WATER QUALITY MONITORING

Program Evaluation Division
Office of the Legislative Auditor
State of Minnesota

Program Evaluation Division

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February 1987

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STATE OF MINNESOTA
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Members
Legislative Audit Commission

In April 1986, the Legislative Audit Commission directed the Program Evaluation Division to evaluate water quality monitoring in Minnesota. Our study focused principally on monitoring programs administered by the Department of Health and the Pollution Control Agency, the two state agencies that have primary responsibility for ensuring that Minnesota's ground and surface waters are free from contamination and safe for human use.

We conclude that, in most respects, the state's water monitoring programs are working well. However, some specific contaminants are not adequately monitored and some water sources are not being tested at all. We recommend legislative and agency action to address these problems.

We would like to thank the management and staff of the Departments of Health and Agriculture and the Pollution Control Agency for their full cooperation and assistance.

This report was prepared by David Chein and Tom Walstrom (Project Manager).

Sincerely yours,

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EXECUTIVE SUMMARY

Clean water is a vital natural resource, important for drinking supplies, agriculture, recreation, and industry. Minnesotans have become increasingly aware that water pollution is a serious concern.

Our evaluation asked:

- Are the water quality monitoring programs of the Department of Health, Pollution Control Agency, and Department of Agriculture adequate to assess the status of the state's water quality and to detect water quality problems?
- Are state water programs well coordinated? Is there a need for reorganization?

A. ORGANIZATION OF WATER PROGRAMS

The organization of water programs involves a complex pattern of governmental relationships. At the federal level the Environmental Protection Agency has responsibility for most water resource programs. In Minnesota, no single agency is responsible for all water quality programs; instead, over ten state agencies, 87 counties, and hundreds of municipalities and special districts are involved.

This fragmentation creates a potential for duplication of effort and administrative inefficiencies. However, these problems can be avoided through effective coordination of agency activities. We examined the extent of coordination and cooperation among the major state water quality programs in Minnesota and found that it had improved markedly in the last five years. Many of the areas where there is a potential for duplication have already been addressed through inter-agency cooperative agreements. However, we found problems with inadequate coordination for managing lake water quality, non-point source pollution, pesticide contamination, water shortage policy, and data collection and management.

We also found that the Environmental Quality Board, after a period of relative inactivity, has made progress in the past year toward fulfilling its responsibility to coordi-

nate Minnesota's water policies. We recommend that the board should continue its activities to coordinate policies and to foster inter-agency communication. We also recommend that the Legislature make the board's Water Resources Committee's role explicit in statute and require the Committee to submit a biennial water plan to the Governor and the Legislature.

Overall, we conclude that:

- Minnesota has avoided most of the pitfalls associated with a multi-agency approach to managing water quality issues. Accordingly, we see no need for major organizational changes.

However, we think that the affected agencies should continue to work out formal agreements for inter-agency cooperation.

B. DEPARTMENT OF HEALTH

The Minnesota Department of Health (MDH) monitors the safety of drinking water in the state under the terms of the federal Safe Drinking Water Act. MDH has programs for monitoring community water supplies, non-community water supplies, and wells.

State rules call for community water suppliers to test their water every year and to test for inorganic contaminants every three years. In many instances, MDH conducts the tests. We examined a sample of 50 community water supplies and found that the department is not monitoring facilities as frequently as called for: inspections are made about every 16 months and testing for inorganic contaminants is done about every 45 months. However, we do not consider this a serious problem. In our view,

- The frequency of inspection and testing of community water supplies by the Department of Health is reasonable to assure that water is safe from currently regulated contaminants.

In fact, in some cases, MDH might inspect and test supplies less often; Minnesota is seldom found in violation of federal drinking water standards. Accordingly, we think that MDH should adopt a more cost-effective, "risk-based" strategy for inspecting and testing water supplies. This strategy would set the frequency for inspecting and testing based on the level at which contaminants have been found in the past. The department should then amend its rules to reflect this strategy.

State rules also call for MDH to inspect non-community water supplies--those which serve more than 25 people on a temporary basis. There are about 11,000 non-community water supplies in Minnesota, including children's camps and resorts as well as some factories, restaurants, schools, and parks. We found that only the 6,000 facilities licensed under the food, beverage, and lodging laws are actually inspected by MDH. And even these are not inspected as often as called for by drinking water regulations or food, beverage, and lodging laws. More importantly:

- More than 95 percent (nearly 5,000) of the unlicensed non-community facilities have never been inspected.

This is a problem because there is evidence that many facilities may have water that is unsafe. Also, 1,700 of these facilities, including schools and factories, are places where people are exposed regularly to the water. Because Minnesota citizens need and expect safe drinking water, we recommend that:

- MDH should begin testing non-community water supplies from which large numbers of people regularly drink.

- MDH should also establish a program to assess the risk of contamination in lower usage non-community water supplies.

By changing the definition of "community water supply", EPA may soon extend stricter standards to many facilities now classified as "non-community." Congress also recently changed provisions of the Safe Drinking Water Act to require monitoring of many more substances. For these reasons, more money soon will be needed to meet the requirements of federal law. A number of funding arrangements are possible, but a user fee may be the most practical for the Legislature to consider.

Finally, MDH enforces the state well code. However, we found that the department has not devoted the resources needed to make this program effective. We found that under five percent of the wells constructed in the state are inspected by the department. In addition, just 59 percent of well drillers' records are submitted as required by law. As a result, state information about the quality of water from wells is deficient. We recommend that:

- The department should more vigorously enforce the requirement for drillers to submit water well records. The Legislature should amend Minn. Stat. §156A.07 to make enforcement easier for the department.

Although MDH has encouraged local governments to take over well code enforcement, only one county has a local program so far. Also, we found that the state does not have a formal program to secure abandoned wells, as required by the well code. Because such wells threaten ground water, MDH needs to identify where they are and ensure that they are properly sealed.

We also think that the Department of Health should reconsider its strategy of depending primarily on local governments to enforce the well code. A stronger state program supported by agreements with interested counties would be more effective.

C. POLLUTION CONTROL AGENCY

The Pollution Control Agency (PCA) monitors surface and ground water quality to see whether federal standards are met and to help clean up existing pollution. We found that PCA's program to monitor discharges from municipal and industrial waste treatment plants was working adequately.

However, we found two problems with the way PCA monitors the quality of surface waters in rivers and lakes. First, the agency takes river water samples at fixed locations and fixed intervals. We think this approach has serious limitations in part because river water quality varies too much to be represented accurately by a few testing stations. We recommend that:

- PCA should conduct more in-depth, but less frequently repeated, studies of river water quality.

Second, PCA's lake monitoring program, which includes only 75 lakes annually, is not well coordinated with the Department of Natural Resources' lake management program. We recommend:

- PCA and DNR should develop a joint lake management strategy that preserves lake water quality and enhances recreational uses. The strategy should include monitoring responsibilities, data sharing, and coordinated activities.

Although PCA has established an adequate system for monitoring ground water at landfills and hazardous waste sites, there is room for more progress. For example, test wells are not always correctly located and landfill operators are slow in sending reports to PCA.

Also, in our view, the agency does not have adequate procedures to ensure the accuracy of reports it receives from permit holders and the laboratories that analyze water samples for them. Thus, we recommend:

- The state should establish a program to certify laboratories providing water quality analyses.

PCA should establish a working group with the Department of Health and other state agencies to determine the best way to certify labs.

We are also concerned that PCA monitors a number of sources of pollution infrequently or not at all. For example, open dumps, underground storage tanks, and feedlots are all infrequently monitored sources of water contamination.

Finally, PCA needs to address more comprehensively the problem of non-point source pollution, sometimes called "polluted run-off". Because many of Minnesota's water quality problems derive from polluted run-off, we support the recommendations of an inter-agency task force for PCA to coordinate an intergovernmental approach to this problem.

D. DEPARTMENT OF AGRICULTURE

The Minnesota Department of Agriculture (MDA) regulates the use of water in food production and the distribution of chemicals which may contaminate water supplies. We found that the department's program for testing dairy farm and food processing wells is adequate, although it does not include tests for all substances that might contaminate milk and food supplies.

We also found that the department has no regular program to detect pesticide contamination in water. Since some studies have shown that parts of Minnesota are vulnerable to pesticide pollution, we support MDA's efforts to establish a pesticide monitoring program.

INTRODUCTION AND BACKGROUND

Chapter 1

A. INTRODUCTION

Minnesota has an abundance of good quality water. However, in recent years there has been an increased awareness of the potential for contamination of water supplies. Events across the country, and in Minnesota as well, have highlighted the fragility of our water resource. Citizens and legislators are increasingly interested in maintaining good water quality in Minnesota and cleaning up areas where the resource has been degraded.

This report is a response to interest among legislators in Minnesota water issues. The report is not all-inclusive. Although we recognize that it is difficult to separate water quality from water quantity issues, we have deliberately restricted the report's scope to water quality monitoring programs. Because water quality monitoring programs alert the state to current problems, assure the safety of water supplies, and help keep track of cleanups of known contamination, we believe they are an important component of the state's overall water strategy. We also believe that the programs can be examined profitably in this context.

The goals of this report are to provide information on the organizational approach Minnesota has taken to water resource problems, and to evaluate the water quality monitoring programs of the Department of Health and the Pollution Control Agency. We also review programs operated by the Departments of Agriculture and Natural Resources. We ask:

- How well are the Pollution Control Agency and Department of Health conducting water quality monitoring programs? Are monitoring programs adequate to assess the status of the state's water quality and to detect water quality problems?

- Are Minnesota's water agencies coordinating their activities? Are organizational changes needed?

The report is organized into five chapters. Chapter 1 describes Minnesota's water resources. Chapter 2 examines organizational questions relating to water resources. Chapters 3 and 4 examine the monitoring programs of the Department of Health and the Pollution Control Agency. Chapter 5 discusses the monitoring programs of the Departments of Natural Resources and Agriculture.

B. MINNESOTA'S WATER RESOURCES

Minnesotans in many ways identify their state with its water resources. In the "land of ten thousand lakes", many Minnesotans have homes or cabins on lakes, or visit lakes, rivers, or streams to enjoy fishing and other water-based recreation. Many benefit directly from economic activity related to water: water for irrigation, industrial processing, and production of electricity is important for the state's economy. Water resources are also the reason that many tourists visit the state. Finally, every citizen has a stake in the quality of drinking water. The quality of life of all Minnesota residents is affected by the state's water resources.

Other states and countries are also affected by the state's water resources because Minnesota is a "headwaters" state. Almost all of the streams and rivers originating in the state flow out. Waters flow out of the state to the Atlantic via the Great Lakes, to the Gulf of Mexico via the Mississippi, and to Hudson Bay via the Red River of the North. Thus, the quality of the water leaving Minnesota affects downstream users in other parts of the country and in Canada.

1. Surface Water

There are 15,291 lake basins larger than 10 acres in Minnesota. However, 3,257 of these are classified as partially or completely dry. It is estimated that about 90 percent of the dry lake basins have been affected by the construction of artificial drainage ditches and the channelization and deepening of natural streams. Excluding Lake Superior, lakes cover over 2.6 million acres or almost 5 percent of the state's surface area.[1] There are also over 250,000 acres of protected wetlands in the state.

Minnesota's lakes are not uniformly distributed around the state. Lakes are most numerous in the northeast and central portions of the state; few lakes exist in the northwestern and southwestern parts of the state. Most lakes in the state are less than 100 feet in depth. Generally, the lakes become shallower as one moves south through the state. In southern Minnesota, many of the lakes are very shallow and commonly experience "winterkill" of fish or "freeze out" over the winter. These lakes are important for retarding runoff and for replenishment of ground water supplies as well as for maintenance of wildlife populations. Many are now supporting viable fisheries through the use of lake aeration devices.

Minnesota has ten major river basins, which are shown in Figure 1.1. The state also lies at the beginning of three major watersheds: the Great Lakes basin, the Souris-Red-Rainy River basin, and the Mississippi River basin.

There are over 25,000 miles of rivers and streams flowing through the state, and many more miles of drainage and irrigation ditches. Over 1,100 miles of the state's borders are formed by rivers that Minnesota shares with Canada, North and South Dakota, and Wisconsin. Streams provide an especially important recreation source in the northwest and southwest where there are few lakes, and also in the northeast and southeast where important coldwater fisheries exist.

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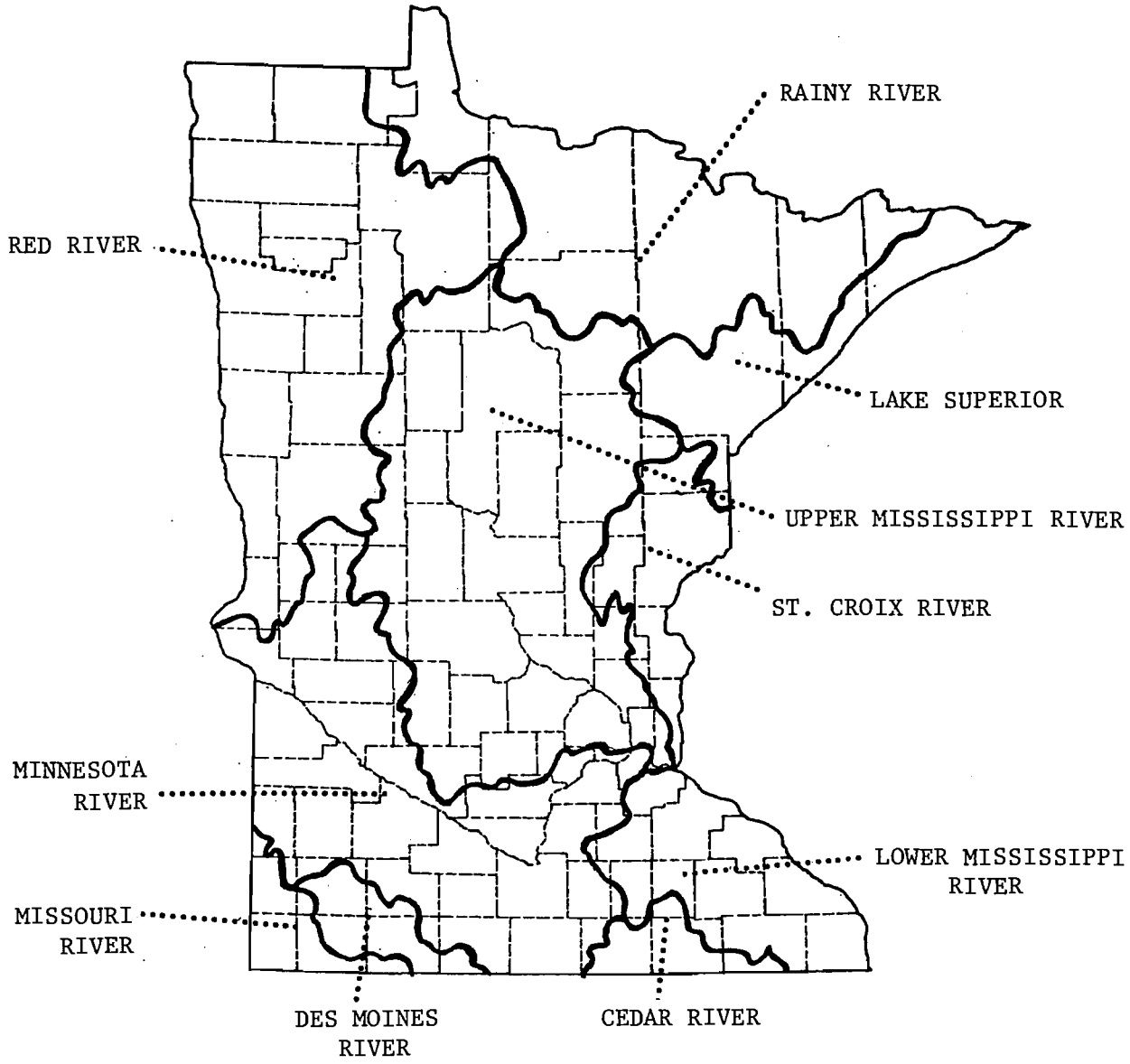
[1] *Toward Efficient Allocation and Management: A Strategy to Preserve and Protect Water and Related Land Resources*, Minnesota Water Planning Board (1979), pp. 8-9.

FIGURE 1.1

MINNESOTA RIVER BASINS



Surface water has many uses in Minnesota. As Table 1.1 shows, surface water is withdrawn by public water supplies, rural uses, irrigation, industry, and thermoelectric power.

TABLE 1.1

ESTIMATED WATER WITHDRAWALS FOR MINNESOTA
1980

(Millions of Gallons Per Day)

	Ground Water		Surface Water		Total	
Use Category	Gallons	Percent	Gallons	Percent	Gallons	Percent
Public Water Supply (domestic, commercial, public, industrial uses)	230	34%	210	9%	440	14%
Rural Self-Supply (domestic, livestock uses)	180	27	10	1	190	6
Irrigation	140	21	18	1	160	5
Industrial Self-Supply	120	18	470	20	590	19
Thermoelectric Power	< 1	0	1,700	70	1,700	55
TOTALS (rounded)	670	100%	2,400	100%	3,100	100%

Source: Department of Natural Resources.

Table 1.2 shows estimates of Minnesota's available surface water by river basin. It is noteworthy that surface water is unevenly distributed around the state, and that the amounts available also vary depending on the amount of precipitation.[2] Almost half of the available flow throughout the state occurs during spring runoff.

Water is also used for recreation purposes. Water quality is important to the many Minnesotans and visitors who engage in fishing, canoeing, swimming, and boating on state lakes and streams.

[2]Note that in 1976, a drought year, there was no net surface water available in south-western Minnesota.

TABLE 1.2

ESTIMATED AVAILABLE MINNESOTA SURFACE WATER

(in billions of gallons per year)

	Average for Period of Record	1976 Drought
Upper Mississippi River	2,035	1,285
Lower Mississippi River	2,607[a]	2,392[a]
St. Croix River	1,330[a]	1,146[a]
Minnesota River	627	269
Lake Superior	698[b]	474
Red River	768	673
Rainy River	3,137[c]	2,153[c]
Cedar River	44	23
Des Moines River	64	20
Missouri River	N/A	0
	11,310[d]	8,435

Source: Minnesota Water Planning Board, *Toward Efficient Allocation and Management: A Strategy to Protect Water and Related Land Resources* (June 1979) p.10.

[a]Includes water from Wisconsin portion of basin.
[b]Estimates are low because of ungauged tributaries flowing into Lake Superior.
[c]Includes water from Canadian portion of basin.
[d]Assumes Missouri River Basin is zero.

2. Ground Water

Ground water, Minnesota's most abundant water resource, is stored in aquifers. An aquifer is a water-saturated geologic formation that will yield water to wells or springs at a sufficient rate so that they can serve as a practical water supply source.

Ground water normally occurs in two different storage areas: thick areas of consolidated sandstone laid down half a billion years ago and shallow areas of loose sand and gravel left by meltwater streams from the last glaciers approximately 10,000 years ago. Little water is stored in the shallow and rocky soils of the northeastern part of the state.

TABLE 1.3

ESTIMATED MINNESOTA GROUND WATER RESOURCES

(in Billions of Gallons Per Year)

Major River Basin	Ground Water (safe yield)
Upper Mississippi River	500-800
Lower Mississippi River	175-300
St. Croix River	85-175
Minnesota River	130-280
Lake Superior	55-110
Red River	77-165
Rainy River	35- 85
Cedar River	25- 50
Des Moines River	10- 25
Missouri River	5- 10
TOTAL	1,097-2,000

Source: Minnesota Water Planning Board, *Toward Efficient Allocation and Management: A Strategy to Protect Water and Related Land Resources* (June 1979), p. 10.

Ground water is more abundant in the south-central and southeastern parts of the state.[3]

There are 14 principal aquifers in Minnesota that provide water to wells. Over half of the municipal population and almost all of the rural population receives water from these aquifers.[4] Estimates of the available amount of ground water in the state vary widely, but it is generally agreed at least one to two trillion gallons are available. Table 1.3 shows estimates of the available ground water in each river basin.

[3]Linda Bruemmer and Thomas Clark, *Ground Water in Minnesota: A Guide to Understanding Minnesota's Ground Water Resource*, Minnesota Pollution Control Agency and State Planning Agency (January 1984), p. 4. See also Gordon Bennett, *Ground Water: an Under-valued Resource*, U.S. Geological Survey Handbook (1978); Dennis Woodward, *National Water Summary -- Ground Water Summary -- Minnesota*, U.S. Geological Survey Water Supply Paper 2275 (1985); and, *Ground Water Protection Strategy Framework for Minnesota*, Minnesota Pollution Control Agency (June 1983).

[4]See D.G. Adolphson, J.F. Rule, and R.J. Wolf, *Designation of Principal Water Supply Aquifers in Minnesota*, U.S. Geological Survey Water Resources Investigations Report No. 81-51 (August 1981).

In 1980, ground water accounted for 21 percent of total water withdrawals and approximately two-thirds of public drinking water supplies. The state's three major metropolitan areas use mostly surface water. However, an overwhelming majority of other municipal systems and almost all of rural Minnesota use ground water. Thus, ground water is especially important in rural Minnesota.

In general, one can conclude that Minnesota has an adequate supply of surface and ground water in years with normal precipitation. Despite the generally positive picture of water supply and demand in Minnesota, localized shortages can still occur. Although Minnesota currently has problems with an excess of water, periodic droughts can exacerbate tensions over water allocation. The Legislature has taken some steps, outlined below, to help define priorities for water use in the state.

3. Water Use Priorities

The Legislature has established the following priorities for water use:

- Public water supply, excluding industrial and commercial uses of municipal water supply.
- Any use of water that involves consumption of less than 10,000 gallons of water per day.
- Agricultural irrigation, involving consumption of more than 10,000 gallons per day, and processing of agricultural products.
- Power production involving consumption of more than 10,000 gallons per day.
- Other uses, involving consumption in excess of 10,000 gallons per day.[5]

The Department of Natural Resources (DNR) is responsible for overall management of the state's water resources. In this capacity, it issues water appropriation permits for most uses of water. (Domestic supplies serving fewer than 25 persons are exempt.) DNR also issues permits for works in public waters, inspects and regulates dam construction, regulates land use and development along shorelines, and manages public waters to benefit fish and wildlife.

C. CURRENT WATER QUALITY

The quality of water available for use is as important as the extent and distribution of water supplies. Water quality is measured by its bacterial, chemical, and physical properties. In this section we review what is currently known about the quality of Minnesota's waters.

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[5]Minn. Stat. §105.41.

1. Water Quality Standards

Measurements of water quality must consider the water's use. Quality standards for surface water have been developed as the result of the Federal Water Pollution Control Act Amendments of 1972, commonly referred to as the Clean Water Act.[6] The Clean Water Act required that:

> wherever attainable, an interim goal of water quality which provides for the protection and propagation of fish, shellfish, and wildlife and provides for recreation on and in the water be achieved by July 1, 1977.[7]

This deadline was later moved to July 1, 1983, and again postponed by Congress until July 1, 1988. The standard essentially requires that the waters of the state be suitable for fishing and swimming by that date.

In Minnesota, this national goal is operationalized in water quality standards established by the Pollution Control Agency (PCA) in state rule. PCA has classified all of the surface waters in the state according to intended use. Standards have been set for domestic consumption, fisheries and recreation, industrial consumption, agriculture and wildlife, navigation and waste disposal, other uses, and limited resource value waters.

The water quality standards that apply depend on the intended use. Most surface waters in the state are classified 2B. Class 2B waters are supposed to permit "the propagation and maintenance of cool or warm water sport and commercial fishing" and are to be suitable for aquatic recreation of all kinds.[8] It is this standard that responds to the charge of the Clean Water Act.

Surface water quality indicators commonly examined by PCA during its monitoring programs include: dissolved oxygen, un-ionized ammonia, nitrate-nitrite concentration, and suspended solids. PCA uses these indicators to determine compliance with the goals of the Clean Water Act.

Adequate levels of dissolved oxygen are necessary to support fish and other aquatic life. Different species of fish have different tolerances for dissolved oxygen, but the minimum standard in Minnesota is 5 parts per million in fishable waters. High levels of un-ionized ammonia are toxic to fish and wildlife. The standard for un-ionized ammonia is a maximum concentration of .04 parts per million. Low dissolved oxygen and high ammonia concentrations in water are usually due to inadequate treatment and discharge of organic wastes, or to decomposition of vegetation. These indicators are usually associated with *point sources* of pollution, that is, discharges of municipal sewage or industrial waste from a single location or "point".

