Protection of Groundwater from Nonpoint Source Pollution: Will Oregon's 1989 Legislation Meet the Challenge?

a Research Paper by

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Submitted in partial fulfillment of the

requirements for the degree of

Master of Science

Department of Geography
Oregon State University
November 1989

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List of Acronyms

AES........................ Agricultural Experiment Station
CFR............................Code of Federal Regulations
DEQ.....................Department of Environmental Quality
EDB...................................Ethylene dibromide
EPA.................. U.S. Environmental Protection Agency
EQC........................Environmental Quality Commission
HA.......................................Health Advisory
H.B...House Bill
MCL..............................Maximum Contaminant Level
MCLG........................Maximum Contaminant Level Goal
OAR............................Oregon Administrative Rules
ODA........................Oregon Department of Agriculture
ORS................................Oregon Revised Statutes
OSHD...........................Oregon State Health Division
OSU................................Oregon State University
S.B..Senate Bill
SWMG.......................Strategic Water Management Group
TCE.....................................Trichloroethene
WRD..............................Water Resources Department

Acknowledgments

Many thanks to those who helped me prepare this paper. Greg Pettit of the Department of Environmental Quality was an especially helpful and valuable source, as was Mary Alvey of the Health Division. I appreciate the advice and encouragement provided by the members of my graduate committee, Keith Muckleston, Allen Agnew, and Gordon Matzke. Dr. Agnew, through his participation on the Groundwater Advisory Committee, was able to provide me with "inside" information, research ideas, and contacts. He also demonstrates an unusually high degree of interest in his students. Keith Muckleston, as my major professor, was always available for consultation; he provided honest and constructive feedback. I hold his teaching and educational philosophy in highest esteem.

Thanks also to Ann Root, who, having survived the thesis option, offered reliable advice on every stage of the research and writing process; to Sharon Gomez for our many philosophical, political, and story-telling sessions; and, of course, to Mike, for his technical assistance regarding groundwater contamination, and most importantly, for his patience and support.

ABSTRACT

Nonpoint sources of pollution are being recognized nationwide as a significant threat to groundwater quality. In Oregon, groundwater supplies in several areas have been affected by contamination possibly caused by nonpoint sources associated with agricultural activities, on-site sewage disposal, and inadequate hazardous materials management in urban areas. State groundwater protection legislation was enacted in 1989 which specifically addresses nonpoint source contamination. While it relies heavily on a non-regulatory approach emphasizing public education and voluntary participation, it also specifies conditions under which mandatory actions may be required.

To shed light on the new program's potential effectiveness, the provisions of the legislation are evaluated herein with respect to four policy issues: 1) compatibility with traditional land management values, 2) compatibility with existing institutional arrangements, 3) long-term protection provided, and 4) adequacy of funding. It is concluded that the legislation offers a promising approach for dealing with nonpoint source contamination. However, two major weaknesses of the legislation are evident: 1) it relies only minimally on the tool of taxing potentially polluting substances to fund the program and to provide an incentive for the development of alternatives, and 2) it creates an unnecessary administrative layer.

I. Introduction and Problem Statement

Since the mid-1970s, the problem of groundwater contamination has become a high priority among environmental concerns. Public pressure has resulted in the enactment of federal and state legislation designed to better regulate the handling of hazardous chemicals and to clean up the thousands of chemically contaminated sites across the country, most of which have contaminated groundwater associated with them. The remediation process is lengthy and costly. Nationwide, the data are far from adequate to determine the extent and severity of existing groundwater contamination, much less to prevent further contamination.

In the past, most attention was directed towards point source problems associated with industrial and disposal facilities. More recently, however, nonpoint sources have also become a concern. Nonpoint source contamination results from diffuse activities distributed over a large area (Henderson 1984). It remains one of the nation's leading surface water quality problems (Novotny 1988), and it is being recognized as a significant threat to groundwater quality as well. Methods for controlling non-point sources are not well developed, and their effectiveness is difficult to measure.

Since 1986, the state of Oregon has been in the process of enhancing its groundwater quality protection program. Nonpoint source contamination is a major target, given that a large area of the state is devoted to agricultural activities and that many rural residents are dependent upon groundwater for their drinking water supply. Senate Bill (S.B.) 423,* enacted at the end of the 1989 legislative session, has as one of its primary goals the prevention and remediation of nonpoint source groundwater contamination. The purpose of this paper is twofold: 1) to summarize the nature and extent of nonpoint source groundwater contamination in Oregon; and 2) to analyze the provisions of S.B. 423 which provide for the protection of groundwater resources from nonpoint source pollution.

II. Methodology

The research involved a review of the relevant literature addressing: 1) the nature and extent of nonpoint source groundwater contamination in the United States, and 2) policies and institutional arrangements providing for groundwater quality protection at the federal and state levels. Nonpoint source problems, data inadequacies, and existing and proposed policies in Oregon were summarized on the basis of published literature, government documents, and interviews with state agency officials and university professors. The provisions of S.B. 423 which are intended to reduce nonpoint source contamination were evaluated with

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* In the last weeks of the 1989 legislative session, S.B. 423 was incorporated along with several other bills relating to the management of hazardous substances into House Bill (H.B.) 3515. For the sake of convenience, the provisions of H.B. 3515 which formerly comprised S.B. 423, namely, sections 17-66, 183, and 185, are referred to in this paper as "S.B. 423."

reference to the following policy issues: 1) compatibility with traditional land management values, 2) compatibility with existing institutional arrangements, 3) provision of long-term protection, and 4) adequacy of funding.

III. Nonpoint source groundwater contamination in Oregon

Numerous sources of groundwater contamination have been identified in Oregon (ODEQ 1988, 1-5). Contamination has been detected at 75 industrial sites and 23 municipal landfills. Septic systems, municipal sewage treatment facilities, and agricultural practices have also been linked to groundwater contamination. The existing data on groundwater quality cannot be considered comprehensive since most of the testing and monitoring to date has been confined to areas of known or suspected contamination. Among monitoring priorities, potential nonpoint sources have only recently gained prominence. This section summarizes the existing data on groundwater contamination in Oregon that may be attributable, at least in part, to nonpoint sources.

