GROUNDWATER PROTECTION AT THE LOCAL LEVEL

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INTRODUCTION

In fiscal year 1984, the Tennessee Valley Authority (TVA) conducted a Groundwater Situation Assessment of the Tennessee Valley Region (1). Two of the primary conclusions of that assessment were that more work needed to be done to educate the public about groundwater and more work should be done on groundwater protection, not cleanup. A demonstration was initiated in the First Tennessee Development District (FTDD) of upper east Tennessee in 1984 to address these two needs.

The State of Tennessee, the FTDD, and the TVA cooperated in demonstrating the implementation of local government groundwater protection plans. Eight counties, twenty-four public water supplies, and forty-three water sources were involved.

It is the intent of this paper to describe the process local governments can go through to protect their groundwater supplies. The approach to protection used in the FTDD demonstration will be the basis of the discussion.

LOCAL GOVERNMENT GROUNDWATER PROTECTION

The Federal government, most notably the Environmental Protection Agency (EPA), has been the primary initiator for protection of air, surface water, and land resources. Only recently has EPA's attention been focused on groundwater. EPA groundwater protection efforts appear to be primarily oriented toward solid and hazardous waste, underground injection control, and underground storage tanks. Other potential contamination activities receive less attention.

EPA has said that the States and not the Federal government are responsible for groundwater management (2). Increasing public concern about groundwater protection, coupled with new emphasis on groundwater, has resulted in a flurry of State activity to establish programs, create legislation, and hire or reorganize personnel. Local governments and groundwater utilities respond to each new law and program change. They should also take a more comprehensive approach to protecting groundwater.

There are four steps to properly manage local groundwater supplies. An assessment of the local resource needs to be conducted first to understand where it is, how it moves, where it may become contaminated, etc. Information should be gathered on the quality of the groundwater resource including manmade compounds such as herbicides, pesticides, volatile organics, etc. Recharge areas for primary water supplies should be estimated or mapped as accurately as possible. Geologic structural controls to groundwater movement should be assessed. Land use patterns should also be mapped relative to the recharge areas.

Secondly, the groundwater assessment needs to be compiled into technical reports and nontechnical public information materials. Technical data have been collected in many communities; however, very little of it has been in a format readily available and understandable by local officials and the general public (1). Maps showing where groundwater is most abundant and maps showing the location of recharge areas for primary groundwater supplies are simple methods to relay technical data to the public.

Step three would be the preparation of a city or county groundwater management plan. The management plan should be prepared using the knowledge gained from the technical assessment. Groundwater management plans should include the identification of a responsible management agency, an evaluation of regulatory needs, an assessment of potential problems (see section entitled "Implementation With Tiered Protection"), an estimate of financial needs, and an implementation schedule to address specific problems.

Any management plan must address public education. An informed public not only can help support professional efforts, but changed attitudes and concern should in the long-term result in fewer contamination problems. These efforts include the use of public workshops, teacher training, fact sheets, public service advertisements, and information brochures in utility bills.

Implementation of the management plan is the last and most important step. Potential problems must be acted upon to remove the threat of contamination. Implementation can but does not necessarily mean a capital outlay and new or revised local ordinances. It is also important to designate a responsible agency for implementation and to monitor its progress.

IMPLEMENTATION WITH LAND USE CONTROLS

Probably the most common land use control for groundwater protection in the United States is zoning in one form or another. Although other land use controls exist (e.g., cluster development, land acquisition, siting controls), zoning and land use controls are frequently equated to each other (3,4). Zoning has many drawbacks.

Zoning ordinances are only as good as the enforcement they receive. Zoning laws constitute a "taking" of land use from someone (5). The general public in many areas resists zoning efforts because of this "taking" action. Landowners do not like to be told how their property can or cannot be used. Many aquifers are relatively large. Zoning of aquifers at the local level can be extremely difficult when an aquifer crosses a political boundary.

Mapping a recharge area requires a knowledge of where the hydrogeologic boundary is located (6). A precise boundary line is extremely difficult and expensive to map. This is particularly true in carbonate aquifer regions.

Land use controls and zoning may be appropriate and acceptable in some areas, but they are not the only tools or approaches available to protect groundwater (5,7). Sometimes the zoning approach only addresses future activity and does little or nothing to address past

problems (5,7). Resistance was encountered during the demonstration on anything connected with zoning.

The approach to implementation of the protection plan for the FTDD Groundwater Demonstration was changed, therefore, to address man's activities (land uses) differently. A tiered approach was tried and this was successful.

IMPLEMENTATION WITH TIERED PROTECTION

There are at least four levels of effort a local government or utility can undertake to protect its groundwater supply. Level 1 Protection–The area immediately around the spring or well is the most important area to protect. Spills of toxic compounds or surface drainage toward a well or spring could easily contaminate a potable water supply. Surface drainage should, therefore, be routed away from springs and wells. It is important that wells be properly constructed and maintained. Wells should be properly grouted. Immediately after the well is installed and developed it should be disinfected. A protective housing is also suggested to keep debris and animals out of the water. In addition, toxic compounds such as herbicides, pesticides, gasoline, solvents, paint thinners, etc., should not be stored or used around a well or spring.