Agricultural fertilizers are a major source of nitrates. Runoff containing nitrates promotes algae and weed growth in the receiving waters and in downstream waters. The domestic consumption standard for nitrates is 10 parts per million. Total suspended solid levels in rivers are affected by the amount of runoff and erosion of soil into the

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[6]Public Law 92-500

[7]33 U.S.C. §1251

[8]See MCAR §7050.022

river. Both nitrates and total suspended solids are indicative of *non-point source* pollution, that is, pollution from a variety of diffuse sources, such as agricultural chemicals, erosion and urban runoff. PCA sometimes refers to this as polluted runoff.

PCA is also responsible for protecting the state's ground water resources from contamination. Standards regulating ground water pollution are mostly concerned with drinking water. Drinking water standards have been developed for total coliform bacteria, nitrates, several inorganic metals and several organic chemicals. Coliforms and high levels of nitrates in drinking water are associated with acute diseases similar to food poisoning. Many metals, on the other hand, are not toxic but can affect aesthetic characteristics such as taste, odor, clarity, and hardness. Some organic substances are believed to cause cancer and other diseases when consumed over long periods.

The appearance of synthetic organic substances in ground water results from chemical spills, improper disposal of industrial and municipal solid waste, and use of agricultural chemicals. Because the presence of toxic synthetic organic chemicals in ground water is only a recent discovery, the health effects from exposure are not fully known. Standards have not been developed for most of these chemicals.[9] Nevertheless, the potential health hazard is sufficient for PCA to be concerned about protecting ground water from pollution and for MDH to issue recommended advisory levels.

2. Meeting Water Quality Standards

a. *Surface Water Quality*

Before we discuss how closely Minnesota meets water quality standards, a caveat is in order. We examine PCA's water quality monitoring efforts in Chapter 4 and find that the measures used by PCA may not reflect the actual status of Minnesota's water. Nonetheless, PCA's data are the best available, and can at least be viewed as *indicators* of water quality. With this in mind, we turn to the question of how well Minnesota is meeting water quality standards.

The evidence of success in cleaning up the state's rivers, lakes, and streams is mixed. PCA currently assesses water quality by reference to "ecoregions". PCA has divided the state into seven ecoregions based on similarities in land use, soil type, land forms, and natural vegetation. Trends have been examined for each ecoregion. In its most recent assessment, PCA indicates:

> There were decreases in un-ionized ammonia concentrations in many of the ecoregions and relatively small changes in dissolved oxygen values in all ecoregions other than Northern Lakes and Forests. These trends indicate more improvement than degradation in those water quality measures most affected by point source pollution. They also indicate some areas of need for more improvement and/or protection from degradation.

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[9]The U.S. Environmental Protection Agency has fallen behind in its efforts to develop standards for pesticides and other organic chemicals. See U.S. General Accounting Office, *Pesticides: EPA's Formidable Task to Assess and Regulate Their Risks* (April 1986). In Chapters 2 and 3 we discuss recent amendments to the Safe Drinking Water Act that require EPA to develop standards for more substances over the next three years.

> Those water quality measures most affected by non-point source pollution, nitrate-nitrite concentration and total suspended solids, were more likely to indicate degradation.[10]

PCA's water quality assessments show that many of the state's rivers and streams are meeting the "fishable and swimmable" goal of the Clean Water Act. However, in 1984-85 almost 60 percent of the river and stream miles assessed did not support swimming, and approximately 17 percent did not support fishing.

There are many examples where water quality in specific areas has been dramatically improved as the result of efforts to control point sources of pollution. Lake Minnetonka, Lake Irving in Bemidji, and the Mississippi River south of St. Paul are a few of the cases of dramatic improvement in water quality.

PCA attributes this improved water quality to the regulation of industrial and municipal sewage "point sources" of pollution. Although many problems remain with the construction of sewage treatment plants for smaller communities, most of the large point source polluters in the state have now been issued permits, and their discharges regulated.

- Many of the streams not meeting standards are being contaminated by non-point sources of pollution.

Non-point sources of pollution are by their very nature more difficult to control than point sources. PCA estimates that non-point source pollution is the reason over half of the streams do not meet designated uses.

As pollution from point sources has been brought under control, state and federal governments are beginning to pay greater attention to non-point source pollution. Federal funds to abate non-point source pollution are likely to increase slightly and an interagency issue team has recommended a new state program for controlling non-point source pollution. It is clear to us that control of non-point source pollution is essential if the overall quality of Minnesota's waters is to be maintained and enhanced.

b. *Ground Water Quality*

Information on ground water quality in the state is scarce, partially because it is necessary to know the geologic character of an area in order to assess the ground water characteristics adequately. Most of the counties in the state have not been mapped for their geologic characteristics. The Minnesota Geological Survey has completed geologic atlases for only two counties and is working on two others.

Nonetheless, there are a number of well sampling and monitoring programs in the state. The Departments of Natural Resources, Agriculture, and Health, as well as the Pollution Control Agency and the U.S. Geological Survey, all have some sort of ground water monitoring programs. Based on these sampling and monitoring programs, the general characteristics of Minnesota's ground water are known, and the consensus is that: "Ground water is generally suited for most uses over much of the state."[11]

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[10] *Minnesota Water Quality: Water Years 1984-1985*, Pollution Control Agency (1986), p. 25.

[11] Water Planning Board, *Toward Efficient Allocation and Management*, Appendix B, p. 20.

TABLE 1.4

MINNESOTA'S AMBIENT GROUND WATER QUALITY

Chemical Parameter	Number of Samples	Water Quality Standard[a]	State Ground Water Quality Average
Arsenic, as As	107	10.1 ug/1	2.85 ug/1
Chloride as Cl	376	250.0 mg/1	19.51 mg/1
Copper as Cu	223	1000.0 ug/1	19.55 ug/1
Fluoride as F	298	1.5 mg/1	0.21 mg/1
Iron as Fe	359	300.0 ug/1	1230.14 ug/1
Manganese as Mn	359	50.0 ug/1	154.16 ug/1
Nitrate (NO_3) as N	388	10.0 mg/1	2.56 mg/1[b]
Phenol	200	1.0 ug/1	<2.0 ug/1
Sulfate as SO_4	299	250.0 mg/1	51.39 mg/1
Total Dissolved Solids (TDS)	360	500.0 mg/1	404.75 mg/1
Zinc as Zn	360	1000.0 ug/1	92.33 ug/1
Barium as Ba	222	1000.0 ug/1	0.13 ug/1
Cadmium as Cd	359	10.0 ug/1	1.90 ug/1
Chromium as Cr (total)	359	50.0 ug/1	8.39 ug/1
Lead as Pb	361	50.0 ug/1	8.39 ug/1
Selenium as Se	222	10.0 ug/1	1.95 ug/1
Silver as Ag	23	50.0 ug/1	0.04 ug/1

Source: *Ground Water Protection Strategy Framework for Minnesota* (1983) pp. 4-11.

[a]Standards are expressed in micrograms per liter (ug/l) (equal to parts per billion) and milligrams per liter (mg/l) (equal to parts per million).
[b]Value represents $NO_2 + NO_3$ as N.

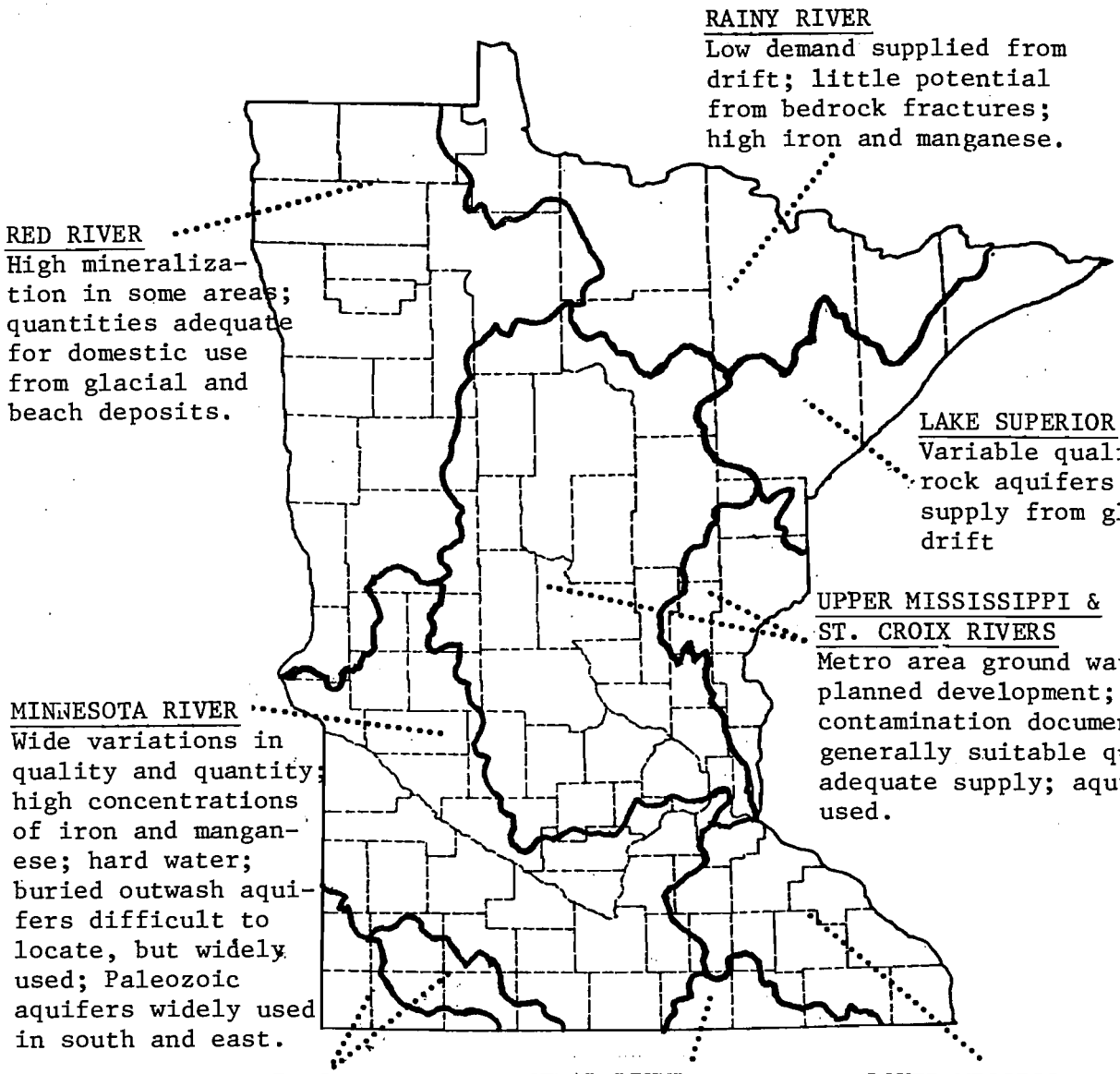
Another indicator of Minnesota's ground water quality is the data gathered by PCA's ambient ground water monitoring program. Table 1.4 shows average measurements from the monitoring program compared to the standard contained in state rule. As one can see in the table, only the standards for iron and manganese are exceeded. However, these data are averages and should not be taken to indicate that all is well with the state's ground water quality. Figure 1.2 describes ground water quality in the state's major river basins.

While Minnesota's ground water quality is generally good, there are areas of specific concern. For example, high nitrate concentrations have been found in southeastern Minnesota. Southeastern Minnesota's unique karst topography results in easy mixing of surface and ground water supplies, making contamination a special concern.

There have also been a number of discoveries of toxic contamination in ground water aquifers in recent years. Toxic contamination of water supplies in St. Louis Park, New Brighton, and Waite Park are only three of the most widely publicized problems. These incidents resulted from improper storage and disposal of hazardous wastes. As of

FIGURE 1.2

GROUND WATER SUMMARY BY RIVER BASIN



Source: Linda Bruemmer and Thomas Clark, *Ground Water in Minnesota: A User's Guide to Understanding Minnesota's Ground Water Resource*, Minnesota Pollution Control Agency and Minnesota State Planning Agency, January 1984, p. 25.

December 1986, 130 sites have been placed on the state "Superfund" list for cleanup. It is also widely recognized that more sites will be found in the near future.

The state has a number of other recognized toxic contamination problems. Many of the state's sanitary landfills, for example, are leaking toxic substances into ground water. Underground storage tanks and open dumps are also sources of ground water contamination. The issue of ground water contamination by agricultural pesticides has become a matter of increasing concern.

Contamination of ground water by toxic substances has only recently been discovered. Only a few years ago, it was believed that the soil provided a natural protection for the ground water beneath, and that substances would naturally decompose before infiltrating aquifers used for drinking water supplies. Only within the last decade have scientists developed the technology and analytical methods to detect low levels of toxic substances. Although not enough is known about the presence and toxicity of these contaminants, sufficient data exist, both nationally and in Minnesota, to conclude that toxic substance ground water pollution is a problem that needs to be addressed.

In summary, Minnesota water quality is generally good. Contamination from municipal sewage and industrial waste has been largely controlled. However, threats to surface and ground water quality from non-point sources of pollution and to ground water quality from toxic contamination persist. Water quality monitoring is essential for identifying problem sites and for monitoring progress in cleaning them up.

WATER RESOURCES ORGANIZATION

Chapter 2

A. INTRODUCTION

The organization of water resource agencies in Minnesota is complex. As a result, many legislators and citizens do not completely understand what the various government agencies do and how they relate to each other. In this chapter, we briefly describe the institutional framework for water resource policy and programs in Minnesota, and we consider how well the current organizational structure is working. Specifically, we examine the following questions:

- What is the current organizational framework for water resource issues in Minnesota? What are its strengths and weaknesses?
- How are agencies cooperating on problems that bear on more than one agency's responsibilities? How do agencies coordinate their efforts to manage water resources?
- Is the Environmental Quality Board an effective coordinating body for water resource issues?

Our analysis is based on interviews with management and staff of state agencies, a review of past studies, and an analysis of the current organizational structure of water resource agencies. In addition, we conducted a survey and reviewed the four principal state water resource agencies' formal and informal inter-agency agreements. We also attended a number of inter-agency meetings to understand how agencies are coordinating programs and policies and resolving organizational differences.

We emphasize that we have not conducted an exhaustive organizational analysis of all agencies involved in water issues. The purpose of this chapter is to describe Minnesota's current water-related programs and to review existing evidence on government organization for water issues. Nonetheless, we believe we have gained some insights into the coordination of Minnesota's water agencies, and those insights are shared in this chapter.

B. HISTORY OF GOVERNMENT INVOLVEMENT

Historically the federal government has been most involved with surface water quantity issues. The Rivers and Harbors Act of 1899 provided authority for the federal government to maintain navigable conditions on interstate rivers and to regulate water pollution.[1] The federal government today exercises a major role in flood control, hydroelectric power plant construction, and the development of major water supply impoundments. The federal government also influences water management through the Environmental Protection Agency, the Soil Conservation Service, the Fish and Wildlife Service, and other agencies.

Water pollution control became a federal priority in the 1970s, when Congress dramatically expanded the government's regulatory efforts to reduce water pollution. Figure 2.1 outlines the major federal legislation dealing with water quality.

In 1972, Congress expanded federal involvement in water quality issues by significantly amending the Federal Water Pollution Control Act (also called the "Clean Water Act").[2] The act provides stricter regulation of municipal sewage and industrial waste discharges into surface water and also provides financing for wastewater treatment plants.

In 1972, Congress also passed the Federal Insecticide, Fungicide and Rodenticide Act which regulates the production, distribution and application of pesticides, an important contributor to water pollution.[3]

The Safe Drinking Water Act of 1974 required EPA to establish drinking water standards and provided funds for state drinking water programs.[4] The 1986 amendments to the act increase the number of standards, require state wellhead protection programs, and authorize additional funds for safe drinking water programs.[5]

In 1976, Congress recognized the importance of protecting ground water from contamination by passing the Resource Conservation and Recovery Act.[6] This legislation established regulatory controls over the generation, storage and disposal of solid and hazardous wastes. The act was significantly strengthened in 1984.[7]

In 1980, Congress passed the Comprehensive Environmental Response, Compensation, and Liability Act (the "superfund" law).[8] The law provided funds for the cleanup of hazardous

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[1]Courts interpreted the provision of the Rivers and Harbors Act that made it illegal to dump any materials into waterways as authority to regulate water pollution.

[2]P.L. 92-500.

[3]P.L. 92-516.

[4]P.L. 93-523.

[5]Conference Report 99-575.

[6]P.L. 94-580.

[7]P.L. 98-616.

[8]P.L. 96-510.

FIGURE 2.1

MAJOR PROVISIONS OF FEDERAL ENVIRONMENTAL LAWS ADDRESSING WATER QUALITY

Federal Water Pollution Control Act Amendments of 1972 (Clean Water Act)

- Provides for wastewater treatment construction grants to municipalities
- Requires states to file regional waste management plans to control point and nonpoint source pollution in order to receive grants
- Requires the Environmental Protection Agency to establish standards for discharge of effluent to surface water
- Sets up National Pollution Discharge Elimination System, administered by states, requiring all dischargers to obtain permit

Federal Insecticide, Fungicide and Rodenticide Act of 1972

- Requires registration of all pesticides with the Environmental Protection Agency
- Requires that pesticides be accurately labeled and not adversely affect the environment
- Requires registration of pesticides applicators
- Delegates enforcement responsibilities to states

Safe Drinking Water Act of 1974

- Requires the Environmental Protection Agency to establish national drinking water standards

Safe Drinking Water Act of 1974, continued

- Delegates enforcement of drinking water standards to states
- Provides grants for public water supply protection

Resource Conservation and Recovery Act of 1976

- Requires Environmental Protection Agency to establish standards for hazardous waste generation, treatment and disposal
- Delegates regulatory enforcement and authority to issue permits to states and provides financial support
- Provides financial support to state solid waste management programs

Comprehensive Environmental Response, Compensation and Liability Act of 1980

- Requires the Environmental Protection Agency to develop national priorities for hazardous waste cleanup and rank all sites accordingly
- Requires parties responsible for hazardous waste contamination to pay for cleanups
- Establishes contingency fund to clean up sites where responsible parties cannot be found or made to pay

substances that pose threats to water supplies. In 1986, the superfund law was reauthorized with a significant increase in funding.[9]

Also in 1986, Congress passed an amendment to the Clean Water Act. The 1986 amendment would have:

- provided $18 billion to states through 1994 to continue their wastewater treatment plant construction grant programs,
- terminated the construction grant program after 1994,
- provided funds for several new programs to control non-point source pollution, and,
- extended the Clean Lakes Program, which provides funds for the cleanup of polluted lakes.[10]

President Reagan vetoed the bill in 1986; however, Congress has re-passed the bill and will likely over-ride President Reagan's veto.

Figure 2.2 presents a brief outline of the major responsibilities of federal agencies involved in water issues. Appendix A presents a more detailed description of the federal, state, and local agencies involved in water resource issues.

The Environmental Protection Agency (EPA) administers most federal laws relating to water quality. EPA issues permits and regulates industrial waste and municipal sewage discharge into surface waters. It runs programs for solid and hazardous waste disposal and administers the federal superfund program. EPA also establishes drinking water standards and gives money to state and local governments to improve water quality.

Other federal agencies play smaller roles in water resource management. For example, the U.S. Army Corps of Engineers regulates construction projects in navigable waterways and regulates the filling of wetlands. The U.S. Geological Survey conducts geological and hydrological research to assess the causes of water pollution and to find appropriate remedies for it. The U.S. Department of Agriculture provides funds for controlling erosion and sedimentation. A number of other federal agencies also play a small regulatory or administrative role in water management.

C. MINNESOTA'S WATER ORGANIZATION

1. State Water Agencies

Most of the federal laws discussed require states to establish standards at least as stringent as federal requirements. Minnesota has done this and, in fact, has gone beyond federal requirements in several instances.

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[9]Conference Report 99-962.

[10]Included in the bill was $7.7 million per year for St. Paul and Minneapolis to separate their storm water and sanitary sewage systems. The current combined systems cannot handle the flow during heavy rains, resulting in the discharge of untreated sewage into the Mississippi River.

FIGURE 2.2

MAJOR FEDERAL AGENCIES RESPONSIBLE
FOR MANAGING WATER-RELATED PROGRAMS

AGENCY	RESPONSIBILITIES
Environmental Protection Agency	■ Set safe drinking water standards ■ Set solid and hazardous waste storage and disposal standards and oversee state regulation ■ Oversee state administration of sewage and industrial waste discharge and approve wastewater treatment construction grants ■ Oversee state administration of "superfund" ■ Register pesticides and oversee state regulation of pesticides
U.S. Department of Agriculture	■ Provide funds to states and local soil and water conservation districts for erosion and sedimentation control
U.S. Geological Survey	■ Conduct hydrological research ■ Assist state and local governments with water resource planning
U.S. Army Corps of Engineers	■ Construct dams and control flooding on navigable waters ■ Regulate construction and other works on navigable waters ■ Regulate filling of wetlands

Minnesota is one of eight states to have its own superfund.[11] Minnesota's superfund supplements the federal fund and finances cleanups of some sites that are unable to qualify for federal money. Minnesota also provides grants to municipalities that do not qualify for federal wastewater treatment facility grants.[12] The state also tests drinking water from selected communities for volatile organic chemicals although the tests are not required by federal law.

Figure 2.3 lists the state and local agencies with responsibility for water quality and quantity programs. Minnesota differs significantly from the federal government in that no single agency is responsible for all water quality programs. Instead, four agencies share primary responsibility for water resource issues: the Minnesota Pollution Control Agency (PCA), the Department of Natural Resources (DNR), the Minnesota Department of Health (MDH), and the Minnesota Department of Agriculture (MDA). Several other state agencies provide coordinating services or run specific water-related programs. Also,

[11]Minn. Stat. Chap. 115B.

[12]Minn. Stat. §116.16, §116.18.

FIGURE 2.3

STATE AGENCIES RESPONSIBLE FOR MANAGEMENT OF WATER-RELATED ISSUES

AGENCY	PROGRAM
Pollution Control Agency	■ Develop standards and issue permits for municipal sewage and industrial waste treatment and discharge ■ Administer state and federal wastewater treatment plant construction grants ■ Regulate solid and hazardous waste storage and disposal ■ Monitor surface and ground water quality ■ Administer state and federal "superfund" laws
Department of Health	■ Monitor and analyze public water supplies ■ Approve treatment of contaminated public water supplies ■ Enforce water well construction and plumbing codes ■ Evaluate health risks associated with contaminated water supplies
Department of Agriculture	■ Administer erosion and sedimentation control programs (Soil and Water Conservation Board) ■ Monitor water used in dairy and food processing ■ Regulate pesticides and fertilizers
Department of Natural Resources	■ Issue water appropriation permits ■ Issue permits for works in protected waters ■ Inspect dams ■ Manage wetlands ■ Regulate shoreland development ■ Maintain fish and wildlife habitats ■ Monitor water quality of lakes
State Planning Agency/ Environmental Quality Board	■ Facilitate planning and coordination among agencies ■ Maintain data base and provide technical support to agencies ■ Responsible for comprehensive water planning
Water Resources Board	■ Establish watershed districts ■ Approve local water management plans ■ Resolve disputes involving water issues
Waste Management Board	■ Develop alternatives to land disposal of hazardous wastes
Minnesota Geological Survey	■ Conduct geological research to assist in water resource planning ■ Maintain ground water data base
Department of Transportation	■ Monitor water pollution from bridge or road construction ■ Regulate transportation of hazardous wastes

Figure 2.3, continued

AGENCY	PROGRAM
Department of Public Safety	■ Provide emergency water supplies ■ Hazardous Materials Team--disaster control
Counties	■ Regulate land use, floodplain, and shoreline development ■ Comprehensive local water resource planning ■ Manage solid waste disposal ■ Drainage
Municipalities	■ Provide and treat public water supplies ■ Manage sewage treatment and disposal
Metropolitan Council	■ Facilitate water resource planning in the metropolitan area ■ Devise and implement regional plan to control pollution
Metropolitan Waste Control Commission	■ Coordinate and manage regional sewage treatment and discharge
Watershed Districts	■ Manage projects to control flooding, conserve water, and protect or improve water quality
Watershed Management Organizations	■ Comprehensive local water planning in the metropolitan area
Soil and Water Conservation Districts	■ Distribute federal and state grants and provide assistance to local governments or residents for erosion and sedimentation control projects
Sanitary Districts	■ Coordinate and manage waste treatment and disposal
Rural Water User Districts	■ Provide and distribute water to communities
Lake Improvement Districts	■ Coordinate and manage lake improvement projects
Lake Conservation Districts	■ Regulate lake activities and conduct research to control pollution

a wide array of other state and local units of government play some role in the management of the state's water resources.