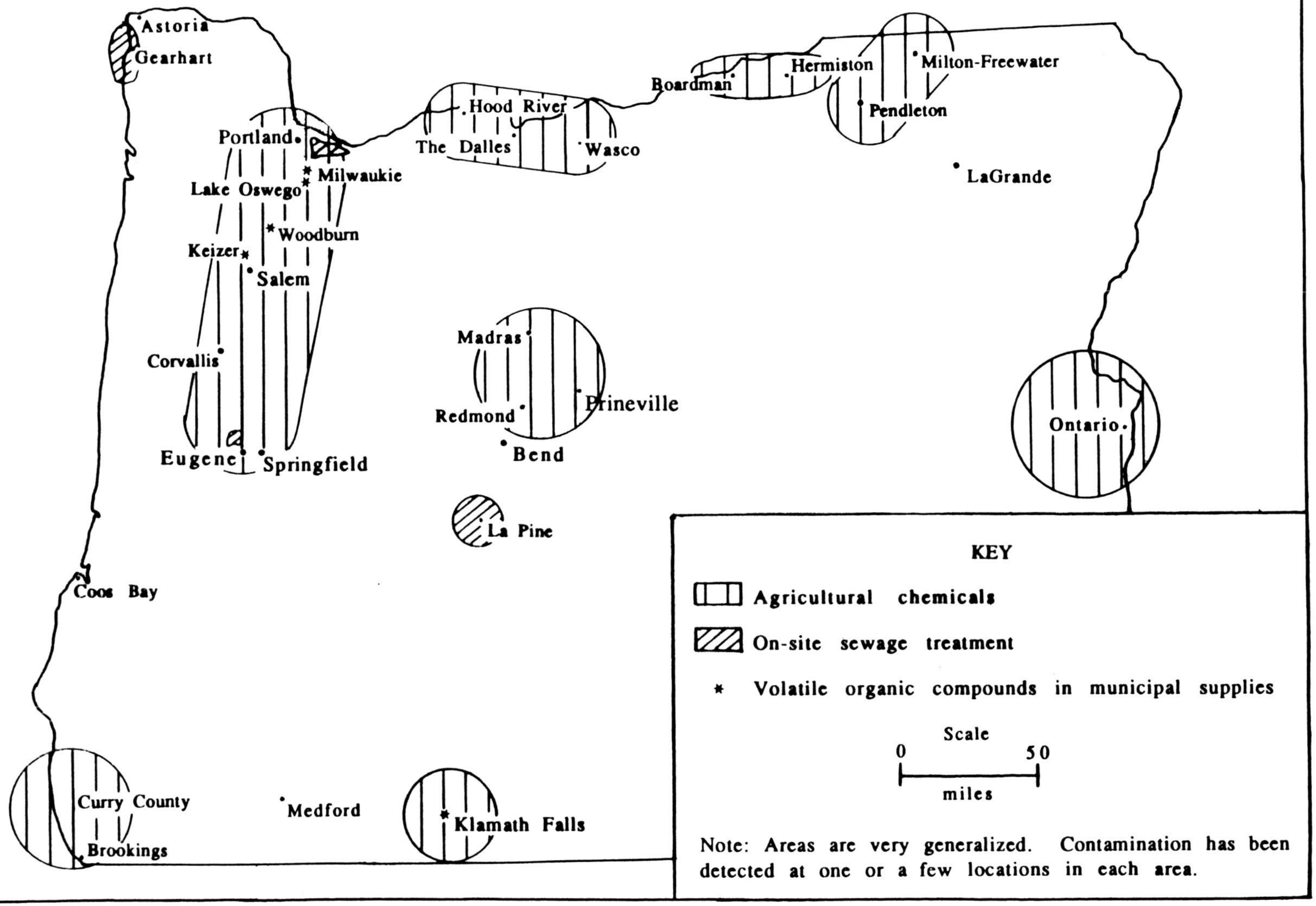
Agricultural chemicals

The application of nitrogen fertilizer and pesticides to agricultural fields can result in the leaching of nitrates and pesticides into the groundwater. Such leaching is an excellent example of a nonpoint source of contamination, since it may be distributed over a large area. Other practices may also cause agricultural chemicals to enter the groundwater. In some cases, runoff from fields is directed into dry wells or sinkholes. Chemigation, or the technique of applying pesticides or fertilizer in irrigation water, may result in groundwater contamination if backflow of the chemicals into the irrigation well occurs. Mixing and loading areas have also been identified as contamination sources. (U.S. EPA 1987.)

As part of a groundwater quality survey in 1985, the U.S. Environmental Protection Agency (EPA) analyzed well samples in the Ontario area of eastern Oregon for 13 pesticides. Out of that effort a statewide project to assess the nature and extent of groundwater contamination from agricultural chemicals materialized, with the Oregon Department of Environmental Quality (DEQ) as the lead agency (Pettit 1988). Domestic and public supply wells in priority areas were sampled for nitrates and pesticides. The priority areas were selected on the basis of aquifer vulnerability, agricultural practices, evidence of existing problems, and the professional judgment of the participating state and federal agency personnel. The specific pesticides for which the samples were analyzed varied by area, depending on chemical usage. Where pesticides were discovered, confirmational sampling was conducted. Figure 1 shows the general areas where contamination from agricultural chemicals was detected. (The results presented here should not be interpreted to imply that the contamination

Figure 1

Areas in Oregon with known groundwater contamination possibly caused by nonpoint sources



levels detected are typical for the large, very generalized areas indicated in Figure 1.)

Table 1 shows the highest levels of contaminants measured in each of the sampling areas (Pettit 1988; Ladue 1987). Nitrate-nitrogen levels in seven of the eight areas exceeded the state planning level of five milligrams per liter (mg/l) and the Maximum Contaminant Level (MCL)* of 10 mg/l, with the Ontario and Boardman-Hermiston areas experiencing the most serious contamination. Based on these results, DEQ personnel conclude that high levels of nitrate-nitrogen are widespread and pose a significant threat to groundwater quality in many areas in Oregon (Pettit 1988).

