardous waste collection programs, designed to eliminate the problem of improperly disposed of pesticides, herbicides, solvents, paints and art supplies, pool chemicals, and other household chemicals. Such a program clearly is not an alternative to the land use management techniques discussed above and therefore can be used in tandem with these other approaches to wellhead protection. Issues of financing, publicity, location of collection points, and disposal of substances collected must be carefully considered before a successful program of household hazardous waste collection is undertaken.

Question 6: How does a municipality go about developing a wellhead protection program? What are the first steps to be taken?

Getting started--taking initial wellhead protection steps--need not overwhelm a municipality. The Federal government, namely EPA, has prepared some excellent program materials which explain various aspects of the wellhead protection program. The Pennsylvania Department of Environmental Resources has a Harrisburg office whose business it is to assist municipalities in the implementation of programs throughout the Commonwealth.

County agencies, the Health Department, Planning Commission, and Water Resource Authority, also are available for advice and guidance. The commitment of the County to providing this important information and to helping its 73 municipalities is reflected in this planning bulletin, as well as other informational efforts being put forward (e.g., County agencies kicked off their information campaign with a November 1991 evening seminar designed to help municipal officials familiarize themselves with the wellhead protection program). The County also wants to make sure that all of our 73 municipalities are aware that, each year, both EPA and PADER distribute grants to municipalities which are developing wellhead protection programs. In past years, no municipalities in southeastern Pennsylvania counties have applied for these grants. In the case of the EPA program, the Federal government provides 90 percent matching grants; the required 10 percent municipal share can be provided in the form of in-kind services.

EPA in its guidance alerts municipalities to several key elements in municipal program implementation:

Funding: if a municipality ultimately decides to enact a program, numerous funding options are available, even including grants from the State and Federal governments as mentioned above; a system of fees can and should be imposed which assign program costs onto those who benefit from wellhead protection efforts. EPA has published Local Financing for Wellhead Protection which provides useful information on how to go about funding programs.

Legal: a municipality can be reasonably confident that a prudent legal path can be followed in enacting wellhead protection program requirements, such that legal challenges not only will be unsuccessful, but will be discouraged from the outset.

Staffing: specific requirements such as staffing and funding for staffing all should evolve after program needs have been established. It is County agencies' belief that the most important wellhead protection program measures can be instituted by the majority of Chester County's 73 municipalities without having to hire additional municipal staff. Some additional consulting expertise is likely to be necessary during program formulation, in order to correctly designate zones of contribution, zones of travel, and other important technical aspects of the program.

Enforcement: in most cases, enforcement of wellhead protection program requirements can be accomplished through already existing systems in the municipality (e.g., planning, zoning, and subdivision regulation elements).

However, even before many of these elements of a municipal wellhead protection program can be resolved, municipalities should consider use of a "task force" or "advisory committee" approach, where either part of an existing municipal body or municipal group would hopefully volunteer to do a preliminary investigation of a wellhead protection approach in the municipality. This "ad hoc advisory committee" should consider many of the issues discussed in this planning bulletin, such as number of public water supply wells within its jurisdiction, general types of geological formations, known instances of wellhead problems, and so forth. Much of this information is already available and need not require the services of a consultant. The committee should then make a recommendation to the municipal planning and governing bodies regarding an appropriate approach to wellhead protection, before any substantial municipal resources are committed. County agencies are available to support municipalities in this effort.

To conclude, we understand that wellhead protection is yet another new term--new program--being put in front of municipal officials, the same municipal officials already beset by proliferation of new regulations and requirements in so many areas. Governing a municipality effectively is becoming an enormously complicated task, requiring more and more energy from local officials willing to volunteer their valuable time. County agencies will continue to do their best to support municipalities in these challenges which must be faced and in solving these problems which cannot be ignored.