The federal government mostly sets standards and goals and provides funds for water quality programs, while state agencies enforce the federal standards. States have

primary responsibility for most issues related to water quantity. Local agencies are involved in specific water quantity and quality issues and usually receive funds from the state and federal governments.

Water issues are commonly separated into two areas: quantity and quality. One cannot draw a distinct line between the two areas since actions that affect water quantity also many times affect water quality. However, in general, DNR has primary responsibility for water quantity issues and PCA, MDH, MDA, and other agencies have responsibility for water quality issues.

As Figure 2.3 indicates, DNR runs programs to ensure that a sufficient quantity of water is available. DNR's programs relate to water quality, however, in that they regulate development along shorelines, regulate projects on rivers and streams, and protect lakes, wetlands, and other fish and wildlife habitats.

The Pollution Control Agency (PCA) and the Minnesota Department of Health (MDH) play the most significant roles in protecting the state's water quality. PCA regulates what goes into the water and cleans up cases of known contamination. MDH ensures that water consumed by the public is safe by testing public water supplies and enforcing the state's well code and plumbing code.

The Minnesota Department of Agriculture is responsible for enforcing state and federal requirements governing the use of fertilizers and pesticides. MDA also monitors water quality in some wells as part of its responsibility to regulate the production of dairy and manufactured food products. Finally, MDA administers, through the Soil and Water Conservation Board, several state and federal programs aimed at reducing soil erosion and sedimentation, two important sources of non-point pollution, and protecting water quality.

The Water Resources Board and the Environmental Quality Board (EQB) play coordinating roles in the state's management of water. The Water Resources Board approves the creation of watershed districts and local water management plans. It is also charged with resolving inter-agency disputes about water issues. The Environmental Quality Board is responsible for state comprehensive water planning and coordinating programs and policies of state agencies. We discuss EQB's role as a coordinating agency later in this chapter.

Other state agencies listed in Figure 2.3 play smaller roles in water resource management. The Waste Management Board was first set up to find a site for storing hazardous wastes. That search for a permanent site has been suspended indefinitely by the Legislature and the board is now trying to find alternatives to land disposal of solid and hazardous wastes. The Minnesota Department of Transportation is concerned with the impact of highway construction on water quality. The Department of Public Safety is responsible for providing water supplies during natural disasters or other emergencies and for protecting surface and ground water by coordinating the hazardous materials response team.

The Minnesota Geological Survey of the University of Minnesota conducts geologic research and maintains a ground water data base. Other University departments and affiliates, including the Water Resources Research Institute and the Natural Resources Research Institute, conduct research on a variety of water quantity and quality issues.

Minnesota's counties and municipalities have many responsibilities relating to water. Primarily, municipalities are responsible for providing safe drinking water supplies to

their residents and treating and discharging municipal sewage. Counties usually manage solid waste disposal and are also concerned with managing local water resources through comprehensive water planning and regulating land use practices which might affect water resources.

The Metropolitan Council coordinates some of these activities in the seven-county metropolitan area. The Metropolitan Waste Control Commission coordinates metro area sewage treatment and discharge. Minnesota has also created many special purpose districts to address specific local water-related issues. The districts may apply for state and federal grants to solve water-related problems and some of them have taxing and regulatory authority. These districts are described in greater detail in Appendix A.

2. Why Are There So Many Agencies?

Considering the many agencies involved in water issues, it is reasonable to ask whether they are all necessary or whether the organizational structure is efficient and effective. In fact, this question has been considered many times in Minnesota. A recent report notes at least 14 different reorganization studies or proposals relating to Minnesota water resource agencies since 1970.[13] And Minnesota is not alone in considering these questions. The proper organizational arrangement for water resource agencies has been an issue before many other state legislatures.

One of the reasons that many agencies are involved is that water issues are complex and far-reaching, affecting almost every citizen. Government agencies are concerned with ensuring an adequate supply (enough, but not too much) of quality water for a wide variety of uses. Consequently, agencies dealing with agriculture, health, public safety, natural resource management, pollution control, and recreation all have legitimate interests in water-related issues. The result, in both Minnesota and other states, is a complex interrelationship among different agencies at different levels of government.

Although many agencies are involved in Minnesota's water resource management, this does not mean there is no rationale for the current organizational structure. The major rationale for Minnesota's organizational approach is that separate agencies can advocate better for their specific areas of responsibility:

> The 'advocacy approach' favors a structure providing separate, visible advocates for key water management functions like pollution control, the safeguarding of public health, and natural resources management.[14]

Although the advocacy approach may prevent one agency or point of view from over-shadowing competing interests, it can have disadvantages as well. Agencies can work at cross purposes or subvert each other's efforts. Agencies may not be able to agree on solutions to problems. If such an approach results in an absence of communication and coordination, agencies may duplicate each other's activities or implement conflicting policies. Such a situation, besides being inefficient, can confuse the public and the local agencies that are affected by state programs and policies.

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[13]John Helland, *State Water Management: Reorganization and Consolidation*, House Research Information Brief (January 1986).

[14]Letter from Jack Ditmore, Deputy Director, State Planning Agency, to Representative Dennis Ozment (October 31, 1985), p. 1.

3. Other Organizational Approaches

There is an almost unlimited number of organizational possibilities for water resource issues. State governments' organization for water issues tends to vary on two dimensions: the degree to which authority is delegated to regional entities, and the number of state agencies involved.

Some states, like New Jersey, have a single state agency to deal with water resources. Other states, like Minnesota, have responsibility largely at the state level with multiple agencies sharing water management responsibilities. Still other states, such as Wisconsin and New York, have delegated significant responsibility to regions, either to regional organizations or to branches of state agencies.

Figure 2.4 shows various types of state organizations based on a 1982 study of 13 states' water management structures.[15] Although organizational structures can be categorized in this way, it is important to keep in mind that each state has developed its own unique way of handling water problems and deploying its resources. In most cases, the water management approach adopted by a state is the result of an interaction of a number of

FIGURE 2.4

STRUCTURE OF STATE WATER MANAGEMENT PROGRAMS

MANAGEMENT APPROACH	NUMBER OF STATE AGENCIES INVOLVED	
	Single Agency	Multiple Agencies
Statewide	Florida Georgia New Jersey	Minnesota Iowa
Regional	Wisconsin New York North Carolina	Arizona Kansas Nebraska South Carolina Virginia

Source: Adapted from *Regional and Statewide Water Management Alternatives*, Kendell and Breman, University of Georgia: Legislative Research Series (December 1982).

[15]James Kundell and Vicki Breman, *Regional and Statewide Water Management Alternatives*, University of Georgia Institute of Government (December 1982).

factors. These include specific water problems, the history of natural resource utilization, and the political environment at the time the organizational decisions were made.

The advantage of a regional approach to managing water-related programs is that it enables policies to meet the particular needs of each region. Minnesota's regions, for example, vary greatly in terms of geology, land use practices, water quantity, and water quality. A statewide approach, on the other hand, could utilize limited resources more efficiently and could provide a more consistent approach to the state's water problems.

The advantages of a single state agency managing water resources are the potential for: one-stop permitting, more efficient personnel utilization, and greater coordination. These are "potential" advantages because combining existing agencies into one large super-agency does not always result in the desired productivity gains. Indeed, it does not even necessarily result in greater coordination. Many critics of a central agency approach maintain that efficiency and coordination are not improved in super-agencies, which may be burdened by inter-divisional rivalries. The larger the bureaucracy, the greater the potential for confusion and conflicts over each unit's role. Decisions may not be made because of uncertainty about who is responsible. Also, there may be less accountability for decision making.

Fragmentation of responsibility is the major disadvantage of a multi-agency approach to organization. With so many agencies involved, fragmented responsibility creates the potential for uncoordinated agency actions that are less efficient and/or unnecessarily duplicative. In the next section of the report we examine to what extent these problems exist in Minnesota.

D. COORDINATION

1. Previous Studies

There have been several efforts to examine Minnesota's water resource organizational structure. The most comprehensive study was a 1979 Water Planning Board report.[16] The report noted that 16 state agencies and boards were administering 80 specific water-related programs.

According to the report, state agencies did not duplicate each other's efforts, that is, they were not conducting the same activities for the same purposes. However, the study identified eleven areas of overlapping authority, in:

- conflict resolution processes,
- coordination of water management,
- water and related land resource planning,
- protection of domestic supplies from degradation,

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[16] *Toward Efficient Allocation and Management: A Strategy to Preserve and Protect Water and Related Land Resources*, Minnesota Water Planning Board (June 1979).

- protection of available supplies during critical periods,
- collection of well logs,
- regulation of well abandonment,
- the interaction of the water pollution control programs with Public Waters Inventory and permitting programs,
- permitting of storm sewer systems,
- certification of dredge and fill operations, and
- provision of guidance to multi-purpose water management districts.[17]

The Water Planning Board's analysis indicated a need to acknowledge and to formalize relationships among state agencies involved in managing water. It also suggested that some means was necessary to identify relationships between agencies that need formalizing.

A more recent inquiry by a legislative committee came to similar conclusions. The committee was concerned about possible duplication of effort among water resource agencies. Duplication is a concern whenever more than one agency is involved in an issue area. In comments to the committee on organizational problems in the state's management of water resources, the State Planning Agency noted, "we did not find examples of duplication as much as inefficiencies, missed opportunities, and gaps."[18]

Every recent water organization study has recommended against the formation of a super water agency. The Water Planning Board reasoned that the current organizational structure could work if coordinated program management could be achieved where overlaps exist. The board recommended that a water coordinating body review agency programs and budgets and provide a forum for interagency coordination and cooperation. The board reasoned that a coordinating agency, combined with a more formalized recognition of the interrelationships between programs, could avoid the pitfalls of separate agencies.

A similar conclusion about the need for a super-agency was reached by a 1985 Citizens League review of state management of ground water issues.[19] The Citizens League concluded that, for the most part, the state's organization of ground water programs is arranged properly, and that merging state programs into a single agency would not necessarily lead to improved efficiency or effectiveness. The League found that greater coordination among agencies was needed and suggested that this function be assigned to the Environmental Quality Board.

The Citizens League did recommend the transfer of responsibility for regulating agricultural chemicals from the Minnesota Department of Agriculture (MDA) to the Pollution Control Agency (PCA). The League reasoned that because MDA promotes agriculture, it is incapable of effectively regulating it. However, the department's major responsibilities

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[17] *Ibid.*, p. 76.

[18] Ditmore, p. 2.

[19] *A Strategy for the Waterbelt*, Citizens League (November 1985).

are regulatory in nature. Besides regulating agricultural chemical use, it regulates dairy and livestock production, food processing and retailing, grain production and storage, and other facets of agricultural production.

It is true, as we point out in Chapter 5, that MDA has not monitored ground water for pesticide contamination until recently . However, neither has PCA nor any other Minnesota agency. MDA is requesting additional appropriations and statutory changes from the 1987 Legislature to strengthen its regulatory program and implement a pesticide monitoring program.

- We see no compelling reason at this time to shift responsibility for regulating agricultural chemicals from MDA to PCA.

2. Current Coordination Efforts

The Water Planning Board report, among others, pointed out the difficulties associated with Minnesota's organization for water resource programs. The two central organizational findings of the report were the need for a central coordinating body, and the need for greater coordination in management of related programs. In this section, we examine what has occurred in the seven years since the report.

a. *Environmental Quality Board*

The 1976 drought prompted the Minnesota Legislature to create the Water Planning Board. The board served as a focal point for Minnesota water policy during its 1977-1983 existence. When the Water Planning Board was phased out in 1983, the responsibility for overall coordination of state water policy was assigned to the Environmental Quality Board (EQB).[20]

A review of EQB's minutes and interviews with board personnel reveal that very little was done with this responsibility between 1983 and November 1985. At that time, the Environmental Quality Board established a Water Resources Committee to carry out these responsibilities. The committee is made up of two citizen members of EQB and deputy or assistant commissioners of the state departments involved with water policy.

Since November 1985, the Water Resources Committee has completed a number of policy reviews and coordinating activities. Some examples are review and assessment of the 1979 and 1983 framework water plans, development of a 1987-1989 Priorities Report for water issues, review of water-related Governor's Issue Team Reports, and a review of water-related budget and legislative initiative proposals. We consider the activities of the Water Resources Committee during the last year a positive contribution to coordination among state agencies. We conclude:

- EQB's Water Resources Committee is fulfilling the role envisioned by the Water Planning Board in coordinating and integrating state water policies.

Efforts such as those by the Water Resources Committee serve to keep agencies responsible for the state's water resources continually informed about each other's activities. EQB

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[20]Minn. Stat. §116C.40.

has been able to shape a water policy agenda and priority list for the state. This EQB effort has served to spur agencies into negotiating more inter-agency agreements, and making responsibilities for various issues clearer. Since the committee's activities have been so positive, we recommend that:

- The Legislature should make the Water Resources Committee's role explicit in statute and should require a biennial comprehensive water plan to be submitted to the Governor and the Legislature.

Such a requirement would help to institutionalize the role of the Water Resources Committee and to assure a continuing focus for the coordination of state water policy.

b. Inter-Agency Coordination

The second major organizational concern cited by the Water Planning Board was inter-agency coordination. To assess how much coordination there was among state agencies, we asked PCA, DNR, MDH, and MDA to provide a list of all formal and informal agreements they had with each other and with other state agencies. Figure 2.5 presents a summary of their responses. In addition, at least six more agreements are planned between PCA and DNR.

Figure 2.5 presents a picture of fairly extensive coordination and cooperation in the management of state water programs. Some of the agreements involve one agency, with superior resources or expertise, performing a service for another agency, on either a contractual or an informal basis. For example, PCA contracts with MDH for laboratory analysis of water samples. Other agreements define agency responsibilities to avoid service gaps and duplication and promote inter-agency communication.

In 1979, the Water Planning Board noted eleven water policy areas where overlap of authority existed, and it suggested these areas needed special efforts at coordination. Our review of these areas reveals that in the intervening seven years many have been addressed by inter-agency agreements or cooperative agreements between agencies. However, little has been done to coordinate protection of available supplies during critical periods. State agencies are also just beginning to address coordination in three areas noted in the report: pesticide contamination, non-point source pollution, and a comprehensive lake management program.

As we suggest later in the report, we believe PCA, MDH, and MDA need to develop a formal agreement setting out their respective responsibilities for pesticide contamination monitoring. Additionally, PCA and DNR need to develop agreements on lake management. Progress has been made by a 13 agency task force on non-point source pollution; however, additional inter-agency agreements will be needed.

In addition to the many interagency agreements listed in Figure 2.5, there are many similar agreements between state and federal agencies and between state agencies and local units of government. While there are already many of these agreements, we believe:

- State agencies should continue to study ways of coordinating their duties with other agencies through additional formal agreements.

We believe the Water Resources Committee is a good forum for coordinating inter-agency agreement development. We asked state staff about the level of communication and coordination among agencies. In general, they responded that coordination was good and that it

FIGURE 2.5

FORMAL AND INFORMAL COORDINATION AMONG MINNESOTA STATE AGENCIES RELATING TO WATER RESOURCES

MULTI-AGENCY COMMITTEES AND AGREEMENTS:

- Environmental Quality Board Water Resources Committee*
- Soil and Water Conservation Board*
- Hazardous Material Emergency Response Team*
- Nonpoint Source Issues Team*
- Information management (ground water, underground tanks, solid and hazardous waste, site investigation)*
- Fish and wildlife residue committee
- State Planning Agency task force on local water planning
- MDH well water advisory council
- PCA on-site sewage task force
- PCA solid waste task force
- System for Water Information Management user committee
- Interagency ground water issues team
- Interagency Water Resources issue team
- Committee on state agencies' hazardous wastes
- Minnesota River work group on nonpoint source pollution
- State Planning Agency task force on wetlands evaluation

PCA WITH MINNESOTA DEPARTMENT OF HEALTH (MDH):

- Basic agreement delineating agency responsibilities, laboratory services and exchange of information*
- MDH review of on-site sewer systems*
- Analysis of private wells near hazardous waste sites*
- Pesticide monitoring study (PCA reimbursement of MDH from Environmental Protection Agency funds)*
- PCA notifying MDH of significant spills
- Interagency toxics committee to develop recommended drinking water standards
- MDH provides health risk assessments to PCA
- MDH reviews wastewater treatment and solid waste permits applications
- MDH assists with superfund investigations
- Well inspection and abandonment projects
- Joint council for certification of water and wastewater operators
- MDH provides down-hole camera services to PCA
- Review of proposed rules
- MDH coordinates with PCA on the placement of monitoring wells

PCA WITH DEPARTMENT OF NATURAL RESOURCES (DNR):

- General cooperative agreement establishing coordination procedures*
- PCA pays DNR for ten fish surveys*
- PCA reviews DNR shoreline management*
- PCA reviews public works permits*
- Coordinated lake management policy
- Services to several PCA projects under federal Clean Lakes Program*
- Permits associated with ground water contamination cleanups*
- Joint reports on ground water quality and quantity
- Legislative Commission on Minnesota Resources funded study of geophysics applications to ground water contamination
- Examination of fish and wildlife kills
- PCA review of water appropriation permits
- Mining reclamation coordination

PCA WITH MINNESOTA DEPARTMENT OF AGRICULTURE (MDA):

- Above ground storage of fertilizers and pesticides and investigation of spills*

PCA WITH STATE PLANNING AGENCY:

- Data storage and coordination with the Land Management Information Center
- Nonpoint source problem assessment*

PCA WITH ENVIRONMENTAL QUALITY BOARD:

- Environmental assessment worksheets for wastewater treatment projects*
- Environmental assessment worksheets for out-state landfills

PCA WITH WATER RESOURCES BOARD:

- Metro area surface water management plans

PCA WITH DEPARTMENT OF ENERGY AND ECONOMIC DEVELOPMENT:

- Allocation of state wastewater grants to communities with economic development*
- Assistance with identification of supplemental funding

PCA WITH UNIVERSITY OF MINNESOTA EXTENSION SERVICE:

- Coordination, cooperation and communication procedures*
- Integration of water quality issues into extension programs*

MDH WITH MDA:

- Legislative Commission on Minnesota Resources funded pesticide project*
- Well code enforcement on dairy farms
- Exchange of laboratory services and methods
- MDH provides health risk information to MDA
- MDH inspects dairy wells on request
- MDH cooperates with MDA on bottled water program
- MDH collects water samples at meat packing plants
- Development of dairy well specifications

MDH WITH DNR:

- MDH provides health risk information to DNR
- Assistance with well abandonment on DNR property
- Cooperation on irrigation wells
- Collection of well water samples
- Engineering review of water supply and waste disposal at DNR facilities
- Sharing information on water supply, ground water movement, contamination, etc.
- Exploratory boring program

MDH WITH DEPARTMENT OF TRANSPORTATION (DOT):

- MDH laboratory analysis of DOT water samples*
- Sampling of drinking water at highway rest areas*
- MDH provides health risk information to DOT
- Well abandonment along new highway rights-of-way
- Review of plans for water supply and waste disposal at DOT facilities
- DOT provides surplus equipment, repairs MDH motorized equipment
- Exchange of hydrologic and geologic data

MDA WITH DNR:

- Data analysis of ground water samples*
- Pesticide enforcement as related to ground water resources*
- Management of private forest lands*
- Sharing of monitoring well network

MDA WITH DOT:

- Exchange of services relating to projects involving water resources*

DNR WITH MINNESOTA GEOLOGICAL SURVEY:

- Maintenance of U.S. Geological Survey topographic map files*
- Ground water data exchange

Source: Program Evaluation Division survey of state agencies.

*Formal agreements or contracts.

had improved from several years ago. Agencies can usually rely on each other to provide assistance on specific issues or concerns.

EQB recently completed a review of progress made since the 1979 Water Planning Board report.[21] It found that approximately three-quarters of the concerns expressed by the Water Planning Board had been addressed. As to overlap of organizational authority, EQB notes that progress has been made by merging the Water Planning Board and the Southern Minnesota River Basin Board into EQB. EQB also is recommending to the 1987 Legislature that the Soil and Water Conservation Board, the Southern Minnesota River Basin Council, and the Water Resources Board be merged. The review further notes that coordination and communication among agencies has been good, as evidenced by agencies cooperating on issue teams and committees. The EQB review confirms our observations about the current level of coordination of water programs.

In summary, agency cooperation, communication, and coordination of like programs has increased since the 1979 Water Planning Board report. Earlier we noted that the major disadvantage of Minnesota's form of water organization was the potential for duplication and conflict. Based on the current efforts we see, and the progress that has been made in coordinating activities in the last seven years, we conclude:

- Minnesota has overcome many of the disadvantages of its current form of water organization. We do not see the need for major changes to the organization of water agencies at this time.

Despite the improvement in recent years, there remain a number of areas that have continued to be problems. We discuss some of these in the next section.

3. Current Gaps

a. *State Planning Agency View*

Overall, inter-agency coordination and cooperation among agencies is generally good, but some areas of fragmentation still exist. The State Planning Agency cited a number of missed opportunities and gaps in the Fall of 1985:

- Failure to develop a mechanism to coordinate quality and quantity concerns as they pertain to specific problems.

- Failure to integrate ground and surface water management.

- Difficulty for local governments to integrate programs dealing with land use, soil erosion, solid waste management, community health planning, and comprehensive local water management, because administrative responsibilities are divided among several state agencies.

- Failure to take comprehensive approaches to problems such as flood damage reduction and soil erosion control.

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[21] *'79 Framework Water Plan and '83-'85 Priority Recommendations Implementation Status*, Minnesota Environmental Quality Board (1986), p. i.

- Absence of an integrated stream-oriented information system that ties together water and related land use data collected by state and federal agencies.

- Lack of a coordinated, comprehensive strategy to manage lakes, including shoreland management, public access, fisheries management, water quality monitoring, lake restoration, non-point source pollution control, and so on.

- Absence of a coordinated effort to address shortages in funding and establish funding priorities for water issues.[22]

In the last year the State Planning Agency and the Water Resources Committee have also cited a need for improved coordination and for a statewide plan for ground water monitoring, data collection and interpretation.[23] So, while we believe that progress has been made in the last year, these are still areas of opportunity for the state to improve water management.

b. *Local Water Management*

One area requiring greater coordination is the integration of state programs with local government efforts to deal with specific pollution problems. It has been recognized for years that specific water quality and quantity issues can best be addressed at the local level.

Minnesota has encouraged local government efforts with the passage of the Metropolitan Surface Water Management Act in 1982 and the Comprehensive Local Water Management Act in 1985.[24] These laws require the establishment of local water management plans in the seven-county metropolitan area and permits outstate counties or other governmental units to do the same.

A number of problems will be faced in implementing the local plans. The first is a lack of funds. The authorizing legislation provided no funds for local units to do the necessary planning. As a result, a number of proposals were submitted to the LCMR for funding, and LCMR recommended funding for eight to the 1987 Legislature. However, a longer term method for funding development and implementation of local plans is needed.

If the Comprehensive Local Water Management Act is not implemented, a second problem could be deciding on the appropriate governmental unit to do the local planning. Without guidance, it is likely that a number of different, and sometimes overlapping, governmental units will be doing local water planning. For example, LCMR received proposals from groups of counties, joint powers agencies, and watershed districts. The Water Planning Board recommended in 1983 that counties were the appropriate unit to handle local water planning.

A third problem area is how to coordinate and integrate water data collection. The information needed by state and local planners is often not automated and is maintained

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[22]Ditmore, p. 2.

[23]See *Manufactured Chemicals and Ground Water Quality*, State Planning Agency (January 1987).

[24]Minn. Stat. §473.875-473.883; Minn. Stat. Chap. 110B.

in separate data bases of many state agencies. Because sharing data with other agencies does not offer a direct payback to agencies, funds to automate and integrate water information are often not appropriated by the Legislature or are reallocated to other uses by state agencies. For the local water planning funded through the LCMR, the State Planning Agency's Planning Information Center is to provide a central point for access to state data. Despite this effort, fragmented state data on water issues remains a real impediment to local and state planning efforts.

D. SUMMARY

Minnesota has made progress in the 1980's toward remedying some of the real and potential problems inherent in its organizational approach to water issues. Recently state agencies have defined their responsibilities more clearly and undertaken more cooperative approaches to problem resolution. The progress made to date is evidence that the current organizational structure can work. Therefore, we do not recommend major changes in organizational structure.

Nonetheless, a number of areas need to be addressed cooperatively by agencies involved in state water policy. Among these issues are: non-point source pollution, pesticide contamination, water shortage policy, lake management policy, local water planning assistance, and data collection and management.

We also think there needs to be a strong inter-agency coordinating body for water policy issues. We believe EQB's Water Resources Committee can fill this role for the state.