Pesticides were detected in four of the eight areas sampled. Dachtal and 1,2 Dichloropropane were identified in the Ontario area; ethylene dibromide (EDB), Bromacil, and Dinoseb in the Willamette Valley; and Aldicarb and 1,2 Dichloropropane in Curry County in southwestern Oregon. (No pesticides were detected in the Boardman/Hermiston area, but pentachlorophenol, a wood preservative, was detected in one well.) The EDB concentrations, which ranged up to 0.72 micrograms per liter (ug/l), significantly exceeded the draft MCL of 0.05 ug/l. The highest level of Aldicarb measured was 10 ug/l, which is equal to the draft MCL. The Dachtal contamination, though below the draft Health Advisory (HA), warranted concern from DEQ because of its

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* An explanation of MCLs and other health-based reference levels is provided in the Appendix.

TABLE 1

Results of assessment of agricultural chemicals in groundwater, 1985-87

Location	Nitrate-nitrogen[a]	Pesticides		
	Highest level detected (mg/l)	Chemical	Highest level detected (ug/l)	Health level[b] (ug/l)
Ontario area[c]	49	Dacthal	432	3500 (draft HA)
		1,2 Dichlo-ropropane	1.4	5 (draft MCLG)
Willamette Valley	35.8	Ethylene dibromide	0.72	0.05 (draft MCL)
		Bromacil	(below HA)	90 (HA)
		Dinoseb	(below HA)	7 (HA)
Hermiston/ Boardman area	80	None		
Curry County	12	1,2 Dichlo-ropropane	4	5 (draft MCLG)
		Aldicarb	10	10 (draft MCL)
Klamath Falls	42	None		
Hood River/The Dalles/Wasco area[d]	4.5	None		
Milton-Freewater/ Pendleton area[d]	14	None		

TABLE 1 (continued)

Prineville/Madras/ Redmond area[d]	11	None		

[a] Maximum Contaminant Level: 10 mg/l. State planning level: 5 mg/l.

[b] See Appendix for an explanation of health-based standards, criteria, and guidelines.

[c] The contaminant levels shown on this table are from the original assessment, not from the subsequent, more extensive monitoring.

[d] Only public supply wells were tested in these areas.

widespread occurrence: it was detected in 67 percent of the 81 wells sampled for pesticides in the Ontario area.

In 1988, the Legislative Emergency Board allocated $376,000 for the development of an aquifer management plan to address the pesticide and nitrate contamination in the Ontario area. DEQ coordinated this project, with the cooperation of the Oregon Department of Agriculture (ODA), Oregon State University's (OSU) Agricultural Chemistry Department, the Oregon State Health Division (OSHD), and the Oregon Water Resources Department (WRD). Most of the money was spent on needed hydrogeological investigations. DEQ was also working to educate area residents about the contamination and to assemble a local advisory committee to assist in developing a management plan. However, the Emergency Board money was insufficient to fund extensive research into better management practices or demonstration projects. (Pettit 1989b.) Programs are not yet underway to address the contamination problems in the other agricultural areas with contamination, though a preliminary assessment of the potential sources has been made and some better management practices have been suggested (Vomocil 1989).

Agricultural practices are clearly a major source of the nitrate contamination in the Ontario area; however, the same is not necessarily true for the other areas sampled in the agricultural chemicals assessment. Follow-up ground-water investigations have not yet been conducted, but it is possible that septic systems and, in the Boardman/Hermiston area, industrial wastewater treatment procedures may also be contributing to the contamination (Vomocil 1989).

On-site sewage treatment

Septic system leachate is the most frequently reported cause of groundwater contamination nationally (Yates 1985). Septic systems can be considered nonpoint sources if the resulting contamination is being contributed by many systems and an areawide solution affecting all systems is necessary. In Oregon, septic system leachate has caused high concentrations of nitrates to be introduced into the groundwater in the following areas: East Multnomah County in the Portland area, La Pine, Eugene, and Clatsop Plains on the northwest coast (Figure 1). Table 2 shows the highest levels of nitrate-nitrogen measured in each of the areas. In addition, septic systems potentially threaten the groundwater in Florence and North Albany, though the concentrations of nitrate-nitrogen detected so far have not generally exceeded the state planning level of five mg/l. New sewer systems have been required by DEQ for East Multnomah County and the affected areas of La Pine and Eugene. Density restrictions are in effect for new septic systems in the Clatsop Plains area. (Pettit 1989c.)

Other nonpoint sources

Potential problems associated with other types of non-point sources are not well documented in Oregon. Stormwater

TABLE 2

Nitrate-nitrogen contamination from on-site sewage disposal

Area	Nitrate-nitrogen Highest level detected (mg/l)	Reference	Notes
Gearhart (Clatsop Plains[a])	27	Clatsop Plains Groundwater Protection Plan, 1982	Wastewater disposal facility on military reservation also partially responsible
LaPine	43	LaPine Aquifer Management Plan, 1982	
Santa Clara -- River Road area (Eugene)	22	Dickenson 1972	Converted from nitrate level
East Multnomah County	8	Pettit 1989c	

[a] A sandy plain extending along the northern Oregon coast from the Columbia River south to the Necanicum River.

along highways and roads drains into holes and sumps, but it is not known to what extent this may threaten groundwater (ODEQ 1988, 47). Some storm drains in the Bend/Madras area, in East Multnomah County, and in several cities in the Willamette Valley empty into injection wells (Pettit 1989a).

In 1988, EPA began requiring the testing of municipal wells supplying a population of more than 10,000 for volatile organic compounds, which are ingredients in many common industrial and household chemicals. In 1989, the requirement was extended to groundwater supplies serving more than 3300 people. (U.S. CFR, Section 141.40.) By the spring of 1989, the routine testing conducted by OSHD had detected contaminants in the groundwater supplies of Woodburn, Lake Oswego, Keizer, Klamath Falls, and Milwaukie. The organic contaminants and the highest levels detected (above 0.5 ug/l) in each city are listed in Table 3. In urban areas such as these, either point or nonpoint sources, or quite possibly a combination of the two could be causing the contamination.

