

Is Your Water Supply Protected?

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The answer to the question is no, unless you are addressing the latent threats of our chemical age and unless you are employing an aggressive, watershed-wide land use management program. The drought that North Carolina and the Southeast experienced last summer demonstrated our vulnerability to the water *quantity* problem. But it shouldn't distract planners from the more pernicious threats to water *quality* posed by urbanizing water supply watersheds in the chemical age. The geometrical increase in chemicals and chemical use since WWII has increased and complicated the threat to our drinking waters. To answer that threat we must mount new and aggressive water supply protection strategies.

In what we now know is an obsolete era covering most of this century, even into the 1980s, planners and water supply managers considered our urban surface water supply watersheds as multiple use areas. Agriculture, forestry, and industrial, commercial, and residential activities were allowed to coexist with the hydrological process of providing drinking water to an impoundment. We assumed that water treatment would make the water safe to drink.

Within the last few years, however, we planners, water professionals and some local officials have begun to move, too slowly I think, into a new era in which we recognize the threat of the chemical age and realize after-the-fact water treatment must be supplemented with the preventative measures of watershed management. This new era retains the concept of the multiple use watershed, but adds the new concept of watershed-wide land use management to make those multiple uses more compatible with the watershed as a source of drinking water.

North Carolina, for example, has instituted a new water supply classification system that considers the watershed as a whole, bases the classification on potential toxic pollutants to the drinking water, and requires local governments to institute a nonpoint pollution control program to qualify for preferred status. In addition to raising state and local consciousness of the importance of water supply protection, such status requires the state to limit point source discharges in the watershed and will perhaps increase the water system's chances for state funds in the future. If recognition of the new approach is slow, progress in actual implementation is slower yet. Nor have we figured out how to achieve intergovernmental coordination, deal equitably with restriction of up-stream property owner rights, or raise the revenues to pay for acquisition of property and property rights and for on- and off-site structural pollution control measures.

The purpose of this commentary is to suggest some principles of watershed management and to urge a partnership of land use planners with water system managers to (1) improve our understanding of the issue, (2) secure the support of elected officials and the public, (3) formulate improved local strategies, and (4) lobby for more state help. This message is based on regional and national studies of water supply watershed management conducted at the Center for Urban and Regional Studies at the University of North Carolina at Chapel Hill.

The First Principle: Construct a Three-Deep Defense

My *first principle* is that watershed land use management must establish three lines of defense for water quality in order to be effective. The three lines of defense are:

- (1) Prohibit the most threatening uses from the water supply watershed altogether.
- (2) Limit remaining uses to suitable locations within the watershed.
- (3) Control site design, site engineering, and construction practices everywhere within the watershed.

All three lines of defense are required; planners cannot rely on any one line of defense alone.

The first line of defense in land use management should be keeping out of the watershed activities that are associated with large quantities or especially dangerous forms of pollutants. Those include industrial or commercial activities that use known toxics, carcinogens or mutagenic substances; land fills; wastewater treatment plans (including package treatment plants); and food processing industries. Further, if politically and economically feasible, the strategy should prohibit all industrial uses, hospitals, shopping centers, truck stops, gas stations, warehousing and storage facilities, heavily traveled highways, high density housing and such agricultural uses as dairy farms, hog farms, chicken farms, veterinary facilities, and other intensive animal care facilities. Of course, prohibition of such uses depends on counter-balancing economic and political needs and the availability of suitable alternative sites outside the water supply watershed. When those uses are already established in a water supply watershed, steps should be taken to prevent their expansion and, over time, to remove them or otherwise protect the water supply from contamination. This first line of defense requires a special district within the county or city zoning ordinance or a special watershed management ordinance that applies to the entire watershed.