MINNESOTA DEPARTMENT OF HEALTH

Chapter 3

A. INTRODUCTION

The Minnesota Department of Health (MDH) is responsible for monitoring health-related aspects of water quality. Most of the department's water quality monitoring is for the purpose of enforcing the federal Safe Drinking Water Act that MDH administers for the U.S. Environmental Protection Agency (EPA).

EPA has delegated responsibility for the federal act's enforcement to MDH. To qualify for federal funding, Minnesota had to adopt statutory provisions at least as strict as the federal standards, which it did in the 1977 Minnesota Safe Drinking Water Act.[1] Because of its delegation agreement with EPA, Minnesota's enforcement of the Safe Drinking Water Act is largely guided by federal standards.

MDH has four monitoring functions directly related to water quality: monitoring community water supplies, monitoring non-community water supplies, monitoring provisions of the well code, and conducting special monitoring studies. MDH also has other responsibilities that relate to water quality, such as enforcement of the plumbing code and certification of public water supply system operators.

We examined MDH programs to answer the general question:

- How well is MDH monitoring the drinking water supplies of the state?

Specifically, we examined how well MDH is carrying out its responsibilities under the state statutes and rules implementing the federal Safe Drinking Water Act. We also considered the effects of the new amendments to the Safe Drinking Water Act and how the department is responding to health threats not currently regulated by EPA. We were especially interested in how well the state has carried out water quality monitoring of community and non-community water supplies. The scope of our review was limited largely to the monitoring functions performed by the department's Public Water Supply and Engineering Section.

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[1]Minn. Stat. §144.381.

B. ORGANIZATION

MDH responsibilities for water-related health questions are handled administratively in the Division of Environmental Health. As shown in Figure 3.1, the water quality monitoring activities of the department are the responsibility of the Water Supply and Engineering Section of this division.

The Water Supply and Engineering Section is organized into five parts:

- Administration - 3 staff
- Ground Water Quality - 4 staff
- Plumbing - 5 staff
- Public Water Supply Engineering - 5 staff and 2 part-time
- Special Services - 3 staff and 2 temporary

In addition, the section oversees some field operations of other parts of the division. Thirteen sanitarians in the Environmental Field Services Section devote one-quarter of their time and seven district engineers spend all of their time on water-related activities. Five sanitarians also spend half of their time on well code enforcement.

Two other sections in the Division of Environmental Health are also involved with water-related problems. The Health Risk Assessment Section evaluates health risk associated with various contaminants, including those found in water. The Community Environmental Services Section provides consultative services to local governments involved with the Community Health Services Act. Approximately half of a full-time position is devoted to water-related questions.

The cost of the MDH program is partially borne by a grant from the federal government. Table 3.1 shows the program's funding for the last three federal fiscal years.

C. COMMUNITY WATER SUPPLIES

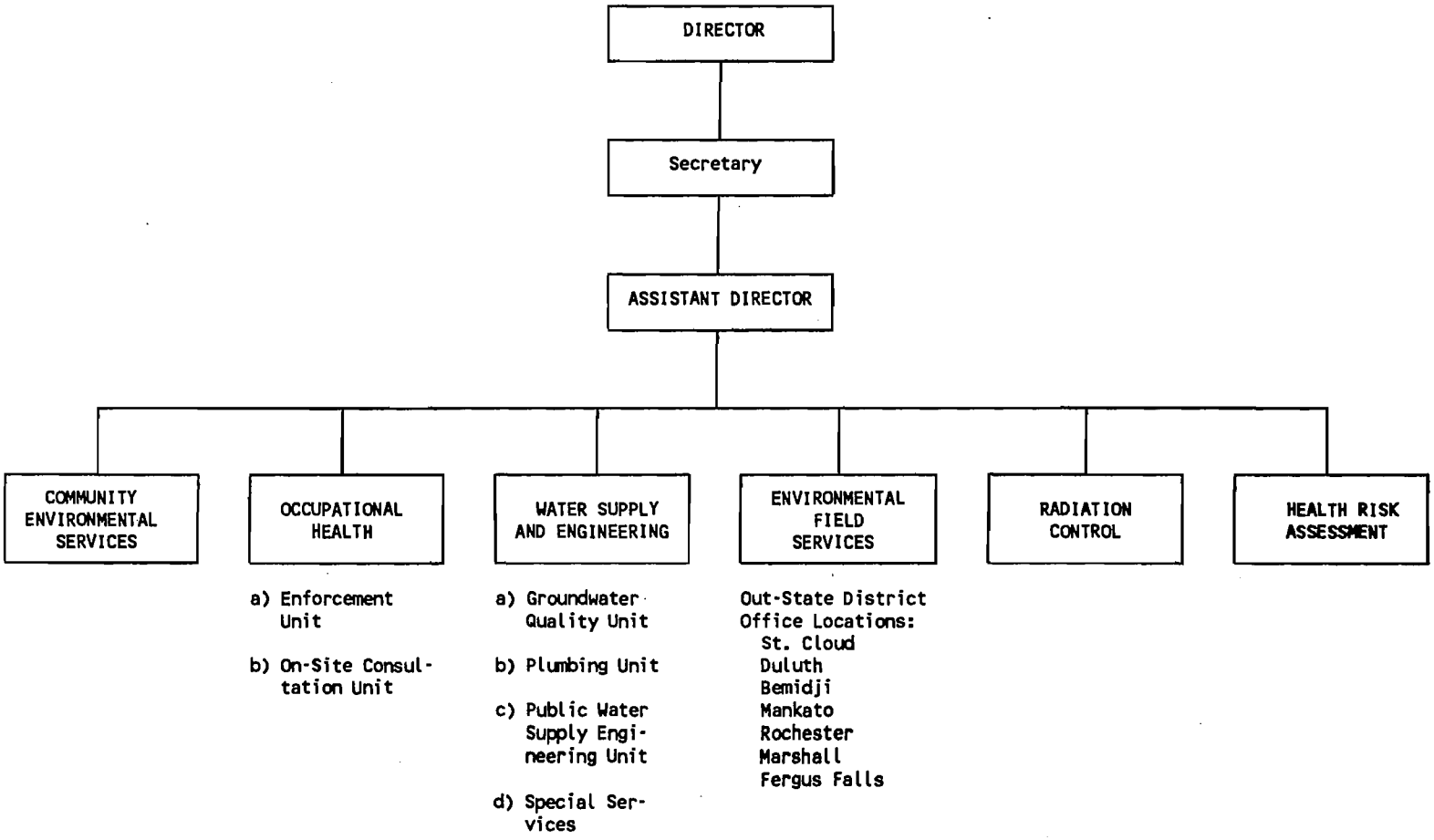
1. Public, Private, Community, and Non-community Water Supplies

The Safe Drinking Water Act makes a distinction between public and private water supplies: public water supplies are regulated under the act, but private supplies are not.

The state well code requires the only state monitoring of private wells that occurs in Minnesota. MDH will test private wells only if there is a potential health risk and if requested by a physician or local official. However, a few counties do regulate and monitor private wells and most counties (approximately 70) will test wells for bacteria if requested. Evidence suggests that many private wells are contaminated, so it is noteworthy that private wells serving approximately one million Minnesotans are not tested.

FIGURE 3.1

MINNESOTA DEPARTMENT OF HEALTH
DIVISION OF ENVIRONMENTAL HEALTH



Source: Department of Health.

TABLE 3.1

FUNDING FOR MINNESOTA'S SAFE DRINKING WATER PROGRAM

Federal Fiscal Years 1985-1987

	Federal Fiscal Year		
	1985	1986	1987
Federal	$ 599,000	$ 659,100	$ 640,800
State	450,843	510,067	556,237
Total	$1,049,843	$1,169,167	$1,197,037

Source: MDH Reports to EPA, 1984, 1985, 1986.

By definition, a public water supply serves more than 25 people or 15 service connections daily for more than 60 days per year. Water supplies serving fewer than 25 persons are not regulated by the state.

There are two types of public water supplies: community and non-community. Community public water supplies are those that serve more than 25 people or 15 service connections year-round.[2] Non-community water supplies (discussed in the next section) are public water supplies that serve less than year-round residents or transients.

There are approximately 1,000 community public water supplies in Minnesota, of which approximately 700 are municipalities and 300 are maintained by developers or institutions.[3] Figure 3.2 summarizes the monitoring of water supplies by the department.

2. Monitoring Requirements for Community Water Supplies

The Safe Drinking Water Act requires the state, and community water suppliers, to monitor water for 21 different parameters or measures of water quality. These include:

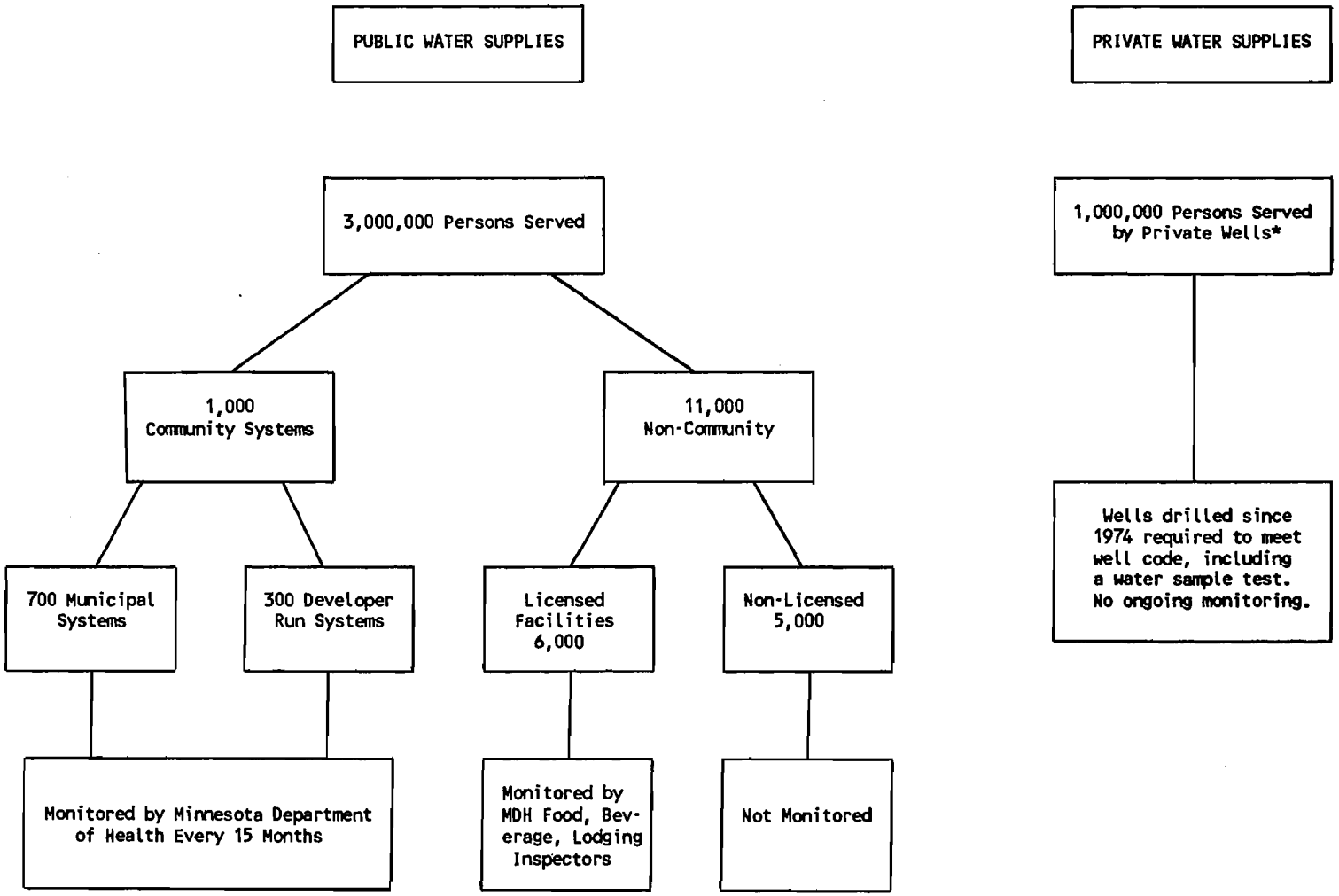
- microbiological contaminants;
- turbidity;
- inorganic chemicals, such as: arsenic, barium, cadmium, chromium, fluoride, lead, mercury, nitrate as nitrogen, selenium, and silver;

[2]See MCAR §4720.0100 et. seq.

[3]Most commonly these other community public water supplies are for developments like mobile home parks.

FIGURE 3.2

DRINKING WATER SUPPLY IN MINNESOTA



*Persons served by private wells also use non-community public water supplies.

- organic chemicals, such as: chlorinated hydrocarbons and trihalomethanes; and
- radiological contaminants.

Under the law, it is the responsibility of the owner of the water supply to test the water quality. MDH monitors the owner's compliance with testing requirements and also conducts further tests itself on a schedule approved by EPA.

MDH approves laboratories around the state to test water supplies for coliform bacteria and turbidity. If an approved laboratory is not available, a sample is sent to the MDH lab. Samples to be tested for the other contaminants are gathered by department personnel during their periodic inspections.

How often water is tested is established in state rule and depends on the compound tested for and the size of the community. For example, turbidity samples are required daily, and coliform bacteria tests are required between 1 and 500 times per month depending on the number of people served by the supply.[4] The presence of inorganic contaminants must be tested once per year for systems using surface water, and once every three years for systems using ground water. Organic compounds must be monitored at least every three years for supplies utilizing surface water. Minnesota rules require testing for organic chemicals in community supplies using ground water at the discretion of the Commissioner of Health. Any community serving over 10,000 people and using a disinfectant in the treatment process must monitor for trihalomethanes on a quarterly basis, unless a variance is obtained from MDH.

Drinking water supplies are monitored most frequently for bacteriological contamination because bacteria pose a direct and immediate public health threat. Public water supplies collect the routine water samples and have them analyzed at labs certified by MDH. Some of the water utilities have their own labs and some rely on private labs to analyze the water samples. Any violation of safe drinking water standards must be reported to MDH.

In addition to requiring the submission of water samples, MDH periodically conducts sanitary surveys of the water suppliers. During these surveys, MDH personnel take water samples for analysis at the MDH lab and also inspect the water supply system for compliance with water supply construction and operation criteria.

The surveys are carried out by 13 sanitarians and seven engineers located throughout the state. The sanitarians also conduct food, beverage, and lodging and other inspections for the department. Approximately 25 percent of sanitarians' time and all of the seven district engineers' time is spent on surveys and associated work with public water supplies. Table 3.2 shows the number of surveys conducted in each of the last three federal fiscal years. Approximately 80 surveys are conducted per full-time equivalent position. EPA staffing guidelines call for approximately 57 surveys per year for each full-time equivalent position.[5]

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[4]For example, the Minneapolis water supply, serving approximately 480,000 people, is required by rule to test at least 210 times per month.

[5]*Manpower Needs - Local Health Units, Water Supply Unit*, EPA Staffing Requirements Guidance Document (December 20, 1983).

TABLE 3.2

SANITARY SURVEYS CONDUCTED
PURSUANT TO SAFE DRINKING WATER ACT

	Inspections in Federal Fiscal Year			
	1984	1985	1986	Total Number of Systems
Community Systems	790	790	780	984
Non-Community Systems	1,730	3,545	2,453	10,973

Source: MDH Reports to EPA, 1984, 1985, 1986.

3. Enforcement of Monitoring Requirements

We examined a sample of 50 community public water supplies to determine compliance with state and federal rules and department policy. We found that:

- MDH does not test community supplies as often as called for in state rule and department policy. On average, sanitary surveys of community water supplies were conducted once every 16 months.

MDH managers have scheduled inspections once every five quarters rather than once per year because of personnel constraints. The department has received EPA's approval for the schedule, but has not changed the policy requiring more frequent testing.

The Safe Drinking Water Act and state rules require community water suppliers to test for inorganic contaminants once every three years. MDH conducts these tests for the suppliers. MDH's policy is to test for inorganics once every 3.75 years, and we found that, on average, MDH keeps to this policy.

- MDH follows its own policy of inspecting and sampling public community water supplies for inorganic contaminants, but state administrative rules call for more frequent sampling.

We found that inspections sometimes are postponed from one quarter to the next because of workload constraints. When this occurs, the field staff are supposed to reschedule the inspections in the next quarter. In several instances, we could find no evidence that inspections were rescheduled. We attribute this to the fact that sometimes more than six months elapse before the central office receives field staff reports. Thus, the central office cannot ensure that scheduled inspections, if delayed, are actually conducted, and that inorganics are sampled. We conclude:

- MDH should examine its scheduling system for sanitary surveys to ensure that water supplies are inspected on a periodic basis as required by department policy.

The Safe Drinking Water Act and state rules also require that utilities test water periodically for six organic chemicals (all pesticides now banned by EPA). MDH stopped testing for these chemicals in the early 1980's after none were found in Minnesota water supplies. While this is a reasonable response on the part of MDH, the department should change the state rule to conform with its current practice.

In the same vein, there are many community water supplies that do not appear to be especially vulnerable to contamination by inorganic compounds. The most cost-effective approach to monitoring is to test for contaminants on a frequency that is related to the likelihood of finding the contaminant. We believe that MDH should adopt a "risk-based" approach to sampling and monitoring drinking water supplies. Such an approach would entail an initial survey of all water supplies to test for the presence of contaminants. The department could then establish a schedule for resampling and monitoring that is based on the presence and level at which contaminants have been detected. Since Minnesota has been testing for inorganics for some time, MDH already has the basis to establish such a scheduling pattern for those contaminants.

The health department generally agrees that such a practice would be desirable. However, such a risk-based approach would mean that public water supplies would have water tests conducted at different intervals, and the current process of billing for water testing does not allow for variable lengths of time between tests. MDH's current procedure is to bill a fixed amount every 45 months, in three installments, for water chemistry tests. MDH uses this procedure because its lab cannot currently report the actual tests performed for a community or the costs of the tests.[6] We recommend that:

- MDH should change its billing practices and institute a risk-based approach to sampling for the chemicals currently regulated under the Safe Drinking Water Act.

A risk-based approach would cut the department's costs because, on average, inspections would be conducted less frequently. This approach would also reduce the costs to the community water suppliers that pay the bills for the analytical work done by the department.

Implementing this recommendation would mean a change in the way the lab reports the results of tests. However, the lab will have to do this anyway, as requirements of the amendments to the Safe Drinking Water Act are phased in between now and 1990. Thus, we recommend:

- MDH should change its procedure for accounting for the costs of laboratory tests.

As we mentioned earlier, in addition to the department's tests, community water suppliers must continually test their water for bacteria. The results of these tests are sent to MDH monthly or quarterly, depending on the size of the supplier. MDH examines the community suppliers' ongoing tests for compliance with federal and state rules.

Minnesota has significantly improved its monitoring of bacteriological violations by community water suppliers in the last two years. Prior to 1984, as many as 96 Minnesota

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[6]MDH currently has five different charges to water suppliers, ranging from $487 to $2,670 based on the approximate number of tests that are supposed to be performed during the 45-month period.

communities were persistent violators of the monitoring requirements. In 1984, EPA requested that Minnesota reduce violations of bacteriological monitoring and reporting requirements. Minnesota has accomplished this goal and currently has one of the lowest violation rates in the country, largely due to the adoption of a new system of following up on violations. Table 3.3 shows the number of violators of the standards over the last several years.

TABLE 3.3

MINNESOTA'S COMPLIANCE WITH SAFE DRINKING WATER ACT
MICROBIOLOGICAL REGULATIONS BY COMMUNITY WATER SUPPLIES

Federal Fiscal Years 1982-1986

	1982	1983	1984	1985	1986
Number of Community Water Supplies	988	988	987	999	1,000
Maximum Contaminant Level (MCL) Violators	13	12	11	12	16
Percent Compliance with MCL	98.7%	98.8%	98.9%	98.8%	98.4%
Monitoring and Reporting Violations	274	287	267	99	60
Percent Compliance	72.3%	71.0%	72.9%	90.2%	94.0%
Persistent Violators	90	96	80	5	0
Percent Persistent Violators	9.1%	9.7%	8.1%	.05%	0%

Source: Environmental Protection Agency reports.

Based on this information, plus our review of files and discussions with other interested parties, we conclude:

- Minnesota has done a good job of ensuring that public community water supplies meet existing standards.

Moreover, Minnesota has taken the lead in monitoring for one currently unregulated group of contaminants -- the volatile organics. With the help of funding from the Legislative Commission on Minnesota Resources (LCMR), the department has been in the forefront nationally in testing for volatile organic contaminants. Volatile organic chemicals (VOCs) are used in a wide variety of industrial and commercial products such as paint thinners, cleaners, degreasers, preservatives, detergents, shampoos, and some pesticides. Many VOCs are suspected or known carcinogens or mutagens and present potential health risks at very low exposure levels.

In the LCMR-sponsored study, approximately eight percent of the 887 community systems tested were found to contain VOCs. Remedial actions were necessary in 15 communities, where wells were either treated or taken out of service.[7] Since this study's completion in June 1985, MDH has continued to monitor selected community water supplies for VOC contamination. All other states will have to complete VOC surveys and begin monitoring as the result of the 1986 amendments to the Safe Drinking Water Act.

Although MDH has been active in testing for volatile organic chemicals, there are a number of other potential contaminants that the department has not yet begun to monitor. MDH has no ongoing monitoring program for pesticides, although there is a current research study. Neither has there been any research or monitoring of pesticide breakdown products in drinking water. Additionally, MDH has not monitored a whole class of water supplies -- the unlicensed non-community water supplies. In the next section, we discuss MDH's monitoring of non-community water supplies.

D. NON-COMMUNITY WATER SUPPLIES

Minnesota has more non-community water supplies than most states. The upper midwest states seem to have more non-community water supplies because of the ready availability of good quality water.[8] Of the 153,000 non-community supplies nationwide, approximately 11,000 (7.2 percent) are in Minnesota. Examples of non-community water supplies include: seasonal facilities (such as children's camps, recreational camping areas, and resorts), and year-round facilities which serve at least 25 nonresidents (such as churches, entertainment facilities, factories, gas stations, marinas, migrant labor camps, office buildings, parks, restaurants, and schools).

As a result of the relative abundance of these systems in Minnesota, monitoring water quality in non-community supplies is important.

1. Monitoring Requirements for Non-Community Supplies

Minnesota and federal rules mandate that owners of non-community water supplies test quarterly for bacteria, and at least once every five years for nitrates.[9] Non-community suppliers that use surface water as a source must also sample for turbidity once per day. These rules pertain to owners of all 11,000 non-community supplies in the state.

Of the 11,000 non-community supplies in Minnesota, approximately 6,000 are licensed under the state food, beverage, and lodging laws and are inspected by MDH sanitarians. The

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[7]*Volatile Organic Survey of Community Water Supplies: Report to the Legislative Commission on Minnesota Resources*, Minnesota Department of Health (July 1985).

[8]For example, Wisconsin has between 13,000 and 14,000 non-community systems and Michigan has over 10,000 systems.

[9]MCAR §4720.12 et. seq. Minnesota rules allow the commissioner to set a different testing frequency; non-community ground water system testing frequency has been set at once per year.

Environmental Field Services Section conducts the inspections, which include water chemistry tests, and coordinates with the Public Water Supply Section.

There are approximately 5,000 unlicensed non-community public water supplies in the state. The exact number of non-community supplies is unknown because MDH has not updated its list of non-community supplies since 1978.

2. Compliance With Non-Community Monitoring Requirements

Water quality regulations noted above apply equally to licensed and unlicensed non-community facilities, but MDH does not inspect unlicensed suppliers. Most of the 5,000 unlicensed non-community suppliers are facilities such as factories, schools, churches, retail operations, and gas stations. A consultant to the Environmental Protection Agency found in 1985 that : "Minnesota hardly has any on-going activities in non-licensed, non-community systems."[10]

Minnesota does regulate newly drilled wells, including those of non-community public water supplies. Consequently, any non-community sources with wells drilled since 1974 have had the water tested at least once when the well went into service. However:

- Unlicensed non-community facilities with wells constructed before 1974 may never have had their water tested.

EPA's consultant estimated that : "More than 95 percent of the 5,000 non-licensed systems have never been inspected."[11]

- Licensed facilities also test water less frequently than called for in state rules and department policy.

According to state and federal drinking water regulations, non-community facilities are supposed to monitor water either quarterly or annually for bacteria. Water is actually tested only in licensed facilities when sanitarians inspect them. Because of personnel restrictions, MDH inspects only about 1,000 to 1,200 of the 3,200 licensed non-community facilities under MDH jurisdiction each year, and this includes reinspections of facilities that previously had problems.[12] So although Minnesota's food, beverage, and lodging law requires inspections of facilities once every year, they are currently being inspected between two and three years apart. In short:

- MDH is not inspecting licensed non-community facilities as often as called for in either the drinking water rules or the food, beverage, and lodging licensing law.