The high levels detected in Lake Oswego were all from one back-up well, which was shut off after the testing (Alvey 1989). Milwaukie switched over to Portland water, which originates in the Bull Run Watershed near Mt. Hood. Subsequent investigations in the Milwaukie area have revealed levels of trichloroethene (TCE) as high as 223 ug/l. Several sources appear to be contributing, though they have not been identified yet. (ODEQ 1989).

TABLE 3

Results of testing for volatile organic compounds in municipal groundwater supplies

Volatile organic compound	Health level[a] (ug/l)	Highest level detected[b] (ug/l)				
		Woodburn	Lake Oswego[c]	Keizer	Klamath Falls	Milwaukie[d]
Benzene	5 (MCL)	0.5				
Carbon Tetrachloride	5 (MCL)	4.4				
1,2 Dichloroethane	5 (MCL)		113.0			
1,1 Dichloroethene	7 (MCL)	1.0				
cis - 1,2 - Dichloroethene	70 (draft MCL)		93.0			
Methylene Chloride	- (carcinogen)	4.7[e]				
1,1,1,2 Tetrachloroethane	-		171.0			
1,1,2,2 Tetrachloroethane	-					0.6
Tetrachloroethene	10 (HA)	1.1	112.0			
1,1,1 Trichloroethane	200 (MCL)	1.3	1.0	0.54	1.4	
Trichloroethene	5 (MCL)	1.1	33.0			8.0
Trichlorofluoroethane	-	7.9				

TABLE 3 (continued)

Results of testing for volatile organic compounds in municipal groundwater supplies

Volatile organic compound	Health level (ug/l)	Highest level detected (ug/l)				
		Woodburn	Lake Oswego	Keizer	Klamath Falls	Milwaukie
Toluene	2000 (draft MCL)	3.2				

[a] The Appendix provides an explanation of health-based standards, criteria, and guidelines.

[b] Highest level detected > 0.5 ug/l.

[c] The contaminant levels for Lake Oswego were detected in a back-up well, which was not subsequently used as a drinking water supply.

[d] After contamination was detected, Milwaukie stopped using its wells and switched to a different drinking water supply.

[e] Laboratory blank: 1.0 ug/l.

IV. Existing groundwater protection policy in Oregon

Under Oregon Revised Statute (ORS) 468, the Environmental Quality Commission (EQC) is to develop and DEQ is to implement rules and standards to preserve and restore the quality and purity of the state's air and waters.* Under this mandate EQC approved in 1981 and revised in 1984 a Statewide Groundwater Quality Protection Policy (ODEQ 1988, 13). This policy (Oregon Administrative Rule [OAR] 340-41-029) focused mostly on the control of point sources, especially waste disposal practices. The "highest and best practicable treatment and control" were to be used generally for sewage, industrial wastes, and landfill leachates. The policy also outlined the means by which problem abatement plans were to be developed and implemented. Relatively little attention was given to nonpoint sources; the policy stated that "nonpoint source activities associated with land and animal management, chemical application and handling, and spill prevention are to be conducted using the appropriate state of the art management practices." In addition, a process was established by which contamination from on-site sewage disposal in an urban area could be addressed using an areawide approach.

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* EQC, consisting of a board of gubernatorial appointees, adopts rules and sets the policies by which the duties assigned by the Legislature are to be carried out. DEQ makes recommendations to EQC and implements its decisions. This commission structure is common to several state agencies in Oregon.

Since the 1984 amendments, DEQ has extensively reviewed federal and state policies pertaining to groundwater protection in order to identify gaps and inconsistencies. No fewer than eight federal statutes, involving four federal agencies and DEQ, and 22 state statutes, involving 13 state agencies, exert varying degrees of authority over groundwater management and protection in Oregon. The needs identified by DEQ with the assistance of a citizen advisory committee and an interagency task force include: 1) the establishment of objective criteria for evaluating and specifying remediation of contamination problems, 2) hydrogeologic characterization of the state's aquifers, 3) better interagency coordination, 4) public education, and 5) programs to address nonpoint sources of contamination. (ODEQ 1988, 20, 45-49.)

A revised groundwater protection policy was proposed by DEQ in 1988 and presented at three sets of public hearings before being adopted in October 1989. In response to public testimony, a proposed aquifer classification system was abandoned, and a section on nonpoint sources was removed with the understanding that a nonpoint source policy would be incorporated in legislation. The process to develop legislation addressing groundwater protection began in the spring of 1988. It involved the production of a set of issue papers by an interagency task force, a public conference at Suttle Lake in September of 1988, and much negotiation among interested groups from inception until passage of the final bill.

V. Senate Bill 423

Senate Bill 423 (now Sections 17-66, 183, and 185 of H.B. 3515) has been endorsed by such widely diverse groups as the Oregon Environmental Council, the Oregon Wheat Growers' League, and Associated Oregon Industries. It is intended to serve two primary purposes: 1) to create a comprehensive groundwater protection program emphasizing better data collection and public education; and 2) to establish a process for managing areawide groundwater contamination problems for which point source oriented remedies are not appropriate or adequate.

The bill adopts an anti-degradation goal: "to prevent contamination of Oregon's ground water resource while striving to conserve and restore this resource and to maintain the quantity and high quality of Oregon's ground water resource for present and future uses (Section 18*)." Protection is not to depend upon present uses; rather, the groundwater is to be protected for "whatever beneficial uses the natural quality allows (Section 19 (6))."

A technical advisory committee, consisting of a toxicologist, health professional, water purveyor, biologist, and representatives of local governments, environmental, industrial, and agricultural organizations, is to be

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* Section numbers refer to H.B. 3515.