Public supplies should be secure against unauthorized access. Many public supply springs and wells found during the demonstration could have been vandalized or contaminated with little or no effort. Some gates were unlocked. Manproof fencing existed at only a few of the water supplies.

Frequently wells and springs are located along major highways. Emergency planning and site preparation could be done to eliminate or significantly reduce the hazards of a highway spill or other emergencies (8,9). The installation of guard rails, retaining walls, highway drainage controls, and emergency cutoff switches are but a few additional actions which could be undertaken near the point of withdrawal.

Level 2 Protection–This level of effort involves a portion of the recharge area further away from the well or spring but not including the entire recharge area. Examples of protection would include repair of a leaking sewer line which crosses a recharge area, mine reclamation, proper closure or removal of roadside dumps, acquisition of land for parks or natural areas, and rerouting of highways. Sinkholes which were found to drain directly toward springs can be protected or in some cases plugged. Plugging of sinkholes or development over sinkholes can cause serious flooding or other drainage problems and should not be attempted without expert advice. Sinkhole areas could be fenced off to help preclude their use as waste disposal sites.

Level 3 Protection–This protection level includes all efforts undertaken within the entire recharge area. In many states the recharge areas are protected by zoning. Development of a water conservation district or similarly zoned area which is the recharge area of a groundwater supply can be done in some cases but it also has drawbacks which were discussed earlier.

There are, however, many things which can be done to protect groundwater in a recharge area once a rough idea of its shape and size is determined. Recharge area maps can be used to assist in planning for industrial sites, sanitary landfills, highway projects, sewer lines, water supplies, and many other projects. New industrial sites, waste facilities, and highways could be located outside these recharge areas to help prevent problems of spills or contaminated liquids reaching public groundwater supplies. Information on recharge area locations could be used to help prioritize areas for sewer connection so that wastewater is removed from the recharge area. Waterlines could be brought into these areas to reduce or eliminate additional wells from being drilled into the aquifer. The more wells that are drilled, the more potential there is for contaminated surface water to enter groundwater.

If the recharge area must be used for new development, construction of new facilities can be undertaken to minimize possible harm to groundwater by ensuring that proper drainage, solid waste, hazardous waste, and wastewater management practices are adhered to during construction.

In the FTDD, many of the recharge areas are locate within the Cherokee National Forest. Local officials and utility operators have asked that the recharge area maps be sent to the United States Forest Service for evaluating land use permit applications such as oil and gas exploration work or logging operations. Other regions probably have similar uses for these maps.

Level 4 Protection–Level 4 protection efforts are those activities applicable to the entire county or, in some cases, city limits. The county or city could designate itself a water conservation district. At this level, everyone is treated equally and no further zoning is necessary. New ordinances would apply to all. A minimum lot size ordinance, for instance, pertaining to onsite sewage systems would help protect all groundwater supplies including private wells.

With the cooperation of the Farm Bureau, Soil Conservation Service, and other rural land-oriented organizations, assistance could be provided to ensure that fertilizer, herbicide, pesticide, feedlot, and wastewater practices are done to minimize groundwater contamination.

Public education and information efforts could be undertaken using schools, mass media, county health agencies, and community organizations. Brochures could be made available to the public to help explain what groundwater is and how it can be protected. Public information ads on television, radio, and in newspapers would help educate the public about groundwater protection. Programs could be developed for school children to incorporate fieldtrips (e.g., to caves and sinkholes) and studies about groundwater into their curriculum.

Countywide refuse collection could be initiated or improved to prevent roadside dumps and garbage in sinkholes from contaminating groundwater. Countywide planning maps locating where groundwater is abundant or lacking help convey basic groundwater information to local decision makers and citizens. Groundwater is out of sight and out of mind. Maps or other visual aids help develop a groundwater protection awareness.

LOCAL GOVERNMENT INITIATIVES

Many of the local governments and utilities in the FTDD have implemented or are continuing to implement one or more of the levels of protection previously described. Two publications will be published by TVA in the near future to assist local governments in protecting groundwater resources. One document is a general brochure which outlines the steps described in the section entitled "Local Government Groundwater protection" (10). A second document contains more specific information and contains most of the informational materials generated during the two-year demonstration (11).

Another publication is also available which contains descriptions of activities designed to educate students about groundwater (12). These activities are suitable for students in grades three through twelve. These activity books are being placed in various school systems throughout the nation.

CONCLUSION

The TVA, in cooperation with the State of Tennessee and FTDD recently completed a two-year demonstration to help local governments protect public groundwater supplies. A four-tiered approach was demonstrated to be effective. This method of protection uses a common sense approach for protection as it identifies concerns first at the point of withdrawal and in a stepwise fashion progresses further into the recharge area and finally extends countywide. This approach is relatively easy to implement, is responsive to local needs, does not necessarily require new laws, and addresses all pollution sources. The tiered approach is now being used by many utilities and local governments to make their groundwater supplies safer.

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