The second line of defense consists of location controls that restrict those uses allowed within the watershed to suitable locations or zones. This second defense should include one zone where essentially all potentially polluting urban, agricultural and silvacultural uses are excluded. Such zones might be called buffer zones, conservation zones, or environmentally critical areas. They may include buffers around the impoundment and along feeder streams, steep slopes, and easily eroded soils. Regulations would allow few uses other than undisturbed natural vegetation in those critical areas. In other, less critical, zones, regulations might allow cropland, pasture, forestry, and low density residential uses only (except on soils unsuitable for septic tanks). Additional, even less vulnerable zones (such as areas further from the impoundment and feeder streams, areas with more suitable soils and areas where roads, sewer, or urbanization already exists) might be created to allow urban development. The point is that in addition to keeping out the most threatening uses from the watershed altogether, the land use strategy must also guide even potentially compatible uses to appropriate locations to minimize their threat to water quality. The second line of defense can be part of the same watershed ordinance or zoning ordinance used to implement the first line of defense.

The third line of defense includes controls on the design of individual sites, site engineering, and construction practices for new development and on the operating practices of allowable uses. It has been tempting to make this third line of defense the main or even sole strategy, but that is a mistake because there is a kind of Murphy's Law or Chernoble Principle at work—whatever can go wrong will go wrong with on-site controls. Sedimentation control devices, materials handling procedures, emergency spill containment procedures, septic tanks, sewer lines and treatment plants, street cleaning practices, and other site practices—they all fail to some degree, at some time. Their design may be faulty. If designed correctly, they may not be constructed as designed. And if designed and constructed correctly, the devices may not be operated and maintained correctly. In other words, on-site controls are inherently unreliable in the intermediate to long run as a sole line of defense of water quality. Furthermore, as a corollary principle to Murphy's

Law, the site design and engineering controls should always include procedures and funds to ensure on-going inspection, maintenance, repair, and replacement (perhaps through public control of those devices). Overlay zones, special use permits, subdivision regulations, and septic tank regulations can be used to require the necessary practices.

The third line of defense should include off-site structural measures in addition to the on-site controls where required to protect (a) the drinking water source from already existing urbanization and agricultural practices or (b) for new development where off-site structures are more efficient than on-site control of stormwater runoff. Off-site structural measures include in-stream detention structures and aeration or chemical treatment of feeder streams or impoundments before the water reaches the raw water intake. Such structural measures might be provided through exactions imposed on new development or paid for through water user fees.

Two more principles

My suggested *second principle* has to do with targeting the land use controls specifically at protection of water quality and coordinating them into a coherent and identifiable package. Water system managers surveyed in our studies told us that whatever types of land use management controls were employed, they worked twice as well if they were designed and adopted for the specific purpose of protecting water quality. That sounds simple and obvious, I know, but we found that many water supply managers and local government officials had been counting on zoning per se, subdivision regulations per se, septic tank permitting per se, and the like, which were just part of the county's or city's overall land use management program, but not specifically designed for water supply protection. In that case, the controls were only half as effective as when they were specifically designed to protect water quality. So, we should not be satisfied, as some of those managers and land use planners were originally, that we protect water quality just by having zoning and subdivision regulation; those tools and others must be designed and enforced specifically to protect drinking water quality.

In addition, land use controls were judged by water supply managers to work 50 percent better if they were a part of an identifiable, coordinated watershed management plan and *program*, a unified package, not just a disjointed series of separate devices, and if the program was employed across the entire watershed.

The *third principle* is to act sooner rather than later. The longer we wait to manage our watersheds, the more numerous will be the already existing incompatible uses and the greater will be the build-up of expectations of profit among landowners. That makes it more difficult both to design an effective strategy and to get it adopted. Not only is it easier to control new development than existing development, but our study showed that as urbanization gains momentum in the watershed, the potential for profit from land value appreciation and continued growth becomes so great that effective programs become increasingly difficult to enact. As that happens, we will be forced to rely increasingly on the more risky methods of water treatment, site design, site engineering, and operating practices that have that dangerous proclivity to fail. By the way, the principle of acting earlier rather than later implies the identification and protection of future water supply watersheds as well as those already being used.

To protect our drinking water, we will have to move soon and aggressively to watershed-wide, inter-governmental, land use oriented strategies to supplement water treatment which can no longer be relied upon as our only means of protecting public health. This effort will take the combined effort of land use planners and water supply professionals, working with state and local governments, to educate, pass new enabling legislation, and implement new local controls. Only then will we be able to say with more confidence that, yes, our water supply is protected. □