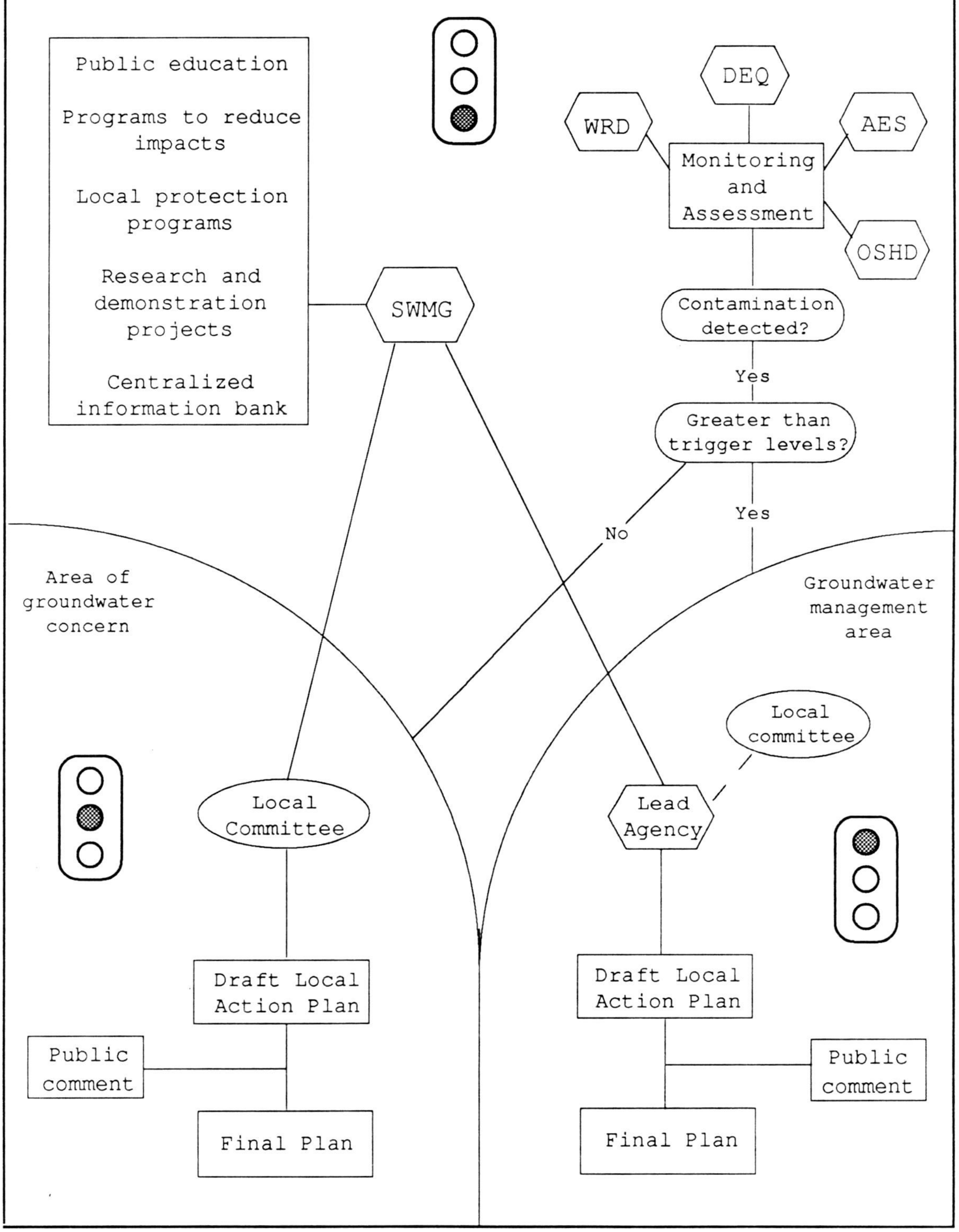
appointed "to recommend the criteria and a method for EQC to apply in adopting by rule maximum measurable levels of contaminants in ground water (Section 24)." These levels will serve as objective criteria to be considered in all groundwater contamination problems. They also trigger specific actions under this bill, as discussed below.

Other provisions of general usefulness to the state's overall groundwater protection programs include: 1) a requirement that the seller of real estate which includes a domestic groundwater well must have the well tested for nitrates and coliform bacteria and report the results to OSHD (Section 30), and 2) an expansion of the Water Resources Commission's authority to regulate the construction and maintenance of wells to include "any hole through which ground water may be contaminated (Section 60 (3a))."

Most of the rest of S.B. 423 has been conceptualized as having green-light, yellow-light, and red-light components, as Figure 2 illustrates. Green-light programs are statewide and ongoing; they include educational programs, research and demonstration projects, local planning, and monitoring and assessment. The Strategic Water Management Group (SWMG), consisting of the directors of each of the state agencies whose jurisdictions relate to water issues, is designated the coordinator for all the green-light programs except the statewide monitoring and assessment, which shall be carried out by DEQ, the OSU Agricultural Experiment Station (AES), and WRD.

Figure 2

S.B. 423: Institutional Structure



The yellow and red-light phases are triggered if contamination "resulting at least in part from suspected nonpoint source activities" is detected in the groundwater (Sections 31,32, and 36). If contaminant levels do not exceed 70 percent of the maximum level adopted by EQC for nitrates or 50 percent of the maximum for other contaminants, the yellow-light or non-regulatory phase begins with the declaration of an "area of ground water concern." Research, education, and monitoring activities are then to be focused on the area, and a local groundwater management committee is to draft an action plan which should identify the potential contributors to the contamination and recommend measures to prevent further degradation. Committee members are to represent a diversity of interests, and public comments are to be considered in adopting the final plan. The emphasis at this stage is on education and voluntary cooperation; the local committee has no regulatory authority.

If contaminant levels are detected in excess of the levels noted above (70 percent of the maximum contaminant level for nitrates or 50 percent for other contaminants), then an "area of groundwater management" is declared. This is the red-light or regulatory phase. SWMG designates a lead agency, which is to identify the possible contributors to the contamination and to draft a management plan; the plan is to be designed to reduce the level of contamination, and may include recommendations of mandatory components.

After a public comment period, a final plan must be submitted to SWMG for its approval. Once approved, the plan is to be implemented by the agencies which have jurisdiction over the stipulated measures. If contaminant levels recede below the designated levels, an area can be moved back into the yellow or green-light phases.