PLANNING BULLETIN

Previous Issues

1. HIGHWAY PRIORITIES (June 1976)
2. TRAFFIC OPERATION PROGRAM TO INCREASE CAPACITY AND SAFETY (July 1976)
3. HOMEOWNERS ASSOCIATIONS (January 1979)
4. POPULATION PROJECTIONS 1980-2000 (August 1980)
5. CURRENT HOUSING ISSUES (January 1981)
6. SUBDIVISION ACTIVITY - 1980 (May 1981)
7. CENSUS OF POPULATION AND HOUSING - 1980 (December 1981)
8. SUBDIVISION ACTIVITY - 1981 (March 1982)
9. STORMWATER MANAGEMENT PRACTICES (September 1982)
10. ZERO LOT LINE HOUSING (September 1982)
11. CENSUS HIGHLIGHTS (January 1983)
12. ACT 247 ACTIVITY - 1982 (February 1983)
13. CENSUS - SEX AND AGE CHARACTERISTICS - 1980 (April 1983)
14. CENSUS - HOUSING HIGHLIGHTS - TENURE, RENT, VACANCY - 1980 (April 1983)
15. CENSUS - MINORITIES - 1980 (September 1983)
16. CENSUS - INCOME PROFILE - 1980 (September 1983)
17. CENSUS - TRANSPORTATION TO WORK AND PLACE OF WORK (March 1984)
18. SCHOOL CLOSINGS AND BUILDING RE-USE (August 1984)
19. CENSUS - OCCUPATION AND INDUSTRY (April 1984)
20. ACT 247 ACTIVITY - 1983 (March 1984)
21. CENSUS - EDUCATION PROFILE (December 1984)
22. ACCESSORY APARTMENTS IN SINGLE FAMILY HOMES: ISSUES AND REGULATIONS (May 1984)
23. HOUSING OPPORTUNITIES FOR THE ELDERLY (July 1984)
24. HOUSING AFFORDABILITY - CHESTER COUNTY 1983 (July 1984)
25. MIXED USE ZONING (October 1984)
26. HOUSING SUPPLY CHANGE 1970-80 (January 1985)
27. COMMUNITY LIVING ARRANGEMENTS (April 1985)
28. POPULATION PROJECTIONS 1990-2000 (December 1985)
29. SLIDING SCALE ZONING (January 1986)
30. BANNERS AND TEMPORARY SIGNS (January 1986)
31. CENSUS OF POPULATION - SINGLE PARENT AND SINGLE PERSON HOUSEHOLD - 1970-1980 TRENDS (November 1986)
32. ELDERLY - CHARACTERISTICS AND TRENDS (August 1987)
33. WETLANDS (August 1987)
34. MICROWAVE ANTENNAS (December 1987)
35. POPULATION PROJECTIONS - 1990-2010 (May 1988)
36. HOUSING TRENDS (December 1988)
37. (Revised) STREAM WATER QUALITY CLASSIFICATIONS (July 1991)
38. MPC ACT 170 AMENDMENTS, 1990 (March 1990)
39. HOUSING COSTS (August 1990)
40. SPRAY IRRIGATION (November 1990)
41. PLANNED RESIDENTIAL DEVELOPMENT (December 1990)
42. ON-LOT SEWAGE MANAGEMENT PROGRAMS (October 1991)

CHESTER COUNTY BOARD OF COMMISSIONERS

Joseph J. Kenna, Chairman
D.T. Marrone
Patricia M. Baldwin

CHESTER COUNTY PLANNING COMMISSION MEMBERS

Rita E. Reves, Chairman
Dr. Henry A. Jordan, Vice Chairman
Susan D. Beach
Edwin R. Hill
William Rambo
Ellen Ann Roberts
Ellis E. Stern, Jr.
John R. Williams
John M. Yeager

George W. Fasic, Executive Director

William H. Fulton	Assistant Director
Wesley R. Horner	Project Planner
Karen R. Peed	Word Processing
Lynne M. Whitman	Graphics

CCPC BULLETIN

PLANNING BULLETIN

CHESTER COUNTY PLANNING COMMISSION

235 W. MARKET ST. · WEST CHESTER, PA 19382 · (215) 344-6285

BULK RATE
U.S. POSTAGE
PAID
PERMIT NO. 23
WEST CHESTER, PA

Board of County Commissioners and the Chester County Planning Commission