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[10]*The Non-Community Water System in the State of Minnesota*, Wade Miller Associates, Inc., Arlington, Va. (October 28, 1985), p. 1.

[11]*Ibid.*, p. 7.

[12]Approximately 2,800 of the 6,000 licensed non-community facilities are inspected by local health departments under delegation agreements with MDH.

The Department of Health's strategy has been to concentrate its resources on water supplies to which the public is most exposed. Thus, most of the department's resources have been focused on public community water supplies and on restaurants and other non-community facilities licensed by the department. The department also has tried to prevent problems through review of plans for new public water systems and wells.

Although this is not unreasonable, it does leave out a class of facilities that citizens of the state may use continually. A number of large employers, factories, and schools use non-community water supplies that are not covered by the department's strategy. Given the department's strategy to focus on systems with higher long-term usage, these non-community systems should be covered.

How great is the potential health threat from unlicensed non-community public water supplies? There is no good way to estimate the problem's seriousness because these supplies are not surveyed or monitored nor is the number of people served known. No estimates currently exist of the extent of VOC contamination of non-community supplies. However, some estimates of bacteria and nitrate problems can be made.

One might hypothesize that the level of contamination would be comparable to that found in newly drilled wells. As we discuss elsewhere in the report, newly drilled wells have nitrate and/or bacteria water chemistry results exceeding standards approximately 30 percent of the time.

Another estimate of the problem can be gained from the results of testing on licensed non-community supplies by the Environmental Field Services section of the department. These tests found problems with bacteria or nitrates in the water supplies 8.7 percent of the time in 1982 and 6.1 percent of the time in 1983. However, this is undoubtedly a low estimate of the problem because these wells have been tested by the department on an ongoing basis for a long time. Thus, many of the problem supplies have been dealt with already.

A third estimate of the problem can be obtained from those counties that test some of their non-community supplies. The department has delegation agreements with 10 different government units to test their own non-community supplies. Olmsted County has one of the more active programs, testing non-community supplies annually. Olmsted County estimates that approximately 40 percent of the supplies test positive for nitrates and 20 percent test positive for coliform bacteria. Applying these results on a statewide basis, however, would result in too high an estimate, because southeastern Minnesota's unique geologic character makes it especially vulnerable to contamination.

Taken together, these three estimates indicate that non-community systems are probably more vulnerable than community systems to contamination. Non-community supplies tend to be older, less well maintained, and more often operated by untrained personnel than community systems.

These observations coincide with the findings from Wisconsin, which has completely inventoried its 13,000 non-community systems and tested them for nitrates. Wisconsin found that between two and three percent of the non-community supplies tested exceeded safe drinking water standards for nitrates. Over 79 percent of the facilities sampled

had detectable levels of nitrates.[13] Wisconsin is now in the process of retesting a high priority group of the non-community supplies.[14]

- In summary, a high percentage of Minnesota's non-community water supplies have never been tested, including many schools, factories, and day care centers. Both state rule and federal law require testing of all non-community water supplies.

Under the current regulations, most of the federal and state drinking water standards (all except those for total coliforms and nitrates) apply only to community public water supplies. The rationale for the current regulation was that transient populations used non-community supplies and therefore no long-term health risk was posed. However, a number of water supplies currently classified as non-community serve the same populations on a long-term basis. For example, schools, factories, and day care centers are currently classified as non-community supplies.

The U.S. Environmental Protection Agency has recognized that many non-community facilities, such as schools and factories, present as much exposure and risk to citizens as community supplies. As a result, EPA is likely to change the Safe Drinking Water Act regulations which define a community public water supply.[15] EPA's new definitions would include many of the types of facilities where people spend a great deal of their time. Although MDH does not have a current inventory of non-community supplies, it estimates that 1,665 of them will be included under the new definition -- approximately 1,325 factories, 245 schools, 85 institutions, and 10 day care centers. Most of these facilities have never had their water tested.

Given the expectation of Minnesota citizens that their drinking water should be safe, the evidence of potential contamination, and the fact that half of non-community supplies have never been tested, we recommend that:

- MDH should begin testing high usage non-community supplies, such as schools and factories.

EPA's change in definition of community public water supplies, if it occurs, will still not address the potential health threat from all non-community supplies. Even if EPA changes the definition to include some currently untested non-community supplies, there will remain over 3,300 non-community supplies that have never been tested. Thus, we also recommend that:

- MDH should establish a program to assess the risk of contamination in both licensed and unlicensed non-community water supplies.

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[13]See *Nitrate Levels in Small Public Water Systems of Wisconsin*, Wisconsin Department of Natural Resources, Bureau of Water Quality (1980), and *Ground Water Monitoring Report: Non-Community Well Nitrate Sampling*, Wisconsin Department of Natural Resources (June 1986).

[14]High priority non-community systems in Wisconsin include schools, factories, day care centers, and any supply where there is a recurring exposure to the same population.

[15]Discussion of the change in definition of non-community water supplies is found in the *Federal Register*, Vol. 50, No. 219, November 13, 1985, p. 46918.

The effect on Minnesota's program of changing the definition of community supplies will be to add significantly to MDH's workload. Community supplies are now inspected once every 15 months. If MDH's estimates are correct, and if inspections are conducted on the current schedule, approximately 1,300 more inspections per year would be called for, thereby doubling the current number of inspections. MDH has estimated that as many as 15 additional staff would be necessary to conduct the sanitary surveys every 15 months. MDH is currently investigating alternative plans to inspect these soon-to-be community water supplies. However, under almost any scenario, increased staffing will be necessary.

EPA's new definition of community water supplies is not the only change on the horizon. Congress passed major changes to the Safe Drinking Water Act in the summer of 1986. In the next section we describe the implications of these changes for Minnesota's drinking water program.

E. SAFE DRINKING WATER ACT AMENDMENTS

1. Introduction

The original Safe Drinking Water Act passed by Congress in 1974 required EPA to set recommended maximum contaminant levels for each substance that may have an adverse effect on health. In the 12 years since the act's passage, EPA has set maximum contaminant levels for only 21 substances. (Appendix B shows the currently regulated substances and their principal health effects.) Congress has become somewhat impatient with the slowness of EPA's standard-setting process and has put greater pressure on EPA to regulate more substances.

2. Amendments to the Safe Drinking Water Act

Congress passed amendments to the Safe Drinking Water Act in the summer of 1986. These revisions will substantially affect Minnesota's monitoring of drinking water. Table 3.4 shows a brief summary of the provisions of the revised act.

The most important provision of the amendments is to require monitoring for more substances. EPA is required to set standards for 83 contaminants in the next three years (see Table 3.5).[16] Appendix C shows the additional contaminants to be regulated under the new amendments and a brief description of the potential health risk from each substance.

There are still a number of substances to be addressed in monitoring programs and standard-setting. For example, nine volatile organic chemicals (VOCs) are listed in the standard-setting schedule, but Minnesota has been monitoring over 50 VOCs for several years in selected communities. By January 1, 1988, EPA is required to publish a list and begin rule-making for at least 25 additional contaminants to bring the total to 108 con-

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[16]The amendment requires at least nine contaminant standards to be established within 12 months of enactment. At least 40 additional contaminants must have standards set within 24 months of enactment, and the remainder must have standards set within 36 months of enactment.

TABLE 3.4

SUMMARY OF SAFE DRINKING WATER ACT AMENDMENTS OF 1986

- EPA must establish maximum contaminant level goals (MCLGs) and maximum contaminant levels (MCLs) for 83 contaminants by 1989. By 1991, 25 more contaminants must be regulated.
- Standards for MCLGs are to be set at the level at which no known or anticipated adverse health effects occur and which allows an adequate level of safety. Standards for MCLs are to be set at a level as close to the goal as feasible with the use of the best technology, treatment techniques or other means available (taking cost into consideration).
- EPA has enhanced authority to take enforcement actions.
- All surface water supplies must use filtration. All drinking water supplies must use disinfection treatments.
- States are required to develop well head protection programs for ground water protection within three years. EPA will pay from 50 to 90 percent of the cost of the well head protection program.
- States are required to establish a monitoring program for unregulated contaminants at all public water systems.
- The use of lead in water supply distribution systems is banned.

taminants to be monitored in 1991. EPA must add 25 additional contaminants to the standards each three years after 1988.

EPA has announced notices of public rule-making for most of the 83 substances.[17] The intent of Congress was that the nine substances regulated in the first year would be the volatile organic chemicals.[18] Among the 40 substances to be regulated in the following two years will undoubtedly be most of the 23 substances for which drinking water standards already exist.

EPA's strategy for setting testing frequencies is to let states establish them, with approval by EPA. EPA will first require a survey of the risk of contamination. Repeat monitoring will be based on the initial monitoring results and the vulnerability to con-

[17]Advance Notices of Public Rulemaking for volatile organics standards were proposed on March 4, 1982, and standards for additional contaminants were proposed on October 5, 1983.

[18]Standards are likely to be established for benzene, vinyl chloride, carbon tetrachloride, 1,2-dichloroethane, trichloroethylene, 1,1-dichloroethylene, 1,1,1-trichloroethane, p-dichlorobenzene, and tetrachloroethylene.

TABLE 3.5

CONTAMINANTS TO BE REGULATED
UNDER SAFE DRINKING WATER ACT AMENDMENTS OF 1986

VOLATILE ORGANIC CHEMICALS (14)

Trichloroethylene	Benzene	Vinyl Chloride
Tetrachloroethylene	Chlorobenzene	trans-1,2-Dichloroethylene
Carbon Tetrachloride	Dichlorobenzene(s)	Methylene Chloride
1,1,1-Trichloroethane	Trichlorobenzene(s)	cis-1,2-Dichloroethylene
1,2-Dichloroethane	1,1-Dichloroethylene	

MICROBIOLOGY AND TURBIDITY (6)

Total Coliforms	Standard Plate Count	Giardia Lamblia
Turbidity	Legionella	Viruses

INORGANICS (23)

Arsenic	Molybdenum	Silver
Barium	Asbestos	Thallium
Cadmium	Sulfate	Fluoride
Chromium	Copper	Beryllium
Lead	Vanadium	Aluminum
Mercury	Sodium	Cyanide
Nitrate	Nickel	Antimony
Selenium	Zinc	

ORGANICS (35)

Endrin	Carbofuran	1,1,2-Trichloroethane
Lindane	Vydate	Dinoseb
Methoxychlor	Simazine	Alachlor
Toxaphene	PAH's	Ethylene dibromide
2,4-D	PCB's	Epichlorohydrin
2,4,5-TP	Atrazine	Dibromomethane
Aldicarb	Phthalates	Toluene
Chlordane	Acrylamide	Xylene
Dalapon	Adipates	Dibromochloropropane (DBCP)
Diquat	1,2-Dichloropropane	Hexachlorocyclopentadiene
Endothall	Pentachlorophenol	2,3,7,8-TCDD (Dioxin)
Glyphosate	Pichloram	

RADIONUCLIDES (5)

Beta particle and photon radioactivity	Radon	Gross alpha particle activity
	Uranium	Radium 226 and 228

tamination. The frequency of monitoring required by EPA is expected to vary from quarterly to once every five years.

What will the increased monitoring requirements mean for the Department of Health? As of January 1987, much is uncertain. The exact effects on Minnesota will depend on EPA's implementation of the act.

However, some general comments about the repercussions of the act for Minnesota can be made. It is likely that Minnesota will have from 12 to 18 months after EPA establishes the standards to begin enforcing them. The increase in the number of contaminants to test will mean an increase in the analytical activity for the MDH lab. As mentioned earlier, MDH will have to change the way the lab reports results from water chemistry tests. MDH may also incur additional overhead costs in the central office to monitor the increased testing of water supplies. Additionally, one can expect that increased testing will result in more contaminated water supplies being identified and thus more enforcement action will be required.

The addition of more contaminants to the list regulated by EPA also means that analytical costs will increase. Analytical costs are borne by the communities and developers of the water supplies. It is estimated that one-time tests for the newly regulated water contaminants would cost between $5,000 and $7,000.

3. Financing Expanded Efforts to Ensure Safe Drinking Water

The federal government has in the past paid for slightly more than half of the costs of the Minnesota drinking water program. The Minnesota Legislature, when it passed the Safe Drinking Water Act in 1977, included a statutory provision ending the state's participation in the program if the federal share of the program's cost declines to below 40 percent of the total cost.[19]

With the passage of the new amendments came somewhat increased authorizations for federal funding, although the actual level of appropriations remains to be seen.[20] Despite this, the increase in responsibility for the state is large enough that the percentage of federal funding of the total program is likely to fall.

Both the amendments to the act and the change in definition of community water supplies have serious fiscal impacts for the program. In addition, as we point out in the previous section, MDH has never fully implemented the state and federally required program for non-community supplies.

Increased funding would be needed in order to:

- Pay for the increased testing and monitoring called for under the federal Safe Drinking Water Act amendments.
- Help small communities meet the estimated 400-500% increase in costs for water chemistry analysis.

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[19]Minn. Stat. §144.388.

[20]Minnesota has historically received approximately 2.2 percent of the available federal funds for the Safe Drinking Water program. In federal fiscal year 1987, it is currently anticipated that Minnesota will receive about $750,000.

- Implement a monitoring program for non-community water supplies, which is already required by law.

- Implement a program of testing and monitoring for a number of schools, factories, and other facilities soon to be redefined as community water supplies.

Given the increase in required activity, it may be time for the Legislature to consider new funding arrangements for the drinking water program. The Legislature may also want to consider whether the statutory restriction on the required federally paid share (40%) of the program's cost is still appropriate.

Funding an expanded program for community supplies and implementing a program for non-community supplies would be costly. For the last year, MDH has discussed a public water supply user fee designed to help fund such programs. However, at this time MDH has not been able to devise a system for assessing the fee that it felt was reasonably equitable to the beneficiaries of the program.

Several possibilities exist for meeting the increased responsibilities of the new law.

- *Do nothing.* Minnesota would not be able to implement the new federal amendments or to monitor non-community supplies as the law currently requires.

- *Increase general fund appropriations.* The rationale for funding the program from the general fund is that it benefits all citizens of the state. Increased general fund appropriations, however, might violate the statutory prohibition against the state paying more than 60 percent of the program's cost.

- *Establish a user fee for community water supplies.* The rationale for this alternative is that the benefits of the program are related roughly to the use of water. The fee would be quite small for individual users. The disadvantage is that it is difficult to establish a fee that adequately captures the benefits derived from an expanded program. Additionally, users of private wells would not pay for monitoring of non-community water supplies that are used by all citizens in the state.

- *Combine a user fee on community supplies with a well drilling fee.* This alternative would require owners of new private wells to share the cost of monitoring with citizens receiving water from community sources. The advantage of such an approach would be that eventually all citizens in some way would contribute to safe drinking water.

F. GROUND WATER PROGRAMS

1. Water Well Construction Code

MDH has responsibility for enforcing the water well construction code and for licensing water well contractors.[21] Minnesota passed the well code in 1974. All wells drilled

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[21]Minn. Stat. Chap. 156A.

since that date have to meet construction standards and the water must meet standards for bacteria and nitrate levels. In the last five years, the department has also been assigned the responsibility for regulating monitoring wells, mineral exploration wells, and ground water heat loops.

The department has four staff assigned to ground water programs. These staff license the drillers, review plans, deal with abandoned wells, and follow up on complaints.

The department maintains that the well program was originally set up to be run by counties or other local governments with assistance from the state. Partially as a result, the state has never staffed the program so that it could adequately enforce the well code. The department realizes that its current well program is insufficient, and it is trying to encourage local governments to establish their own well programs. However, to date only one county has a local program.[22]

Has the local approach to regulating wells worked? Given the experience of the last 12 years since the well code's passage, it is difficult to argue that it has. It is also unlikely that many counties will adopt local well programs in the future. Specialized expertise is required to manage a local program, and most counties cannot justify funding a full-time position for the program. In short, it may be time for the state to re-examine its approach of fostering local well programs. An expanded state program combined with delegation agreements in interested counties may be a more effective approach.

2. Enforcement of the Well Code

Between 7,000 and 10,000 wells are drilled annually in the state by approximately 400 licensed well contractors. The contractors are required to send a water well record and either a water sample or a report of an analyzed sample to the department within 30 days of drilling the well. A copy of the records is sent to the Minnesota Geological Survey and the Department of Natural Resources. In addition, at the end of the year, drillers send in a tabulation of all wells drilled that year.

MDH does not have sufficient personnel to inspect all wells constructed. As a result, most department inspections are of monitoring wells or are in response to a specific request. Although the department inspects approximately 300 drinking water wells per year, the wells constructed by some drillers are rarely inspected.

Water well records or logs are important for several reasons. First, they help ensure that the wells drilled are in compliance with the code and that the water is safe for consumption. Second, the logs provide an inventory of all the wells drilled in the state. Each water well record carries a unique identification number. It is important to be able to identify where all wells in the state are located to ensure that they are properly abandoned at some future date, and also in case contamination becomes a problem in the same area. Third, the water well record gives the health department, the Minnesota Geological Survey, and DNR valuable information about the geology, aquifers, and water use in the state.

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[22]Olmsted county currently has a county well program, and a delegation agreement with MDH is being negotiated. Winona, Goodhue, and Wabasha counties are working with MDH to negotiate delegation agreements, but no well programs currently exist.

However, since the program began, water well drillers have never submitted all of the required records. In the early years of the program, approximately half of the well records were submitted.[23] Our review of the department's records for the last three years shows compliance with this requirement is currently about 59 percent. The reasons that the records are not sent in include: contractors consider the records proprietary information, some contractors don't keep good records, and the Department of Health is lax in enforcing the requirement.

The department may suspend or revoke the license of drillers not submitting the required records.[24] However, MDH has never suspended or failed to renew a license for this reason. Indeed, there is no enforcement of the well record requirement *per se*.

When MDH responds to a complaint, it reviews the water well records of the driller and, if there are no records, requires the driller to submit them. The department has relied mostly on friendly persuasion to gain compliance from drillers.

There is an easy and effective remedy for the department to gain compliance with the well log requirement: no water well records, no license for the driller. Unfortunately, MDH authority under the current statute does not make it easy to enforce this provision. According to MDH, formal license revocation proceedings are the only current remedy. Accordingly, we recommend that:

- MDH should enforce the requirement that water well records be submitted by well drillers. The Legislature should amend Minn. Stat. §156A.07, to require drillers to submit all water well records before MDH may renew their license.

3. Abandoned Wells

The department also has the responsibility under the well code to see that wells are properly abandoned. There are approximately 200,000 active water wells in the state, with between 7,000 and 10,000 new wells drilled each year. The department estimates that there are as many as 800,000 abandoned wells in the state.

Proper abandonment is designed to guarantee the integrity of the well when it is no longer in use. Proper abandonment is especially important in multi-aquifer wells, since over time well casings will rust out and result in a direct flow of water from one aquifer to another. In the case of single aquifer wells, the result of improper abandonment is the direct introduction of surface water into the aquifer.

Informal agreements between state agencies exist regarding the abandonment of wells on state property. DNR and the Department of Transportation both advise the Department of Health when abandoned wells are found on property under their jurisdiction. Several counties are also becoming interested in well abandonment issues. MDH submitted a proposal to LCMR in 1986 to set up model well programs in three counties. However, it was not funded.

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[23] *Evaluation of Irrigation Permits: Appropriation Permit System and Statewide Ground Water Information Collection: Progress Update*, Office of the Legislative Auditor, Program Evaluation Division Staff Paper (1981), p. 25.

[24] Minn. Stat. §156A.07.

MDH will assist with the abandonment of wells when requested. Department staff conduct approximately 100 well abandonment inspections per year. However,

- The state has no formal well abandonment program.

The department has tried to encourage proper well abandonment by working with and educating builders, contractors, and building code officials. But, without a more formal well abandonment program, the state may face a number of potentially serious ground water contamination problems in the future.

In summary, Minnesota has only limited enforcement of the well code. Enforcement of well construction standards is very important for private wells, and proper abandonment of wells is also very important for protecting ground water from contamination.

G. SPECIAL WATER MONITORING STUDIES

One relatively small but important part of the department's monitoring efforts is the special studies that it conducts. The Special Studies Section helps identify problem areas where the state needs to devote increased attention. This unit currently has four studies in progress.

The first study is a joint pesticide project with the Department of Agriculture funded by the Legislative Commission on Minnesota Resources (LCMR). The LCMR project has total funding of $375,000, with $207,000 going to MDH and $168,000 to the Department of Agriculture. The Department of Agriculture is studying pesticide contamination in monitoring wells near the point of pesticide application. Agriculture's part in the project is discussed more fully in Chapter 5.

As part of this joint study, MDH is studying pesticide contamination in 400 public water supplies, approximately half from community and half from non-community water supplies. MDH is testing for approximately 30 different pesticides, depending on the pesticides commonly used in various areas of the state. The testing involves a one-time sampling with follow-up on positive results.

The study is expected to be completed by June 1987; preliminary results show the presence of at least one pesticide in about 35 percent of the samples. Approximately 15 different compounds have been found, with as many as eight found at one site. However, none of the levels found have been above the preliminary drinking water standards, although a number have been close. Atrazine has been the most common compound found.

The LCMR grant is also funding a second study sampling non-community water supplies for the presence of volatile organic compounds (VOCs). MDH is sampling approximately 300 of the 11,000 non-community water supplies in the state. This is in some respects an extension of the VOC study of community water supplies funded by LCMR and EPA several years ago.[25]

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[25]See *Volatile Organic Survey of Community Water Supplies: Report to the Legislative Commission on Minnesota Resources*, Minnesota Department of Health (July 1985).

MDH is using a similar methodology in a third study to examine the presence of pesticides in private drinking water wells. This study is funded by $130,000 from the EPA as part of PCA's Ground Water Protection Program. MDH is sampling 200 private wells and farm wells on a one-time basis, and following up on positive results. In addition, 25 wells are being sampled eight times each to determine the variation in levels due to rainfall and weather conditions. Preliminary results show 50 to 60 percent of the wells testing positive on one or more compounds.

MDH is not testing for pesticide breakdown products as a part of either of the current pesticide studies. Many pesticides break down into other chemical compounds relatively quickly in the environment. However, many of the breakdown products are as toxic or more toxic than the original compounds. For example, the second, third, and fourth order breakdown products of aldicarb, a common pesticide, are as toxic as the original.

- To date, there has been no survey of problems associated with pesticide breakdown products in Minnesota.

The last special study the section is conducting is of private wells located near metro area landfills. The Department of Health received approximately $125,000 in 1985 from the 2 1/2 cent per cubic ton tax on mixed municipal waste disposed in the metro area. MDH is identifying and testing wells within one-half to one mile of identified active or abandoned dump sites. MDH worked closely with PCA to identify the active and abandoned dumps and is now beginning to test wells downgradient from the sites. Approximately 200 sites were identified, with approximately 140 having wells (an average of ten wells per site) within the perimeter to be tested. The workplan calls for the department to test approximately 500 wells (approximately 35 landfills) per year.

H. CONCLUSION

What MDH has set out to do in water quality monitoring, it has done relatively well. However, we think the Department of Health has a number of gaps in its current approach to safeguarding the drinking water of the state. These gaps include:

- Little enforcement of the well code.
- No abandoned well program.
- No monitoring of unlicensed non-community water supplies.
- No regular pesticide monitoring program.
- No monitoring of pesticide breakdown products.

POLLUTION CONTROL AGENCY

Chapter 4

A. INTRODUCTION

The Pollution Control Agency (PCA) is responsible for enforcing many state and federal water quality regulations. To support its regulatory programs, PCA also monitors water quality in the state. We reviewed PCA's monitoring of surface and ground water in order to answer the general question: Is PCA's water quality monitoring adequate to detect instances of water contamination and to assess progress in cleaning up problem sites? Specifically we asked:

- Does PCA effectively monitor the discharge of municipal and industrial wastes into the state's surface waters? How well do PCA's routine surface water monitoring programs assess general trends in water quality?
- Does PCA adequately monitor ground water at landfills, hazardous waste storage sites, and other places where contamination can occur? Is water monitoring at superfund sites adequate?
- Is PCA assured that analysis of water samples is accurate?
- Does PCA have an adequate program for monitoring and reducing pollution from agricultural and urban runoff (non-point source pollution)?

Figure 4.1 presents PCA's organization chart. Two divisions are responsible for administering water quality monitoring programs: the Water Quality Division primarily monitors surface water, and the Solid and Hazardous Waste Division primarily monitors ground water. PCA spent over $2 million for water quality monitoring in FY 1986. Those expenditures are shown by category in Table 4.1.