This process is already being followed generally in the development of an aquifer management plan for the Ontario area. However, S.B. 423 will introduce into the process a number of new elements. The process, its trigger, and its timeframe are institutionalized; time need not be spent resolving disputes over what sort of process should be used or even over whether a problem is serious enough to warrant action. People interested in participating should find it easier to learn when and how they may do so. Under the bill, SWMG, not DEQ, will select local groundwater management committees and approve final plans. Finally, the language in S.B. 423 allows for the appropriation of funds which SWMG could allocate for research into better management practices and for the hydrogeologic work that may be needed in one or more groundwater management areas. Previously, such funding had to be requested separately from the Legislature for specific projects. (Pettit 1989c.)

VI. S.B. 423 and policy issues relevant to nonpoint source contamination

Since S.B. 423 was enacted just a few months before this paper was completed, analyzing its effectiveness would be premature. However, it may be possible to gain some insight into how well S.B. 423 will address nonpoint source pollution by discussing the bill's components with reference to particular issues.

In order to determine the most pertinent issues to consider, a review of literature addressing groundwater protection strategies was undertaken. A number of organizations and authors (National Research Council 1986, Conservation Foundation 1987, Chemical Manufacturers Association 1987, Duda and Johnson 1987, Henderson 1984) have attempted to identify the key elements necessary for an effective and practical groundwater quality protection strategy. Henderson (1984) discussed the pros and cons of different options within three basic components that a state program should contain: 1) a protection policy (e.g., nondegradation goal, differential protection, etc.), 2) a management strategy (e.g., aquifer classification, uniform management, etc.), and 3) protection techniques (e.g., quality standards, source controls, user regulations, etc.) All of the cited authors agreed that more data need to be collected on hydrogeologic characteristics and ambient groundwater quality. The recommendations of the National Research Council, the National Groundwater Policy Forum (Conservation Foundation), the Chemical Manufacturers' Association, and Duda and Johnson concurred in that aquifers should be classified according to priority so that more important aquifers could be targeted for more protection, and that objective groundwater quality standards should be established. Other recommendations included public education, an open planning process including public participation, enforcement authority to restrict contaminating activities or substances, and interagency coordination.

All of these recommendations referred to overall groundwater protection programs; none was specific to nonpoint source problems. With respect to potential pesticide contamination, the National Research Council recommended that states consider: 1) establishing a pesticide use data base, 2) including leaching potential in the pesticide registration process, 3) introducing a pesticide tax to fund monitoring activities, 4) encouraging a reduction in pesticide use levels, and 5) restricting or prohibiting the use of certain pesticides in a local area if necessary. Other authors, while not making proposals for overall protection strategies, suggested particular measures to specifically address nonpoint source problems. With reference to household hazardous waste disposal, Brown (1987) called attention to the importance of public education and of providing opportunities for the proper disposal of hazardous materials. Cassel (1988) recommended setting up citizen committees to develop household hazardous waste management strategies. He also suggested three legislative options: excise taxes on polluting substances, prohibition of some substances, and programs requiring retailers to take back certain household substances generated in large quantities, such as motor oil and batteries. Baker (1987) and Fleming (1987) recommended measures to encourage low-input farming, such as more research on reducing the need for pesticides and fertilizers, restructuring farm subsidy programs, and taxing pesticides and fertilizers.

Consideration of these proposals, of the nonpoint source contamination problems in Oregon, and of the political atmosphere in the state has led this writer to suggest four policy issues that may prove critical to the effectiveness of S.B. 423 with regard to nonpoint sources: 1) compatibility with traditional land management values, 2) compatibility with existing institutional arrangements, 3) provision of long-term protection, and 4) adequacy of funding. The bill's provisions are discussed below in terms of these four issues.

Compatibility with traditional land management values

Agricultural practices constitute a major potential source of groundwater contamination in Oregon. As discussed above, excessive levels of agricultural chemicals have already been detected in several areas, even though monitoring has been limited. Representatives of agricultural interests were very involved in the drafting of S.B. 423, and several farm groups support the bill, which demonstrates that the farming community recognizes both its contribution to groundwater contamination and the importance of preserving high quality groundwater supplies.

Nevertheless, there is a strong tradition in the United States that farmers should be the ones to make the decisions about how they manage their land. Any form of government regulation tends to be viewed with suspicion; direct regulation of farming methods is strongly resisted. Hence, such agencies as the U.S. Soil Conservation Service, the Tennessee Valley Authority, and the land-grant college Agricultural Extension Service have traditionally attempted to promote better farming practices through educational means; federal farm support programs offer financial incentives to induce voluntary farmer participation; and water pollution control laws have relied on the development and voluntary adoption of best management practices.

Since agricultural practices are suspected of being a major category of nonpoint source groundwater contamination, it seems that any assessment of the effectiveness of S.B. 423 against nonpoint source contamination must consider to what degree the bill's provisions are compatible with traditional American values regarding the independence of the private farm manager. While the bill permits regulatory action, it respects traditional farmer sovereignty in three ways: by emphasizing research and education, by eliciting voluntary participation, and by providing for a large degree of public participation in choosing corrective actions.

Public education, research and demonstration projects are basic elements of the green, yellow, and red-light phases of the bill. These activities are to take place on the state and local level; they are to be tailored to the needs of particular groups and regions. The agricultural community is accustomed to this approach, which trusts that farmers will recognize the potentially serious impacts of groundwater contamination and voluntarily adopt improved techniques to reduce its occurrence, especially if they can be implemented at minimal cost, or better yet, with the expectation of a net benefit.

The yellow-light phase still relies on a non-regulatory approach. The recommendations of the local groundwater committee are not mandatory. It is hoped that farmers and other potential contributors to the contamination will voluntarily implement the recommended measures in order to avoid mandatory restrictions that might be imposed if the contamination were to worsen.

The process established to deal with contamination in both the yellow and red-light phases may well be the critical element needed to strike an acceptable balance between voluntary and mandatory measures. The bill provides for a substantial degree of public participation such that farmers have the opportunity to help shape the elements in the action plans. The local groundwater management committee appointed by SWMG after the declaration of an area of groundwater concern must "be composed of at least seven members representing a balance of interests . . . (Section 35 (1))". If agricultural practices were suspected of contributing to the contamination, representatives of the agricultural community would be on the committee and heavily involved in the process of identifying remedial measures. In addition, the draft plan must be submitted to public comment before the final is approved. During the red-light phase, the local committee is to act in an advisory role, and once again, the draft action plan must be submitted for public comment.

These provisions are critical to the successful implementation of S.B. 423 in that if farmers are to cooperate or, if necessary, to submit to mandatory restrictions, they should be meaningfully involved in the decision-making process. They may give up a measure of individual sovereignty, but in exchange they can exercise a measure of collective sovereignty. This bill provides the opportunity for a local area to design its own corrective actions, rather than have them imposed from above. Whether any of the interests in a local area, including the farmers, will use this opportunity in a constructive fashion, by advocating strong but acceptable measures, rather than in a defensive manner remains to be seen. The success of the public participation program will also depend on the skill of the lead agency in soliciting and incorporating public input.

<u>Compatibility with existing institutional arrangements</u>

American water management is characterized by fragmentation. Water quantity and quality are typically managed by separate agencies and separate laws. Ground and surface waters are managed in many cases as if they were not interconnected hydrologically. The large number of agencies and statutes dealing with groundwater quality in Oregon was noted earlier. Part of the rationale for developing a more comprehensive protection program was to eliminate inconsistencies and fill gaps in the existing programs. Given the existing complexity and difficulty in coordinating the activities of so many agencies, it would be desirable that a new program not introduce additional fragmentation and complexity.

By many measures, the framers of S.B. 423 went to great lengths to encourage a well integrated approach to managing groundwater quality. The bill recognizes the relationship between land activities and groundwater quality, and between groundwater quality and quantity. Section 56 (11) states: "All activities in the state that affect the quality or quantity of groundwater shall be consistent with the goal" of protecting the groundwater resource.

SWMG is assigned the major implementation role in Oregon's new program. Created by the Legislature in 1983, SWMG consists of the Governor and the directors of all state agencies that have any jurisdiction over water issues. It is charged with coordinating state agency activities and responses relating to water resources, encouraging federal actions that are consistent with state water policies, and coordinating the state's participation in the Federal Energy Regulatory Commission's process for licensing hydroelectric facilities (ORS 536.120 to 536.150). The creation and continuance of SWMG are an effort to promote interagency communication and reduce some of the problems resulting from the fragmented management of an interconnected system of land and water resources. SWMG has facilitated better communication and coordination among agencies with respect to issues such as: drought management, data management, hydropower facilities licensing, anadromous fish protection, and water quality management. (SWMG 1986-88.)

While the Legislature's choice of SWMG to implement major portions of S.B. 423 can be viewed as an attempt to better coordinate interagency activities and to promote more integrated management of natural resources, it also further complicates the water management network in the state. DEQ, under the direction of its policy-setting board, EQC, would be the natural implementer of a groundwater quality protection program because it is generally charged with the protection of water quality. Since its creation, SWMG's major role has been to provide a forum for better communication and coordination among state agencies. It would have continued to provide that important function even if DEQ had been designated the lead agency in implementing S.B. 423. Instead, the bill grants SWMG new authorities, e.g., developing educational programs, awarding grants, and holding final approval over local action plans. SWMG will probably delegate much of its authority to other actors, in which case it would appear that the bill may have created an unnecessary layer of administration.

The real motivation behind the selection of SWMG instead of DEQ appears to be the discomfort of the agricultural community with having DEQ in charge of groundwater contamination problems associated with agricultural activities (Pettit 1989b). It would prefer to have an agriculture-oriented agency, such as ODA, take on this potentially regulatory role. During the 1987 legislative session, a bill was considered but not enacted which would have given ODA jurisdiction over agricultural chemicals with respect to groundwater contamination. Within this context, it appears that SWMG's most important role may be one of mediation.

The interagency turf dispute regarding agricultural chemicals also seems to be evident in another provision of the S.B. 423. In earlier versions of the bill, the monitoring and assessment program was to have been carried out by DEQ in coordination with WRD. This would have been a practical arrangement since DEQ has primary jurisdiction over water quality concerns and WRD has experience and expertise in conducting hydrogeologic investigations. Towards the end of the legislative session, however, the bill was changed to read: "In cooperation with the Water Resources Department, the Department of Environmental Quality and the Oregon State University Agricultural Experiment Station shall conduct an ongoing state-wide monitoring and assessment program . . . (Section 29)." The Experiment Station was added because of its expertise regarding pesticides, fertilizers, and their interactions with the soil and groundwater (Dutson 1989). It sponsors relevant research and also has analytical capabilities. While the Experiment Station should probably be consulted in the design and implementation of an assessment program, its designation as an apparently equal partner with DEQ seems to create a burdensome institutional arrangement, which may result in unnecessary delay and inefficiency. At the time of this writing, it was not yet clear how responsibilities would be divided among agencies (Dutson 1989, Pettit 1989d).

As discussed earlier, a technical advisory committee is assigned the task of recommending to EQC a method and the criteria for setting maximum levels for contaminants. This committee's function is to involve interested publics in the potentially controversial process of setting maximum levels. The inclusion of this provision enabled the legislation to move forward without resolution of differing views about how the levels should be set. Since it is a temporary committee, it does not significantly complicate existing institutional structure.

Provision of long-term protection

One of the prime motivations for the development of a groundwater quality program is the prevention of contamination. Cleaning up contaminated groundwater is very expensive and in some cases impossible. A conservative unofficial estimate of the cost to clean up existing contaminated groundwater in Oregon ranges from five to ten million dollars per site (Pettit 1989b). An emphasis on the prevention of contamination is evident in the statement of the goal of S.B. 423:

> "The Legislative Assembly declares that it is the goal of the people of the State of Oregon to <u>prevent</u> contamination ... and to <u>maintain</u> the high quality and quantity of Oregon's ground water resource for present and future uses." (Section 18, emphasis added.)