B. WATER QUALITY DIVISION

PCA's Water Quality Division monitors discharges from municipal and industrial wastewater treatment plants, monitors ground water near pollution spills, and administers several programs that monitor surface water quality. We examined these programs to answer the following questions:

FIGURE 4.1

MINNESOTA POLLUTION CONTROL AGENCY
ORGANIZATIONAL CHART

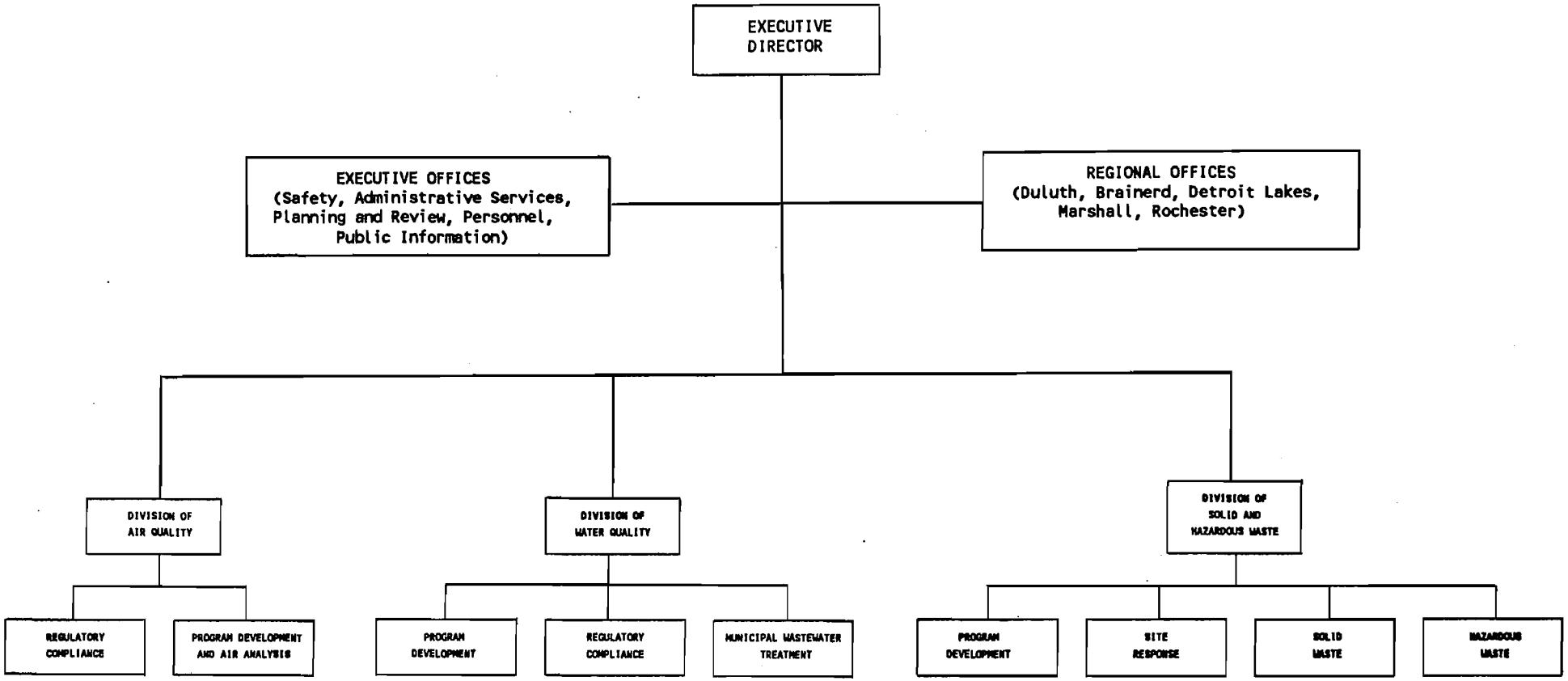

TABLE 4.1

PCA EXPENDITURES FOR WATER QUALITY MONITORING

Fiscal Year 1986

Division/Section	Salary Expenditures	Laboratory Expenditures	Equipment Expenditures	Total Expenditures
WATER QUALITY DIVISION				
Program Development	$ 735,000	$265,500	$ 43,256	$1,043,756
Regulatory Compliance	224,000	30,000	12,712	266,712
Municipal Wastewater Treatment	11,200	0	775	11,975
Regional Offices	140,000	0	0	140,000
Division Total	$1,110,200	$295,500	$ 56,743	$1,462,443
SOLID AND HAZARDOUS WASTE DIVISION				
Program Development	$ 12,600	$ 18,200	$ 3,900	$ 34,700
Solid Waste	42,000	94,200	25,900	162,100
Hazardous Waste	29,400	29,500	4,900	63,800
Site Response	131,600	210,300	19,800	361,700
Division Total	$ 215,600	$352,200	$ 54,500	$ 622,300
AGENCY TOTAL	$1,325,800	$647,700	$111,243	$2,084,743

Source: Pollution Control Agency, Divisions of Water Quality and Solid and Hazardous Waste.

- Does PCA adequately enforce requirements that wastewater treatment plants monitor their discharges? Do wastewater treatment plants submit monitoring reports on time?

- Does PCA have adequate procedures for ensuring the accuracy of monitoring reports?

- Do PCA's programs to monitor water quality in rivers and lakes produce reliable data which can be used to assess long term water quality trends?

1. Monitoring Waste Disposal

Federal law requires that all dischargers of waste into surface waters receive a permit under the National Pollutant Discharge Elimination System (NPDES). The permit system is simply a method of keeping track of potential polluters and regulating their discharges. PCA administers the permits in Minnesota; permit holders are required to monitor their discharges to streams or lakes, and to report the results to PCA at regular intervals.

NPDES permits have different requirements for two types of plants, municipal and industrial. Municipal permits generally require monthly reports on seven characteristics of the water they discharge -- fecal coliform bacteria, biological oxygen demand, total suspended solids, pH, water temperature, clarity, and flow.[1] The number of water samples taken per month varies based on the size and type of the municipal treatment plant. Industrial permit requirements vary depending on the way in which the water is used. Where industries are discharging cooling water, only temperature and pH levels are tested. Industrial permits usually require monthly or quarterly monitoring of water samples.

Some municipal sewage, sewage sludge, and industrial wastes are disposed of by applying them on land. PCA regulates this activity through a State Disposal System (SDS) permit, which requires permit holders to monitor ground water at sites where sewage is disposed. Holders of SDS permits are required to submit ground water monitoring reports. Although the specific requirements vary for each system, quarterly sampling for nitrates, ammonia, chloride, pH, and specific conductivity is usually required. Some permits also require semi-annual testing for inorganic metals.

The Division of Water Quality also monitors ground water near ponds used for waste treatment, near drainfields for community septic tanks, and in relation to spills of potential ground water pollutants, such as petroleum products, agricultural chemicals, and chemicals stored in underground storage tanks.

We examined whether wastewater treatment facilities were submitting required water quality monitoring reports and whether PCA adequately enforces permit requirements. To evaluate these programs we examined a sample of 35 treatment facilities, including 27 that had NPDES permits and eight that had SDS permits.

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[1]Depending on the type of wastewater and treatment plant, metals, toxics, and biological monitoring are required.

a. Enforcement of Monitoring Requirements

We found that permit holders were generally submitting the monitoring reports as required. Thirty-one of the 35 permit holders in our sample had submitted the most recent report required. PCA periodically reviews the reports and follows up on violations. When a report is not submitted, PCA eventually issues a notice of violation of the permit. Since 1980, PCA had issued notices of violation to four of the facilities in our sample for failing to file reports or filing them late. Two other violation notices were issued for improperly calculating effluent levels. These enforcement actions were successful in that the facilities' reports are now up-to-date. PCA is developing a computerized system for tracking the reports, which should assist PCA staff in making sure reports are submitted on time.

We conclude, based on PCA's developing a new tracking system, and its follow-up on violations in our sample, that:

- PCA has an adequate system for ensuring that discharge monitoring reports are submitted in a timely manner.

b. Accuracy of Monitoring Reports

PCA's regulatory system relies on self-monitoring and reporting by permit holders. Larger municipalities and industrial facilities take their own water samples and analyze them in their own labs. Smaller municipalities usually hire independent labs to sample and analyze water. In our opinion, this results in a serious shortcoming in PCA's enforcement program:

- As a rule, PCA does not independently verify the accuracy of data submitted by treatment plant operators.

PCA requires that municipal treatment plant operators be certified, and the certification requires training in water sampling techniques. PCA also reviews sampling procedures with facilities. However, PCA does not regularly supervise water sampling or analysis and has no way of assuring that operators' reports are accurate. One way of assessing accuracy is to "split" samples and have an independent lab check the accuracy of the results. PCA reports that it does occasionally split samples from major facilities. However, we found no evidence of PCA taking split samples in facilities we reviewed. Also, PCA staff report that split sampling is not done on a regular basis and is rarely done at the smaller facilities.

PCA staff note that they are each responsible for approximately 100 facilities and they do not have the time to adequately check the accuracy of each report. Quality assurance programs would help to ensure accurate lab results. However, we believe that:

- PCA should have a system for verifying the accuracy of discharge monitoring reports by taking split samples or independent samples on a regular basis.

Samples could be taken and quality assurance programs reviewed by PCA regional staff during plant inspections. Where errors are found, PCA should require corrective action or impose penalties. The frequency of the accuracy checks should be based on the extent to which errors are found.

c. Facility Inspections

EPA requires annual inspections of major municipal and industrial treatment plants. Although there is no similar requirement for minor facilities, PCA's goal is to inspect minor municipal facilities every three years and industrial facilities every five years. PCA inspectors periodically complete "Compliance Monitoring Surveys" which summarize conditions at each facility. Inspectors also review discharge monitoring reports to determine how well the facilities have met the standards specified in their permits.

Of the municipal NPDES facilities we reviewed, all four major plants had been inspected within the past year. Eight of twelve minor municipal facilities had been inspected within the past three years as called for by PCA policy.

PCA took enforcement actions in cases where violations were noted. Three facilities had received warning letters and five had received notices of violations. Violations included failure to file reports, pond overflows resulting in the discharge of untreated sewage into surface waters, operational and maintenance problems, and effluent levels exceeding limits.

None of the industrial plant files we reviewed contained compliance monitoring surveys or any other type of investigation reports. However, four of the plants had received notices of violations and two of those had entered into stipulation agreements with PCA. Three of the violations pertained to spills and the fourth was for failing to keep discharges within allowed levels.

Although there are some record-keeping deficiencies, we conclude that:

- PCA is adequately inspecting facilities and enforcing permit requirements regarding the operation and maintenance of wastewater treatment facilities.

Although PCA adequately enforces the terms of permits, it is limited in its ability to force municipalities to correct deficiencies in treatment plant design or operation. Some treatment plants are too small to effectively handle all the sewage being generated by their communities. Others are old and in need of upgrading. Until the municipalities with inadequate treatment plants receive construction funds for new or upgraded plants, they will have difficulty meeting standards.

2. Assessments of Surface Water Quality

In addition to monitoring discharges, PCA has several programs to check the quality of the state's surface waters and to assess the impact of its regulatory programs. PCA conducts a routine monitoring program and lake studies to assess the overall quality of the state's water and how it changes over time. PCA utilizes the results of four other types of monitoring programs--use attainability, wasteload allocation, and bioassay and fish tissue studies--to help determine if permits are setting appropriate standards.

a. Routine Monitoring Program

In order to assess water quality trends in the state's streams, PCA takes water samples nine times per year from 75 monitoring stations. Fifty-seven stations, including 19 stations that are part of the Environmental Protection Agency's (EPA's) National Fixed Station Network, are sampled every year. The other 18 stations rotate between river

basins. For example, in FY 1986 18 additional stations on the Red and Rainy River basins were sampled. In FY 1987, 18 additional stations in the Lake Superior Basin will be sampled. In FY 1988, the additional stations will be in the Mississippi and Minnesota River Basins. PCA hopes to draw conclusions about the state's river water quality by periodically sampling water from these locations.

Use of fixed-station, fixed-interval monitoring networks like the 75 stations that PCA takes samples from may not be the most desirable monitoring method. Both 1981 and 1986 General Accounting Office studies found serious methodological problems in state and national efforts to measure stream water quality and to assess long-term trends.[2] The difficulties arise primarily because stream water quality is complex and constantly changing and cannot be accurately portrayed by infrequent sampling from a few stations. Water quality changes depending on air temperature, rainfall, ice cover, riverbed structure, riverflow, and other biological and chemical factors. In short, it is a continuous, not a static phenomenon. As a result, infrequent sampling cannot accurately represent water quality in even one site. Also, water quality varies too much throughout river basins to be represented by a few stations, regardless of the number of point source polluters in the basin.

For example, GAO points out that levels of dissolved oxygen fluctuate rapidly in response to hydrological, climatic, biological, and chemical influences. Dissolved oxygen levels are unique to each river and to each segment of a river. Thus, monthly samplings from a few selected sites cannot possibly reveal changes in dissolved oxygen levels on a statewide or even river-wide basis. Furthermore, dissolved oxygen levels can fluctuate widely during the day. Sampling at the same time each day could produce an inaccurate picture of average dissolved oxygen levels.

GAO makes the same point about total suspended solids, another major indicator of surface water pollution. Total suspended solids in a river are affected by rainfall and riverflow and vary from location to location according to the soil, vegetative cover, steepness of terrain and land use around the river basin.

Another complicating factor in assessing water quality is the introduction of error due to inconsistent sampling and laboratory procedures. PCA agrees this can be a problem and suggests that quality assurance procedures can improve the data's validity.

As the result of these complicating factors, PCA is faced with a difficult task in accurately assessing water quality trends over time. PCA recognizes that fixed-station monitoring has some limitations. PCA believes, however, that fixed station networks are valuable because they permit some assessment of water quality trends over time. PCA has recently divided the state into seven "ecoregions". These ecoregions are defined by land use, soil type, land surface form, and vegetation. PCA maintains that generalizations about water quality over time can be made from fewer samples within an ecoregion than statewide. We agree that ecoregions may help to reduce the variability of the data and, if this is true, then fewer samples would be needed. However, the ecoregion concept is not a panacea for PCA's efforts to accurately assess water quality trends. PCA must still deal with problems of location and timing bias.

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[2] *Better Monitoring Techniques are Needed to Assess the Quality of Rivers and Streams*, General Accounting Office (April 1981), and *Key Unanswered Questions about the Quality of Rivers and Streams*, General Accounting Office (September 1986).

While we agree that PCA's current sampling is better than nothing, it is not adequately designed to accurately reflect trends in water quality. PCA's sampling strategy of using fixed-point stations might be adequate if there were many more stations and if sampling intervals were randomized. However, given PCA's current procedures, we have serious questions about the validity of conclusions about water quality trends drawn from the data. At the very least, PCA needs to reexamine and redesign its sampling plan. Because designing a sampling plan to accurately portray trends across time would be very complex, and the number of stations would be much greater, we believe PCA should consider alternative means of assessing trends. GAO has suggested that intensive studies might be a more useful method of assessing trends. Therefore, we recommend:

- PCA should conduct more in-depth, but less frequently repeated, studies of river water quality.

Besides assessing trends in different watersheds, intensive studies could also provide useful information about the nature and causes of pollution in a certain area. This kind of information could guide efforts to improve water quality. Intensive studies could be replicated several years later to assess the impact of pollution abatement programs. In order to improve its water quality trend assessments, PCA believes additional funds will be necessary.

b. Lake Studies

By measuring the level of nutrients, such as phosphorus and nitrogen, PCA analyzes lakes to determine whether they meet designated uses for fishing and swimming. Excessive nutrients result in excessive growth of algae and other micro-organisms which interfere with water clarity and aquatic life. Algae also may produce undesirable odors and certain algaes may harm humans who swim in lakes.

PCA takes water samples one to three times each year from about 75 lakes. PCA also coordinates a citizen's lake monitoring program that uses volunteers to measure lake transparency by lowering a disk into the water and recording the depth at which it disappears from view. PCA has at least one phosphorus measurement for 1,028 lakes, and it has transparency readings for 640 lakes.[3]

PCA's lake team conducts a number of excellent special studies.[4] PCA is also cooperating with DNR on a study of 23 acid rain lakes in northeast Minnesota. PCA is also working on several cooperative studies with lake associations.

However, PCA's lake water monitoring program is limited in comparison with the scope of Minnesota's lake resources. For example, the Department of Natural Resources (DNR) manages almost 2,000 fishing lakes, but PCA takes water samples on only 75 lakes per year. By contrast, DNR conducts biological surveys of 500 to 600 lakes per year. DNR surveys contain information on both water quality and factors that affect water quality.

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[3]Steven A. Heiskary, *Trophic Status of Minnesota Lakes*, Minnesota Pollution Control Agency, November 1985, p. 8.

[4]Examples of special studies include an on-going study of the Garvin Brook watershed funded by LCMR, lake restoration projects such as Big Stone and Clearwater lakes, and other in-depth studies. See, for example, *Limnological Investigation of the Sauk River and Horseshoe Chain-of-Lakes*, Pollution Control Agency (1985).

We asked PCA officials why they did not utilize the results from DNR surveys in their assessments of lake water quality. PCA responded that they did not trust DNR's water chemistry results and that DNR's data were not computerized. We are not convinced by this reasoning. DNR's water samples are gathered by professionals and analyzed by a professional lab. PCA does not trust these results, yet it trusts results gathered by non-professionals from its Citizen's Lake Monitoring Program.

DNR biologists note that lake water quality is complex and cannot be reflected in simple measurements of phosphorus and transparency. In fact, they say phosphorus is often reflective of better biological conditions for fish growth. While PCA samples lake water only one to three times per year during the growing season, DNR believes that water samples should be taken as many as ten times per year in order to obtain a complete characterization of a lake. They also think that lake studies should gather other biological information, such as the types of fish, algae, and vegetation in the lake.

DNR has historically been the state agency responsible for lake management. Although PCA has a role in protecting lake water quality, its efforts should be coordinated with DNR's activities. Lake management is one area where the state's multi-agency organizational structure has resulted in less than optimal coordination. It is clear that PCA and DNR should coordinate activities so that common objectives, sampling procedures, quality assurance, data storage, and roles and responsibilities are better defined. We recommend that:

- PCA and DNR should develop a lake management strategy that addresses concerns for maintaining lake water quality and preserving lakes for recreational uses.

- PCA and DNR should negotiate an agreement to define each agency's lake water monitoring responsibilities and provide a method for coordinating activities and sharing data.

c. Use Attainability Studies

Use attainability studies evaluate the water quality of rivers and streams to determine whether they can support their designated uses. The studies are also used to justify the need for advanced treatment and define discharge limits for municipal sewage plants. PCA has recently begun conducting use attainability studies to define the state's ecoregions and to study non-point source pollution; PCA plans to complete studies on eight river segments in FY 1987.

Designated uses have been determined for each stream segment in Minnesota. Streams are presumed to be suitable for fishing and swimming unless specific conditions preclude those activities. Between October 1983 and September 1985, 377 stations representing 1,925 river miles were monitored. Of those, 313 river miles (16 percent) did not meet the standards for fishing. Of the 1,717 river miles classified as swimmable, fecal coliform concentrations exceeded water quality standards in 1,029 river miles (60 percent).[5]

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[5]*Minnesota Water Quality: Water Years 1984-1985*, Minnesota Pollution Control Agency, pp. 27-31.

d. Waste Load Allocation Studies

Waste load allocation studies are used to evaluate the need for new wastewater treatment plants and to define effluent limits for them. In these studies, numerous samples are taken (usually above and below pollution sources) and a statistical model is developed. Subsequent samples are then taken to test the model. PCA uses the model to estimate the ability of a stream to accept discharges from a treatment plant. Permits with discharge limits are then issued for the plant. PCA has three staff assigned to wasteload allocation studies and plans to complete ten studies in FY 1987.

3. Bioassay and Fish Tissue Studies

PCA conducts two types of studies on organisms living in rivers and lakes: bioassay tests and fish tissue analyses. Bioassay tests determine whether existing permit requirements are sufficient to protect water from degradation. For bioassay tests, minnows and water fleas are placed in a test chamber to determine whether the effluent discharged from a treatment plant is toxic to them. All municipal and industrial wastewater treatment plants in the state have been tested once, and PCA found toxic discharges in 25 percent of the plants. PCA required plants where toxicity was found to either upgrade their facilities or pretreat the effluent. In 1987, PCA plans to retest about 25 of the plants to see if the changes have eliminated the toxicity.

PCA participates in a Fish and Wildlife Contaminants Committee made up of officials from PCA and the Departments of Natural Resources, Health, and Agriculture. The committee meets several times per year when questions arise concerning the contamination of fish or wildlife flesh. These agencies work together to analyze fish tissue for the presence of mercury, dioxins, PCBs, and other contaminants. DNR selects the sample of lakes and collects the fish. PCA prepares the fish for analysis in MDH's laboratory, and issues reports based on the laboratory results. The Department of Agriculture's role is largely to help with analysis of suspected pesticide contamination.

If, as a result of a fish tissue analysis, MDH feels that the public health is endangered, it issues a consumption advisory. Mercury contamination in some northeastern Minnesota lakes and PCB contamination in some river segments below municipalities have been the major problems uncovered by these studies.

3. Conclusions

In summary, we conclude that overall PCA's water quality monitoring of surface waters is adequate to detect major point source pollution problems. We found that wastewater treatment plants generally do submit monitoring reports in a timely way, and that PCA has an adequate enforcement process to ensure permit conditions are met. However, we note that PCA does not have a system for checking the accuracy of monitoring reports, and we recommend it establish a monitoring quality control system.

We found problems with two of PCA's surface water assessment programs. We found that PCA's fixed station, fixed-interval approach to surface water assessment has real limits for accurately representing water quality conditions. We suggest that PCA reorient its surface water assessments to more detailed but less frequent studies. Second, we found that PCA has a relatively limited lake water quality assessment program, given the scope of Minnesota's lake resources. We recommend that PCA and DNR work on developing a lake management strategy that considers both water quality and recreational concerns.

Although the Water Quality Division monitors some types of ground water pollution, the Solid and Hazardous Waste Division is responsible for ambient ground water monitoring, and ground water monitoring near known and potential contamination sites, such as landfills and hazardous waste sites. These responsibilities are discussed in the next section.

C. SOLID AND HAZARDOUS WASTE DIVISION

PCA's Solid and Hazardous Waste Division is responsible for protecting the state's ground water from pollution and for monitoring progress in cleaning up known contamination. Our review of PCA's ground water monitoring activities focuses on the following questions:

- Does PCA adequately enforce ground water monitoring requirements at sanitary landfills and hazardous waste disposal facilities?
- Does PCA effectively monitor ground water near underground storage tanks and open dumps?
- Is PCA's ambient ground water monitoring program useful for identifying and addressing ground water contamination problems?

1. Monitoring Around Landfills

a. Contamination Problems

EPA sets standards for the proper storage, handling, treatment, and disposal of solid and hazardous wastes. In Minnesota, PCA has responsibility for enforcing federal and state requirements for proper waste disposal.

Prior to the 1970s, the threat of ground water contamination from solid waste disposal was not well understood. Wastes were frequently deposited in open dumps, with no liners or other devices to prevent harmful substances from filtering through the earth into the underlying ground water. In recent years, hydrological and epidemiological research has led to a greater understanding of ground water contamination and its threat to human health. As a result, restrictions have been placed on the disposal of solid wastes. All solid wastes must be deposited in sanitary landfills which have permits issued by PCA. In addition, all new and expanded landfills must be constructed and operated in accordance with standards designed to protect ground water quality. Operators of landfills must also monitor ground water (and in some cases surface water) quality under and near their landfills.

As of September 1986, there have been 131 permits issued for sanitary landfills in Minnesota. Ninety-eight of these landfills are currently operational. Sanitary landfills receive mixed municipal waste, or garbage generated by residences and businesses.

Landfills are not supposed to receive hazardous wastes. To deposit wastes in landfills a company must have a plan approved by PCA for assuring that the waste is not hazardous.[6] However, many household items, such as paints, solvents, cleaners and other household chemicals, contain substances that are hazardous to health. These are commonly deposited in landfills. In addition, many landfills were constructed before current safety standards were adopted and before controls on what is deposited in landfills were enforced. As a result, PCA reports that:

- Most sanitary landfills are contaminating ground water.

A 1986 survey categorized the 131 permitted sanitary landfill sites according to what is known about their impacts on ground water quality. The results of the survey are reported in Table 4.2. The table shows that most of the metro area landfills and about three in five non-metro area landfills are suspected of contaminating ground water.

TABLE 4.2

GROUND WATER CONTAMINATION AT SANITARY LANDFILLS

	Metropolitan Area		Outstate	
Extent of Contamination[a]	Number of Landfills	Percent	Number of Landfills	Percent
Known Ground Water Pollution	11	73%	27	23%
Known Ground Water Impacts	2	13	17	15
Suspected Ground Water Impacts	1	7	27	23
None of These	1	7	45	39
Total	15	100%	116	100%

Source: Minnesota Pollution Control Agency, Solid and Hazardous Waste Division, "Ground Water Pollution at Permitted Mixed Municipal Landfills," February 1986.

[a]"Known ground water pollution" refers to the presence of organic or inorganic substances in excess of safe drinking water standards in one or more monitoring wells. "Known ground water impacts" refer to the presence of substances attributable to landfill contamination above background levels (i.e., above the levels in wells upgradient from the landfill). "Suspected ground water impacts" also refer to elevated contaminant levels, but in these cases, it is uncertain whether the landfill is the source of the contamination. "None of these" refers to landfills that have no ground water impacts observed to date.

[6]There are 23 industrial waste landills, 45 demolition waste landfills, and 19 transfer stations where garbage trucks are unloaded for further compacting. Many of these landfills are at the same site or next to a sanitary landfill. None of the landfills are allowed to receive hazardous wastes.

These figures probably underestimate actual ground water contamination because many landfills do not have adequate water quality monitoring systems. The greater percentage of metro area sites with known ground water pollution may simply be a reflection of better monitoring systems at those landfills. As existing monitoring systems at outstate sites are upgraded, more contamination problems may be identified.

These findings are underscored by the fact that as of December 1986, 35 percent of the 130 sites on the "Permanent List of Priorities" for the state superfund were landfills.

b. Monitoring Requirements

The potential for ground water contamination at sanitary landfills requires monitoring of ground water to identify existing pollution, evaluate cleanup efforts, and assess the effectiveness of ground water protection strategies. Our analysis of PCA's ground water monitoring activities at landfills is based on interviews with division management and staff and a review of monitoring activities and results from 19 sanitary landfills chosen at random from PCA case files.

Prior to 1978, landfill permits were issued for an indefinite time until the landfill reached capacity. Beginning in 1978, landfills were required to obtain five-year renewable permits. PCA began implementing this rule in 1978 by applying it only to new landfills or expansions of existing landfills. In 1982, PCA began to apply the rule to all existing landfills. As of August 1986, 33 five-year permits had been issued for new or expanded landfills and 38 for existing landfills. These new permits have more rigorous water quality monitoring requirements than the earlier ones. They require landfills to develop and implement a water quality monitoring plan based on a hydrogeologic investigation.

Landfill operators have resisted this process of reissuing permits and approving monitoring plans. As a result, the process has consumed much PCA staff time.[7] PCA has currently suspended its efforts to issue five-year permits to the remaining 25 operational landfills until the water monitoring plans of the other landfills are approved and implemented.

All but two of the 98 operational sanitary landfills have wells for measuring water quality. However, well design and placement in older landfills was not scientifically based so data from these wells are of dubious quality. It is important that monitoring wells be situated both upgradient and downgradient from the landfill. By comparing the water quality of downgradient and upgradient wells, PCA can determine whether the landfill is the source of contamination.

The 25 landfills without new five-year permits do not have correctly located monitoring wells. In addition, new correctly located monitoring wells are not yet in place at some re-permitted landfills. As of August 1986, PCA staff estimate that they have reliable water quality data for 61 of the 98 operational landfills.

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[7]The process of issuing permits and approving water quality monitoring plans is very time consuming. For example, approval for one sanitary landfill in our sample that cooperated with PCA required almost a year. After approval, the monitoring plan must be implemented, which can also take considerable time (in this case, another year). When the landfill does not cooperate, the process can be even more protracted.

The specific water quality monitoring requirements for each landfill are contained in its permit. In general, water is monitored three times a year for a routine set of substances and annually for an extended list of organic and inorganic compounds. In the sample of landfills we analyzed, the number of monitoring wells per landfill ranged from one to twelve, with two to four wells being most common. For some landfills, surface water quality in nearby streams was also measured. While PCA staff occasionally take water samples, landfill operators are generally responsible for monitoring ground water at their own facilities.

Landfills contract with private laboratories for the collection of water samples and their analysis. As we noted in our discussion of wastewater treatment plants, this reduces the extent to which PCA can be sure its decisions are based on an accurate picture of ground water quality at landfill sites.

c. Enforcement of Monitoring Requirements

We examined water quality monitoring reports from 17 landfills to determine whether they were submitting complete and timely reports. Table 4.3 shows that as of August 1986, landfills have not submitted water quality monitoring reports promptly. The majority of the landfills had not submitted the April 1986 quarterly report. One landfill had not submitted a report since 1981. Its owner claimed to be unable to afford to monitor water quality.

TABLE 4.3

MOST RECENT WATER QUALITY MONITORING REPORT SUBMITTED BY SANITARY LANDFILLS
August 1986

Month/Year	Number of Landfills
July 1986	2
April 1986	6
October 1985	7
July 1985	1
Before 1985	1
Total	17

Source: Sample of water quality monitoring reports in PCA files.

Further, in the past 18 months, we noted five instances where landfills had failed to submit a report or had submitted an incomplete report. PCA is aware of this problem. Several letters were sent to landfill operators reminding them that their reports were late. Two landfills in our sample received formal notices of violation of permit terms for failing to submit their reports.

Although PCA has taken enforcement actions, it does not have a formal, consistent policy for dealing with landfills that do not submit complete monitoring reports on time. Therefore, we recommend that PCA should take enforcement action whenever water quality monitoring reports are not completed on time.

Additionally, laboratories need to conduct prompt analysis of certain substances in order to get an accurate reading. We found that this is not always done. For example, volatile organic compounds must be analyzed within 14 days. However, there were many instances in which more than 14 days passed between the date the sample was drawn and the analysis was completed. For the most recent report submitted by the landfills we analyzed, the 14-day period was exceeded in seven of the 17 reports (41 percent). PCA staff point out that the organic compounds may have been tested within the 14-day period and that some of the substances for which time is not crucial may have been analyzed later. However, the important point is that:

- Although PCA staff are instrumental in designing water quality monitoring systems at landfills, they have little control over the actual monitoring activities of landfill operators.

d. Landfill Inspections

PCA staff do inspect landfills regularly for operating and sanitary conditions. All landfills in our sample had been inspected at least once within the past two years, and most had been inspected in the last six months. PCA staff found problems in 15 of 17 landfills in our sample. The major problems were in landscape design and inadequate cover of the waste material. These problems permit leachate (liquid bearing waste materials) ponds to form and possibly seep into the ground water. Litter and animals were also cited as problems in some landfills.

Although PCA staff inspect landfills on a regular basis and identify sanitary, design, and operational problems, they have met with limited success effecting meaningful change. In six of the 15 landfills with problems identified in the most recent inspection, the same problem was identified in the previous inspection. Only two of the landfills in our sample had been issued formal notices of violation, although one of the landfills had been issued three such notices.

PCA's approach to maintaining good sanitary and operational practices at landfills is to maintain a cooperative working relationship with the operators rather than a confrontational one. Thus, legal enforcement action is taken as a last resort and only when staff are convinced that voluntary compliance will not occur.[8] While this approach may have merit, we believe that:

- PCA should develop specific policies about the number and types of violations that will be tolerated before formal actions are taken. These limits should be based on an assessment of the likely effects that failure to act would have on ground water quality. When the limits are exceeded, PCA should take prompt and effective enforcement action.

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[8]PCA reports that for the twelve months ending September 1986, it issued six notices of violation to landfills and entered into eight new or amended stipulation agreements.

2. Hazardous Waste Storage Facilities

Federal and state rules place stringent restrictions on the generation, transport, storage, treatment, and disposal of hazardous wastes. Generally, hazardous wastes include corrosives, acids, highly flammable substances and known carcinogens. All generators of hazardous waste have to register with the Environmental Protection Agency (EPA). PCA has been assisting in the registration effort by sending out fact sheets to 16,000 companies that might be hazardous waste generators.

Permits are required for the treatment or disposal of hazardous wastes, or for the storage of hazardous wastes for more than 90 days. Federal law requires that all existing land disposal facilities for hazardous wastes receive a final permit by November 1988. No new facility can begin operations without a final permit. However, existing facilities have interim status.

PCA has been delegated responsibility for hazardous waste permits, subject to EPA oversight. As of October 1986, no hazardous waste facilities in Minnesota had received final EPA permits. Forty-five facilities (five land disposal, five treatment, one incineration, and 34 storage facilities) in Minnesota have interim status. All of these facilities propose to store or treat wastes generated by their own operations and have not proposed to serve as a storage, treatment or disposal facility for wastes generated statewide. All hazardous wastes generated in Minnesota by companies without interim status are being shipped out of state.

EPA requires a rigorous set of safety precautions in the design of land disposal facilities for hazardous waste. Water samples must be analyzed from upgradient or adjacent wells for a group of indicator substances and compared with water quality from at least three downgradient wells. If statistically significant differences are found between the two sets of wells, additional analysis is conducted on an expanded list of substances. Analysis focuses on the extent of the contamination and its environmental impact. If pollution is found, a cleanup plan is implemented and water quality is monitored to assess the cleanup's progress.

We reviewed the case files of four hazardous waste land disposal facilities. All four have water quality monitoring systems in place. Three of the sites are at or adjacent to superfund sites, so ground water is also being monitored for the superfund cleanup. This complicates the design of an adequate monitoring system for the hazardous waste site, since it is sometimes difficult to isolate the source of contamination.

As is the case with landfills, the hazardous waste facility permitting process is extensive and time consuming. PCA appears to be on target for getting all sites permitted and all water quality monitoring systems installed by EPA's target date of November 1988.

3. Underground Storage Tanks

PCA estimates that there are 60,000 underground storage tanks in Minnesota which contain or once contained petroleum products or other hazardous substances. PCA estimates that over ten percent, or 6,000 tanks, may leak. Each year the Water Quality Division investigates over 100 reported spills or leaks. Besides contaminating ground water, leaking tanks pose a risk of vapor accumulating, causing explosions or fires.

Since July 1985, owners of new, active, or abandoned underground storage tanks have had to notify PCA about their existence. The Legislative Commission on Minnesota Resources

has provided funds to PCA for an inventory of underground storage tanks. PCA has mailed over 30,000 notification forms to gas stations and other businesses which might be expected to have underground storage tanks. As of June 1986, PCA has received responses from 16,000 individuals or businesses providing information on over 45,000 tanks.[9]

PCA has adopted temporary standards for the construction and installation of new tanks and is in the process of promulgating permanent rules for tank construction and installation, leak detection and testing, and ground water monitoring. However:

- PCA does not currently monitor ground water near underground tanks except near spill investigation sites.

PCA notes that a method for early identification of underground leaks needs to be developed and implemented. The Legislative Commission on Minnesota Resources is providing funds for PCA's underground storage tank program through FY 1987. The agency is requesting additional appropriations of $161,000 in FY 1988 and $126,500 in FY 1989 to pay for the program. The appropriations would be reimbursed by an increase in fees paid by distributors of petroleum products. To further its efforts beyond FY 1987, PCA is proposing legislation to establish an Underground Storage Tank and Petroleum Tank Release Cleanup Fund.

4. Open Dumps

In 1980, PCA conducted a statewide inventory of solid waste disposal facilities. The inventory determined that there were about 1,400 open dump sites in Minnesota. In contrast to sanitary landfills, open dumps have not been required to obtain a permit and have been accessible to anyone wishing to dump garbage or waste. Dumps tend to be located on land that has low value or little potential for development, with little attention given to environmental impact. Many are located in abandoned gravel pits or wetlands. The 1976 federal Resource Conservation and Recovery Act required states to close all open dumps or upgrade them to the status of permitted sanitary landfills. PCA estimates that as of August 1986, there were still about 30 active open dumps in Minnesota.

A 1985 PCA study of 15 open dump sites found that all had contributed to some degradation of ground water quality. Volatile organic compounds were found at 13 of the sites, and three had volatile organic compounds levels exceeding safe drinking water standards. Two of the three had been closed for over ten years.

Although based on a very small sample, the study underscored the importance of proper closure for open dumps, such as providing a sloped, low permeability cover to isolate the waste, increase runoff and reduce the infiltration of precipitation. The study recommended additional ground water monitoring for those sites most likely to be contaminated at levels exceeding drinking water standards.[10] Despite this recommendation,

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[9] *Minnesota's Underground Storage Tank Program*, Minnesota Pollution Control Agency (August 1986).

[10] *Ground Water Analysis Near Open Dumps*, Minnesota Pollution Control Agency (June 1985).

- PCA does not currently have a program to monitor ground water at or near open dumps.

5. Superfund Monitoring Activities

The uncontrolled disposal of hazardous waste in the U.S. has created serious public health and environmental problems. In response to these problems, Congress passed the 1980 Comprehensive Environmental Response, Compensation and Liability Act (the "superfund" law). This act created a program to identify parties responsible for past releases of hazardous wastes into the environment and hold them accountable for the costs of cleaning up the contaminated sites. The law also provides for a fund (called the "superfund") financed by a tax on the petroleum industry, to cover the costs of cleaning up sites where a responsible party cannot be located or cannot afford to pay cleanup costs.[11] The superfund process is intended to provide the speediest and most effective cleanup of hazardous wastes released into the environment.

The federal superfund program requires a ten percent state match for federal cleanup expenditures. In FY 1986, $6.8 million was obligated from the federal superfund for Minnesota projects. This amount is expected to increase as the result of a five-fold increase in the federal superfund authorization recently approved by Congress. Nevertheless, the federal superfund is not sufficient to pay for cleanups of all contaminated sites in Minnesota. PCA notes that implementing a cleanup program for one superfund site can cost between six and eight million dollars. Accordingly, the state enacted the Minnesota Environmental Response and Liability Act (the "state superfund") in 1983. It provides a supplementary state fund, financed by a tax on hazardous waste generators. PCA reports that the state superfund, which spent $645,000 in FY 1986, is running out of money and will be insufficient to provide the required ten percent match for federally funded cleanups or to clean up sites not eligible for federal funds. PCA is requesting additional appropriations of $6 million in FY 1988 and $6 million in FY 1989 to make up for the expected shortfall.

The superfund process involves identifying and evaluating reports of hazardous waste contamination, identifying responsible parties, applying for federal and/or state funds, and developing and implementing a cleanup plan. Most sites targeted for cleanup have a spill, leakage from buried drums, or contamination from wastes stored at landfills or open dumps. PCA's Solid and Hazardous Waste Division investigates reports of hazardous waste contamination to determine the nature and extent of the environmental damage. Spill sites with long-term cleanup requirements are referred to the division for inclusion on the superfund list.

After the division's investigation, each site is assigned a *hazardous response score* based on the toxicity of the substances released, the likelihood of ground water migration, and the potential population that might be affected if the hazardous material spread. A score of one or higher results in a site being placed on the *permanent list of priorities*. It is then eligible for state cleanup funds if a responsible party cannot be made to pay. If the score is sufficiently high (28.5 as of October 1986), the site is also included on the *national priorities list* and is eligible for federal

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[11] A broad-base corporate tax was recently added to the petroleum tax to support increased revenues for the superfund. See Superfund Amendments and Reauthorization Act of 1986, Conference Report 99-962.

funding. As of December 1986, there were 130 sites on the state list; 38 sites were also on the national list and 12 more sites have been proposed for the national list.

PCA will investigate the cause of the contamination for all sites on the *permanent list of priorities*. If a responsible party is found, PCA will try to have the party pay for the cleanup, either by a voluntary consent order or through litigation. As of June 1986, a responsible party had been found in 48 cases.

Whether or not a responsible party has been found, PCA is involved in designing a plan, hiring a contractor, and supervising the cleanup. In both the preliminary investigation and the cleanup phase, extensive ground water monitoring is required to measure the extent of contamination and the effectiveness of cleanup efforts. PCA estimates that between 15 and 25 monitoring wells are used during most superfund investigations. Follow-up monitoring is required for thirty years after a cleanup plan is implemented.

PCA spent $361,700 on superfund related water quality monitoring in FY 1987. This amount represents most (58 percent) of the Solid and Hazardous Waste Division's water quality monitoring expenditures.

6. Ambient Ground Water Monitoring

PCA's ambient ground water monitoring program seeks to describe ground water quality over time in all parts of the state. A total of 410 different sites have been sampled at least once since the program started in 1978. Between 1978 and 1984, 1,023 samples were drawn and analyzed at MDH's lab.

Traditionally, analysis has concentrated on describing bacteriological and physical characteristics of water and identifying the presence of inorganic substances. In 1983 and 1984, PCA received a grant from the Legislative Commission on Minnesota Resources to expand its ambient ground water program to begin testing for the presence of volatile organic compounds.

Table 4.4 presents the percent of tests where substances exceeded safe drinking water standards. Only coliform bacteria, nitrates, and volatile organics are considered health threatening. The other substances measure secondary characteristics of water such as taste, odor, hardness, and clarity. The percentages for coliform bacteria and nitrates are inflated because they include positive results from stations even if retests did not find levels exceeding drinking water standards.[12] Coliform findings were particularly high in the Upper Carbonate aquifer of southeastern Minnesota, with positive results found in 70 percent of the samples. PCA attributes this to the fact that many sampling stations were underground springs, interconnected with surface water. If the results from that aquifer were omitted, only 11 percent of the samples contained positive coliforms. To the extent that conclusions can be drawn from this limited data, there does not appear to be a great amount of health threatening contamination naturally present in Minnesota's ground water.

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[12]We note also that the ambient program tests for total coliforms, whereas only fecal coliforms are considered health threatening.

TABLE 4.4

PERCENT OF SAMPLES EXCEEDING DRINKING WATER STANDARDS AT AMBIENT GROUND WATER STATIONS

Substance	Standard	Percent Exceeding Standard
Total Coliform Bacteria	1 Organism/100 ml	17%[a]
Nitrates	10 mg/l	7
Volatile Organics	Varies by Compound	0[b]
Chloride	250 mg/l	1
Sulfate	250 mg/l	8
Iron	300 ug/l	53
Manganese	50 ug/l	46
Dissolved Solids	500 ug/l	21

Source: *Ground Water Quality Monitoring Program: An Appraisal of Minnesota's Ground Water Quality*, Minnesota Pollution Control Agency, Division of Solid and Hazardous Waste (June 1985) p. 3.

[a]Standard is for fecal coliforms, one of several types of coliform bacteria.

[b]EPA has not set drinking water standards for most volatile organics, with the exception of trihalomethanes, which did not exceed standards at these stations. The presence of volatile organics was detected in 10 percent of the samples tested.

Volatile organic chemicals were detected in 10 percent of the samples but did not exceed standards.[13] However, as we noted in Chapter 3, EPA has not yet determined drinking water standards for many volatile organic substances.

The ambient ground water monitoring program does not suffer from the same reliability problems as PCA's routine surface water monitoring program because ground water is more stationary than surface water. PCA maintains that its ambient ground water monitoring program is useful for determining "normal" levels for comparison with specific contamination problems. However, we cannot be certain that the samples are representative of the state's water quality as a whole or even of the major aquifers from which they were obtained, because so few wells have been sampled.

[13]In 1985, the Legislative Commission on Minnesota Resources provided funds for an MDH study of volatile organic compounds in about 1,800 community drinking water supplies. Volatile organics were detected in 109 (eight percent) of the community supplies. Concentrations were generally low. These results are consistent with PCA findings. See *Volatile Organic Survey of Community Water Supplies*, Minnesota Department of Health, July 1985.

PCA has recently begun to describe ground water quality conditions in the major geologic regions of the state. For example, it recently published a joint report with the Department of Natural Resources on ground water characteristics in the central sand plain region of Minnesota.[14] The report discusses the consequences of land use and irrigation practices on ground water quantity and quality.

We believe that focusing on more in-depth studies in specific areas where problems are known or suspected is a shift in the right direction. Sampling water from a few widely scattered locations has little relevance for identifying and addressing ground water pollution problems. On the other hand, focusing on water quality conditions in specific areas of the state where ground water problems are believed to exist, or on specific contaminants believed to be a problem, allows PCA to gather information about the sources of those problems and develop strategies to solve them. The resulting information can then be applied to other areas with similar problems and geologic conditions.

7. Conclusions

PCA has instituted a process of issuing permits to sanitary landfills and hazardous waste facilities and requiring them to install useful ground water monitoring systems. However, many landfills have not yet installed new monitoring wells and many landfills are behind in submitting water quality monitoring reports. In addition, PCA does not independently verify the results of most of the reports it receives. We also found that there is virtually no monitoring of ground water near open dumps or underground storage tanks, two important sources of ground water contamination.

D. LABORATORY QUALITY CONTROL

We have already discussed our concern over wastewater treatment plants and landfills being responsible for their own water quality monitoring. We noted that PCA loses some control over the monitoring activities of its permit holders, and we suggested that PCA make greater efforts to check the accuracy of the reports it receives. These problems are especially evident in the laboratory analyses conducted by independent uncertified labs. In this section, we discuss our concerns and suggest a framework for greater quality control in laboratory analyses. We asked:

- Does PCA have sufficient controls to ensure the accuracy of laboratory analyses of water samples from facilities which have permits?

Most industrial and large municipal wastewater treatment facilities have their own laboratories and perform their own water quality analyses. Smaller municipalities generally contract with private, independent laboratories. Landfills also contract with private laboratories for ground water analysis. PCA does include certain quality control factors in its permit requirements to reduce the chances for inaccurate analyses. However,

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[14] *Land Use and Your Well: From the Field to the Faucet in Minnesota's Central Sandplain Region*, Minnesota Pollution Control Agency and Minnesota Department of Natural Resources, Division of Waters (1986).

- PCA is limited in its ability to enforce standards of quality control in private laboratories because there is no state program to certify the labs.

There are many potential sources of error when water samples are analyzed. One source is the collection of the sample itself. This is especially a problem for ground water analysis. Steps have to be taken to ensure that the sample is not contaminated by the monitoring well, or by the process of drawing the sample from the ground. For all samples, the water must be handled properly and the sampling must be done under the right conditions.

Handling of the sample in the laboratory is also important, to ensure that samples are stored and labeled properly. Laboratory equipment must be maintained and sanitized, to protect against false findings from residues left from previously analyzed samples. Laboratory techniques themselves are complex, requiring sophisticated equipment and extensive staff training. This is especially true for volatile organic compounds typically found at landfills, which must be detected in parts per billion. Finally, laboratories may intentionally falsify data. For example, one laboratory which contracted with several small municipal wastewater treatment facilities was submitting data to the facilities without actually analyzing water samples. PCA uncovered this when it noticed that identical reports were being submitted from several facilities. The laboratory has since closed.

Important decisions costing thousands of dollars and affecting the health of Minnesota's citizens are made on the basis of monitoring results. For example, the failure to detect a cancer-causing substance near a landfill may result in preventable deaths and illnesses. Conversely, a positive finding of a cancer-causing substance near a landfill may launch an expensive superfund investigation. Inaccurate results from a municipal or industrial wastewater treatment facility may result in the deterioration of a stream or lake and the destruction of fish and wildlife. Findings that effluent levels exceed permit conditions at a municipality may prompt an expansion or modification of the facility. Therefore, it is important that PCA receive accurate and dependable laboratory results from regulated facilities.

A 1978 American Chemical Society study of 161 Minnesota laboratories revealed serious deficiencies in their standards and accuracy.[15] Only 65 percent of the laboratories had at least one individual with a college degree, and that degree was not always in chemistry. Only 41 percent had a formal quality control program.

In the study, water samples prepared by the Minnesota Department of Health were given to 55 of the laboratories. The study found that results were not within the acceptable ranges for about 30 percent of the analyses. It is important to note that the analyses were conducted under optimum conditions. The samples were prepared with distilled water and reagent chemicals with no known interferences present. Laboratories were informed of the study's purpose and samples were identified according to the category of substance present. Participation was voluntary, so it is likely that the 55 participating laboratories (35 percent of the those studied) were among the more conscientious of the total sample. Finally, the study was conducted before the discovery of water contamination by volatile organic compounds, which must be detected in very small amounts using sophisticated equipment and methodologies. Thus, it is probable that a study today of the same types of laboratories would reveal continued problems.

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[15] *An Assessment of the Credibility of Data from Water and Wastewater Laboratories*, Minnesota Section, American Chemical Society, undated.