The statement of this goal notwithstanding, S.B. 423's main focus is to detect contamination (monitoring and assessment program), and then manage and hopefully reduce contamination where it exists (yellow and red-light phases). Nevertheless, to the degree that it promotes educational programs and research into the development of less polluting chemicals and practices, it has the potential to provide some measure of long-term groundwater quality protection.

In the discussion of the ongoing program for the Ontario area (Part V), it was noted that more money was needed for research and demonstration projects of better management practices that would reduce chemical leaching. The grants to be administered by SWMG under Section 22 would encourage research and education in specific areas such as Ontario and in general, but these grants were not funded for the 1989-1991 biennium. The Legislature did provide $250,000 for research into the interaction of pesticides and fertilizers with groundwater (Sections 65 and 183). More funding for the SWMG grants in the future would greatly enhance the bill's contribution to long-term protection.

A long-term protection tactic that S.B. 423 generally does not employ is the use of fees or excise taxes on chemicals causing nonpoint pollution, such as agricultural and hazardous household chemicals. By raising the economic cost of a chemical being found in groundwater, such a fee may lead to lower usage rates, which in turn could reduce the incidence of leaching. Iowa and Wisconsin have increased pesticide and fertilizer fees to help fund their groundwater protection programs. Iowa also charges retailers of hazardous materials an annual permit fee based on gross sales. (Duffy and Johnson 1988; Holden 1986.) S.B. 423 does impose an increased inspection fee on fertilizers to provide the $250,000 for pesticide/fertilizer research under Section 65. The rest of the funding for the bill, however, is provided from the state's General Fund. A more effective long-term strategy would perhaps combine the educational programs mentioned above with more stringent economic disincentives to the use of polluting chemicals.

It should be noted that Sections 69 through 76 of H.B. 3515 direct DEQ to coordinate periodic collection events around the state for household hazardous waste and small quantities of commercial hazardous waste. In addition, permanent disposal depots for such wastes are to be established in the Portland area, and a state-wide public education program is to be implemented to provide information on the reuse, recycling, proper disposal of, and alternatives to the use of household hazardous chemicals. Since the opportunity to properly dispose of these chemicals does not currently exist in most areas of the state, this program has an important role in the protection of groundwater quality. However, it was never a part of S.B. 423, so it is not discussed here in greater detail.

Adequacy of Funding

No matter how well designed, an act lacking the necessary funding to carry out its provisions will not live up to its mandate. Unfortunately, such appears to be S.B. 423's fate, at least for the first biennium. In 1988 a legislative workgroup estimated that the cost of funding the programs envisioned under the bill would be $12 million per biennium. In his budget, the Governor requested $3.7 million. When the bill was before a Ways and Means subcommittee, DEQ was asked to prepare several budgets with estimates of what could be accomplished with varying amounts of money. DEQ felt that the minimum amount needed to carry out the provisions of the bill was $2.336 million. At one point a substitute bill consisting solely of the state-wide monitoring and assessment program was being considered. DEQ estimated that $1.9 million would be necessary to fund this program alone. In the end, only approximately $1.8 million was appropriated to DEQ, even though most of the original bill's provisions were adopted.

Sections 21 and 22 direct SWMG to award grants for groundwater research, demonstration projects, educational programs, and the development of alternatives, both as green-light activities and in yellow or red-light phases. However, no money was appropriated for these grants. As noted earlier, Section 65 increases the fertilizer inspection fee to provide $250,000 for grants to fund "research and development related to the interaction of pesticides or fertilizers and groundwater." These grants appear to be separate from those of Sections 21 and 22; they are to be administered by ODA, not SWMG, and their focus is much narrower. Hence, while the bill was drafted to rely heavily on education rather than regulation, the Legislature denied funding for many of the green-light programs and non-mandatory tools that could have been used in the yellow-light phase, thereby undercutting the educational emphasis.

Funding for S.B. 423's programs was included in appropriations for DEQ's Water Quality Division under H.B. 5033. In addition to setting up the monitoring and assessment program, DEQ plans to continue work in the Ontario area. Attention to the other problem areas, however, will be slower than hoped.

VI. Conclusion

Several areas in Oregon have groundwater contaminated at least in part by nonpoint sources. Agricultural practices and on-site sewage treatment systems have resulted in contamination; numerous activities in urban areas may also be contributing. S.B. 423, enacted during the 1989 legislative session, offers a promising approach for dealing with nonpoint source contamination. By relying heavily on education, public involvement, and voluntary participation, the approach recognizes the highly valued independence of private farm managers. The balance it achieves between voluntary and required actions will prove critical to its success in curbing pollution from agricultural sources. The bill's emphasis on research and education also serves the long-term goal of protection. The most serious weaknesses of the bill appear to be that: 1) it does not generally use the tool of taxing potentially polluting substances to fund the program and to provide an incentive for the development of alternatives; and 2) it creates an unnecessary layer of administration by giving SWMG, not DEQ, the role of implementer. In addition, the minimal funding provided by the Legislature for the first biennium greatly diminishes the bill's potential for promoting public education and research, and for addressing the nonpoint source contamination already known to exist in several areas.

Appendix

Explanation of health-based drinking water standards and guidelines

Maximum Contaminant Level:

A Maximum Contaminant Level (MCL) is the "maximum permissible level of a contaminant in water" delivered to any user of a public water supply (U.S. CFR, Section 141.2). MCLs are enforceable drinking water standards.

Maximum Contaminant Level Goal:

A Maximum Contaminant Level Goal (MCLG) is the "maximum level of a contaminant in drinking water at which no known or anticipated adverse effect on the health of persons would occur, and which allows an adequate margin of safety (U.S. CFR, Section 141.2)." MCLGs are nonenforceable health goals.

Health Advisories:

Health Advisories (HA) are nonenforceable guidelines which present EPA's most recent assessment of the concentrations of contaminants in drinking water at which adverse health effects are not expected to occur given specific exposure durations. They contain a margin of safety for sensitive populations. HAs noted in this paper are for a lifetime exposure; that is, EPA believes that water containing that level of a contaminant every day over the course of a lifetime does not pose health concerns. Lifetime HAs are not developed for carcinogens. (U.S. EPA 1988.)

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