Some steps have been taken to improve quality control in uncertified laboratories. The Environmental Protection Agency (EPA) has a program, originated in 1979, in which known samples of water are submitted for analysis to major municipal sewage treatment plants. Analysis is performed in the municipal plants' laboratories and the results mailed to EPA. EPA then sends reports to PCA and all participating facilities informing them of the accuracy of their analyses and suggesting possibilities for improvement.

A summary of the laboratory accuracy in identifying known samples is presented in Table 4.5, which indicates that Minnesota's laboratories are somewhat less accurate than other labs in the region and the nation as a whole. The table shows an improvement since 1980 in the percentage of laboratories which acceptably analyze all samples submitted to them in the EPA test. In Minnesota, this percentage has grown from 33 percent in 1980 to 49 percent in 1985.

TABLE 4.5

ACCURACY OF LABORATORY ANALYSES
AT MAJOR MUNICIPAL SEWAGE TREATMENT PLANTS

	Percent of Analyses Within Acceptable Limits			Percent of Permittees With 100% Acceptable Data		
	Minnesota	Regional[a]	National	Minnesota	Regional[a]	National
1980	80%	74%	74%	33%	25%	32%
1982	82	77	79	54	38	42
1983	81	82	83	49	43	50
1984	87	84	85	55	50	55
1985	82	83	85	49	50	56

Source: John M. Davenport, *Discharge Monitoring Report Quality Assurance Status Report*, Minnesota Pollution Control Agency, Division of Water Quality (August 1986).

[a]EPA Region V includes Minnesota, Wisconsin, Illinois, Indiana, Michigan and Ohio.

In conjunction with the EPA program, PCA staff periodically visit municipal treatment plant laboratories and review their quality control procedures. These inspections examine facility conditions, equipment, and employee training and check to make sure that laboratories use prescribed analytical methods. Twenty-three facilities were visited in FY 1986 and PCA plans to visit an additional 25 in FY 1987. PCA reports that most of the observed problems involve personnel. Laboratory analysts are usually treatment plant technicians, not chemists. Most municipal treatment plants do have adequate facilities and equipment to conduct the analyses.

Although this program is valuable in assessing laboratory procedures and accuracy, it is limited in its ability to improve accuracy and institutionalize a meaningful quality

control process. PCA recommends quality control improvements to treatment plant operators, but does not check to see if the improvements are made. In addition, industrial plants and independent laboratories have not been included in this program, nor is there a corresponding program for laboratories which analyze ground water for landfills.

Both NPDES and solid waste permits require that facilities submit laboratory quality control plans. In the case of NPDES permits, PCA's Water Quality Division does not systematically analyze the plans or check to see that they are implemented. For solid waste permits, the Solid and Hazardous Waste Division has been requiring that newly permitted facilities (and facilities updating to five-year permits) include a laboratory quality control plan. The plan must deal with sampling methods and protocols, laboratory procedures, and methods to assess the reliability of laboratory results. The latter includes the analysis of duplicate or split samples to ensure consistency of results and the analysis of samples of distilled water to ensure that positive results do not result from contaminated laboratory equipment.

Since the division is in the process of reissuing permits and upgrading water quality monitoring systems at landfills, it is only now receiving laboratory quality control plans. PCA staff report that submitted plans have not been adequate, indicating that laboratories are not sufficiently versed in quality control procedures or do not wish to make the effort to put together a good plan.

We think the Solid and Hazardous Waste Division's requirement for laboratory quality control plans is a step in the right direction. However, it does not go far enough. A method should be established to ensure that independent laboratories are actually implementing effective quality control procedures and that the procedures result in accurate data. We believe that these requirements should also be imposed upon laboratories serving NPDES facilities. PCA is the major state agency consumer of outside laboratory analyses; therefore, we recommend:

- PCA should initiate the establishment of a state certification program for laboratories.

As a first step, PCA and MDH should establish a state agency working group including Agriculture, DNR, and any other interested agencies to investigate laboratory certification. MDH has also recognized the need for lab certification and has expressed an interest in running a certification program. Since MDH already certifies clinical labs it may be the best administrator of an analytical lab certification program.

Whatever the administrative agency, a certification program should require that laboratories:

- Have an approved quality control program.
- Submit to annual inspections of equipment and facilities and a review of personnel training and analytical procedures.
- Promptly correct any deficiencies that are observed.
- Achieve satisfactory results on analyses of prepared water samples.
- Lose their certification if they fail to meet these standards.

The agencies may discover other benefits from a laboratory certification program. One example might be the ability to contract for services when state laboratories cannot adequately handle their workload. This is an especially important consideration in light of the increased laboratory analyses called for by the 1986 amendments to the Safe Drinking Water Act.

PCA staff note that some better independent laboratories already have quality control procedures. In fact, some Twin Cities laboratories participate in a voluntary program analyzing substances prepared by MDH. For these laboratories, a certification program should be welcome. A certification program should allow further improvement in quality control efforts and require inferior laboratories to meet acceptable standards.

A considerable amount of money is spent on water quality monitoring in Minnesota and the results of the analyses have important consequences for protecting human health and the state's water quality. It is important that decisions on these matters be based on accurate data. The best way to ensure accuracy is to require laboratories to demonstrate their ability to perform those analyses.

E. NON-POINT SOURCE POLLUTION

Non-point source pollution is diffuse pollution resulting from land use practices. It includes both agricultural and urban runoff. Major non-point sources of pollution include fertilizer and pesticide use; runoff from animal feedlots; runoff from urban streets, yards, and construction sites; runoff from mining, forestry, and other industrial sites; road de-icing activities; seepage from septic systems; infiltration of ground water from abandoned and unsealed wells; and excessive soil erosion due to a variety of urban and agricultural land use practices. These sources of pollution are widespread. No single source makes a significant contribution to water pollution, but collectively, non-point sources are now the major contributor to water pollution.

Until recently, PCA has concentrated its efforts on reducing pollution from point sources. PCA's Water Quality Division has focused on eliminating pollution from municipal sewage and industrial waste. Its Solid and Hazardous Waste Division has focused on reducing pollution from landfills and hazardous waste sites and cleaning up pollution from past disposals of hazardous waste. Much of PCA's staff time has been spent investigating site-specific pollution events. However,

- PCA has not implemented a program to deal effectively with non-point source pollution.

PCA's regulatory oversight approach is not well suited to controlling non-point source pollution. There are simply too many farms, too many septic tanks, too many roads, and too many construction sites to oversee.

For example, PCA administers an animal feedlot permit program for Minnesota farmers. Owners of feedlots holding at least ten animals must receive a permit or a certificate of compliance from PCA. However, out of approximately 90,000 feedlots in Minnesota, only about 15,000 have applied for permits. PCA states that it does not have the resources to inspect all feedlots or even enforce the requirement that they obtain permits. Water quality near or under feedlots is not routinely monitored. PCA's efforts have been

focused on responding to complaints and reacting to reported problems. PCA has delegated feedlot permitting responsibilities to 22 counties and is trying to enlist the participation of others. This experience is noteworthy because it is one of the only permit programs related to non-point source pollution in Minnesota.

PCA has recently made efforts to address non-point source pollution. In the summer of 1986, PCA reorganized its Water Quality Division into three sections, at least partially to better address non-point source pollution. One section deals with construction grants. A second section focuses on issuing permits and enforcing permit conditions. The third section concentrates on program development. It is responsible for directing the agency's routine monitoring efforts toward a greater concentration on non-point source pollution and developing the agency's approach to the problem.

Prior to the reorganization, no section in PCA had responsibility for dealing with non-point source pollution. The reorganization, if accompanied by a commitment of resources, should enable PCA to deal more effectively with non-point source pollution.

The Non-point Source Pollution Issues Team, which includes representatives of PCA and other state, federal, and local government agencies, has recently recommended a non-point source pollution control program focused on public education and local community involvement.[16] The team has recommended that a coordinated state, federal, and local effort is necessary to effectively attack non-point source pollution problems. The team recommends that this coordinated approach focus on:

- Using existing programs and resources where possible.
- Ongoing research and water quality monitoring.
- Public information and education.
- A combination of financial and technical assistance and regulatory incentives to induce individuals to adopt land mangement practices that reduce pollution.
- Evaluation of the effectiveness of specific efforts to reduce non-point source pollution.

The issue team recommends that non-point source pollution abatement efforts concentrate on special projects to reduce high-priority existing problems. For example, funds would be appropriated to local units of government to improve lakes, streams, and aquifers degraded by non-point sources of pollution. A second focus should be the promotion of land use management practices that reduce the likelihood of pollution. The issue team recommends that PCA, working through the Environmental Quality Board's Water Resource Committee, provide overall coordination of programs and activities and evaluate their effectiveness in reducing non-point source pollution.

In conjunction with this effort, the issues team recommends that a Minnesota Clean Water Partnership Program be established. The program would provide 50 percent matching grants to local units of government to identify water quality problems caused by non-point source pollution and implement programs to protect water quality. The program would provide technical and financial assistance to communities with critical water quality

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[16] *Nonpoint Source Pollution Issues Team Report*, November 1986.

problems. PCA is requesting that $5 million be appropriated per year from the Public Health Fund[17] to support this program.

It is beyond the scope of our study to review all of the elements of the Non-point Source Pollution Issue Team's recommendations. In general, it is our view that the issue team has taken a sound approach to controlling non-point source pollution. We also agree that PCA, charged with protecting the state's water quality, is the proper agency to coordinate and oversee the effort. In order to accomplish this, PCA will need to redirect its traditional focus on point source pollution towards a greater concern with non-point sources. We also believe that there needs to be greater interdivisional coordination and cooperation within PCA to successfully carry out its non-point source pollution responsibilities. PCA has separate divisions for dealing with surface and ground water issues. Non-point source pollution, however, affects both ground and surface water. PCA should make sure that its non-point source efforts bridge this organizational division of responsibilities so that an integrated effort is possible.

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[17]Revenue for this fund comes from taxes on cigarettes. See Laws of Minnesota, 1985, First Special Session, Chap. 14, Art. 19, Secs. 28, 37.

OTHER MONITORING PROGRAMS

Chapter 5

A. INTRODUCTION

In this report we have concentrated on the monitoring programs of the Pollution Control Agency and the Minnesota Department of Health. Although those programs are the largest water quality monitoring programs, they are by no means the only ones. In this chapter, we review the activities of the Minnesota Department of Agriculture and the Department of Natural Resources. Other agencies that monitor water quality are discussed in Appendix A.

B. DEPARTMENT OF AGRICULTURE

The Minnesota Department of Agriculture (MDA) has two regulatory responsibilities that relate to water quality. First, MDA regulates the use and distribution of agricultural chemicals which may contaminate drinking water supplies. Second, MDA regulates agricultural products to ensure that water used in food production is safe.

We examined MDA programs to determine if all required water monitoring is being conducted. We focused on the following questions:

- Does MDA have an adequate program for detecting agricultural chemicals in the state's ground water?
- Does MDA have adequate procedures to ensure the safety of well water used in dairy and food processing?

MDA has three divisions directly involved in water quality monitoring activities. The Dairy Division monitors water quality on dairy farms; the Food Inspection Division monitors water quality at food production facilities; and the Agronomy Services Division monitors water quality relating to agricultural chemicals. The Laboratory Services Division analyzes water samples taken by the other divisions. Table 5.1 shows how much MDA spent on water quality monitoring in 1986.

First, we discuss MDA's Agronomy Services Division, which regulates agricultural chemical use in Minnesota. Agricultural chemicals, primarily fertilizers and pesticides, have

TABLE 5.1

DEPARTMENT OF AGRICULTURE EXPENDITURES
FOR WATER QUALITY MONITORING
Fiscal Year 1986

Division	Salary Expenditures	Laboratory Expenditures	Travel and Supplies Expenditures	Total Expenditures
Dairy	$ 12,420[a]	$ 29,176	$ 0	$ 41,596
Food Inspection	4,011[a]	23,922	0	27,933
Agronomy Services[b]	197,466	66,614	93,000	357,080
Agency Total	$213,897	$119,712	$93,000	$426,609

Source: Minnesota Department of Agriculture.

[a]Based on estimates of the proportion of time devoted to water quality monitoring.

[b]Includes inspections of storage facilities, investigation of spills of pesticides and fertilizers, and the department's share of the LCMR-funded pesticide monitoring study.

been found in ground water and pose potential health risks if consumed by humans. They are used extensively in Minnesota by farmers to increase crop yields and by homeowners to protect gardens and improve lawns.

1. Pesticides

Pesticides are chemicals added to the environment for the purpose of killing or regulating some kind of life. There are about 40-45,000 individual pesticide products in use nationwide with about 600 different active ingredients. These products include agricultural herbicides and insecticides and household sanitizers, fungicides and rodenticides.

Certain pesticides can leach through the soil and contaminate the ground water. The degree to which ground water contamination occurs depends on the depth of the water table, the permeability of the soil, and other geologic conditions. It also depends on the characteristics of the pesticide. Some pesticides degrade rapidly, before they reach the ground water, while others degrade slowly and do contaminate ground water. To date, pesticide contamination from agricultural practices has been found in the ground water of at least 23 states.[1]

[1]See S. Z. Cohen, C. Eiden, and M. N. Lorber, "Monitoring Ground Water for Pesticides", in Willa Y. Garner, Richard C. Honeycutt, and Herbert N. Nigg, ed., *Evaluation of Pesticides in Ground Water*, American Chemical Society (April 1986).

a. Dangers of Pesticide Contamination

It is difficult to get direct evidence on the health effects of most pesticides. Most of the evidence comes from laboratory studies of animals. These studies suggest that many pesticides are associated with increased risks of cancer, reproductive abnormalities, damage to fetuses, surpressed immune systems, and gene mutation.

The effects of pesticides on humans are inferred from the animal data and from a few comparative studies of human populations. For example, a study by the National Cancer Institute found that farmers who used the pesticide 2,4-Dichlorophenoxyacetic acid (2,4-D) had a higher incidence of non-Hodgkins lymphoma, a type of cancer, than those who did not.[2] Higher incidences of non-Hodgkins lymphoma have also been associated with other pesticides in Minnesota, Kansas, Iowa, and Nebraska. A study of Wisconsin women found that those whose water came from private wells with low levels of the pesticide aldicarb in their drinking water supplies were more likely to have had suppressed immune systems than those whose wells did not contain aldicarb. A study in California found higher rates of death from stomach cancer and lymphoid leukemia among agricultural workers exposed to the pesticide DBCP than those not exposed.[3]

In addition to the direct dangers of pesticide contamination to human health, pesticides can break down into other substances which may pose health risks. This may occur naturally, as pesticides filter through the soil. The extent of water contamination from pesticide breakdown products is not yet known, although some breakdown products have been found in other states. In general, significantly less is known about the chemical characteristics and toxicity of breakdown products than about the pesticides themselves. Nevertheless, the potential health hazard from breakdown products should not be overlooked.

b. Regulation of Pesticides

The Federal Insecticide, Fungicide, and Rodenticide Act[4] authorizes the U.S. Environmental Protection Agency (EPA) to regulate pesticides and their uses. The law allows EPA to delegate many of the administrative responsibilities to the states. All pesticides must be registered with EPA, which conducts tests of their safety. A report by the

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[2]Sheila Hoar, *et al.*, "Agricultural Herbicide Use and the Risk of Lymphoma and Soft-Tissue Sarcoma", *Journal of the American Medical Association*, Vol. 256, No. 9, (September 1986).

[3]Aaron Blair, "Increased Risks of Leukemias and Non-Hodgkins Lymphomas Among Farmers? Case Studies in Minnesota, Iowa, and Kansas"; Michael Fiore, "Aldicarb Contaminated Groundwater and the Effects on Human Immune Function"; Richard Jackson, "An Epidemiological Comparison of Patterns of DBCP Drinking Water Contamination: A California Case Study"; all papers presented at "Pesticides and Groundwater: A Health Concern for the Midwest", Radisson Hotel, St. Paul (October 1986). See also Leon Burmeister *et al.*, "Selected Cancer Mortality and Farm Practices in Iowa", *American Journal of Epidemiology*, Vol. 118, No. 1 (1983); and Aaron Blair and Deborah Whitte, "Leukemia Cell Types and Agricultural Practices in Nebraska", *Archives of Environmental Health*, Vol. 40, No. 4 (July/ August 1985).

[4]P.L. 92-516, as amended.

General Accounting Office noted, however, that EPA cannot adequately test for all of the existing pesticide products, much less evaluate the safety of new products coming on the market.[5]

MDA registers the approximately 7,500 pesticides used in Minnesota. In addition to registering pesticides, the department samples about 250 products a year off the shelves and checks them for label accuracy. MDA also licenses pesticide applicators and annually inspects facilities to ensure proper storage, handling, mixing, and disposal of pesticides.

The department responds to pesticide spills and to complaints about pesticide misuse, such as a pesticide intended for one field drifting over to someone else's property. MDA reports that it responded to 191 complaints in the year ending September 30, 1985. Most of the complaints concerned pesticide drift. Other complaints concerned label inaccuracies and improper performance of applicators, such as failure to perform services, spraying the wrong field, and improper disposal of pesticide residue. MDA cited 80 violations which resulted in 42 formal actions, including stop-sale orders, informal hearings, applicator license suspensions, and referral to county attorneys for criminal prosecution. MDA does not have authority to levy civil penalties.

MDA is proposing legislation to significantly strengthen regulatory controls over pesticide distribution and use, including the authority to issue civil penalties. MDA states that criminal prosecution is ineffective because county attorneys assign low priority to these cases and are reluctant to prosecute.

The department is also requesting an increase of $430,000 in its appropriation for the the FY 1988-89 biennium to carry out its regulatory responsibilities in the face of increasing numbers of pesticides, pesticide applicators, and complaints about pesticide misuse. MDA proposes to fund this expanded program with an increase in license and registration fees for pesticide dealers and applicators.

c. Monitoring for Pesticides

Despite the concern that pesticides may impose significant health risks,

- Minnesota has no regular program to monitor pesticide contamination of ground water.

MDA reports that it does monitor both soil and water at problem sites, where spills occur. However, neither MDA nor any other state agency has implemented a program for routine monitoring for pesticides, in spite of the fact that pesticides were first detected in ground water in other states in the late 1970s.

The Legislative Commission on Minnesota Resources has provided funds to MDA and the Minnesota Department of Health for a joint two-year (1986-1987) research study of pesticide contamination in ground water. The department has been sampling water from shallow aquifers near fields with known pesticide use. MDA's monitoring wells are concentrated in the central sand plain and in southeastern Minnesota, where geologic conditions make ground water most vulnerable to contamination.

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[5] *Pesticides: EPA's Formidable Task to Assess and Regulate Their Risks*, U.S. General Accounting Office (April 1986).

Table 5.2 reports preliminary results from MDA's monitoring wells. It indicates that the pesticide atrazine was found in 36 percent of the water samples. Other pesticides were found less frequently.

TABLE 5.2

PRELIMINARY FINDINGS OF PESTICIDES IN WELL WATER[a]

Pesticide	Percent of Wells With Pesticides Found	Highest Level Found (parts per billion)	Guideline Action Levels (parts per billion)[b]
Atrazine	36%	42.40	260
Alachlor	5	2.81	10
Metribuzen	2	0.78	175
Dicamba	1	0.78	87
Aldicarb	1	30.60[c]	9
Simazine	1	2.58	350
Terbufos	1	0.63	N/A

Source: Minnesota Department of Agriculture, Agronomy Services Division.

[a]Based on samples taken mainly during the spring and summer of 1986.

[b]Guideline action levels established by MDH's health risk assessment group, based on the best information available on the chronic long-term effects of consuming these substances. Levels subject to change as new information becomes available.

[c]Found in one sample from a well that does not supply drinking water.

So far the joint study has found that a majority of the private wells (52 percent) and significant proportions of monitoring wells and public drinking supplies (38 percent and 25 percent, respectively) had detectable amounts of pesticides. Overall, measurable amounts of pesticides were detected in 38 percent of the wells. In most cases, the levels were below federal or state drinking water standards. As we noted above, however, the effects of long-term exposure to low levels of pesticides are unknown at this time.

Pesticide monitoring programs have been implemented in Wisconsin and Iowa. In Iowa, a statewide program has been in effect for several years. The University of Iowa Hygienics Laboratory, the Iowa Geological Survey, and the U.S. Geological Survey have been engaged in systematic monitoring of private wells and public drinking supplies. They conclude that about 40 percent of the wells, serving about 27 percent of the state's population, contain low concentrations of pesticides.[6]

[6]Richard Kelley, presentation at "Pesticides and Groundwater: A Health Concern for the Midwest", Radisson Hotel, St. Paul, Minnesota (October 1986).

The Iowa Department of Natural Resources has been monitoring ground water to determine those areas most susceptible to pesticide contamination. It has found particularly high percentages of pesticide contamination in northeast Iowa, an area similar to southeast Minnesota in that it is dominated by shallow aquifers and sinkholes.[7] A February 1986 sampling indicated that 40 percent of the wells in areas dominated by shallow aquifers and 92 percent of the wells in areas characterized as karst topography (where sinkholes are prevalent) have detectable levels of pesticides. Nitrate levels were also found to be high and exceeded drinking standards in many wells.[8]

Pesticides were first discovered in Wisconsin's ground water in 1981. Aldicarb, a pesticide heavily used in the central sand plain area of Wisconsin, was detected in 13 of 116 sample wells. In five of the wells, the level of contamination exceeded EPA's advisory level of ten parts per billion. Wisconsin found other pesticides in its ground water in 1982. As a result, a program was implemented to identify pesticides used in the state and identify areas susceptible to ground water contamination. Well monitoring is an important part of this program. As a result of these early efforts, Wisconsin has set up its own ground water standards and budgets about $130,000 annually for pesticide monitoring.[9] Wisconsin is also considering more stringent standards for commonly used pesticides.

Minnesota is behind its neighboring states in developing a pesticide monitoring program. The LCMR-funded study has documented that a problem exists. Now Minnesota needs to further define areas of the state and additional pesticides that might present problems, and also to investigate other forms of pesticide contamination (such as that caused by urban runoff). More information is also needed on the extent to which pesticides break down into other toxic substances. Finally, a better understanding of the movement of pesticides through the soil to the ground water is needed. Overall, we conclude:

- Minnesota needs a regular pesticide monitoring program.

Such a program should be integrated among agencies, with methods developed for sharing and coordinating data. We recommend that MDA develop a formal interagency agreement with PCA and the Department of Health that defines responsibilities and provides for coordinated activity. A pesticide monitoring program should lay the groundwork for determining pesticide use standards and developing necessary regulatory policies.

MDA is proposing an increase in its appropriation of $470,000 for the FY 1988-1989 biennium to establish a ground water monitoring program for pesticides and fertilizers. The program will monitor the movement of pesticides and fertilizers in ground water. The department hopes to use the knowledge gained about ground water contamination to improve its management of agricultural chemical use.

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[7]Iowa's Department of Natural Resources is proposing to the 1987 Iowa Legislature a $236 million, ten-year program to protect water suplies from pesticide and other ground water contamination.

[8]George Hallberg, presentation at "Pesticides and Groundwater: A Health Concern for the Midwest", Radisson Hotel, St. Paul, Minnesota, October 1986. See also, George Hallberg, "Nonpoint Source Contamination of Groundwater by Agricultural Chemicals", presented to the U.S. Senate Committee on Environment and Public Works, Subcommittee on Toxic Substances and Environmental Oversight (December 12, 1985).

[9]Kevin Kessler, presentation at "Pesticides and Groundwater: A Health Concern for the Midwest", Radisson Hotel, St. Paul, Minnesota (October 1986).

2. Fertilizers

MDA regulates the storage of fertilizers in Minnesota. There are about 650 liquid and 650 dry storage facilities, some at the same location. Any new facility or expansion requires a permit. All existing facilities are on a schedule to be issued permits by 1989. Facilities are observed and products sampled twice per year, and a complete inspection takes place at least once every three years.

From a pollution standpoint, fertilizer use is associated with excessive levels of nitrates in ground water. Despite this concern, there are no restrictions on the amount of fertilizer used by farmers and homeowners. The presence of nitrates in community drinking supplies is monitored by the Department of Health. As noted above, food processing wells are tested for nitrates but dairy farms are not. Nor is there any regular testing of private drinking wells.

3. Dairy Farms

MDA's Dairy Division monitors water quality to ensure that the water used in the production of dairy products is safe for human consumption. Quality standards are different for Grade A dairy farms, which produce milk for direct consumption, than for Manufacturing Grade farms, whose milk is used for processing into other dairy products, such as cheese or butter.

a. Grade A Dairy Farms

MDA tests water supplies from wells on all 10,000 grade A farms in Minnesota for coliform bacteria once every three years. Farms may have the analysis done by MDA or by a certified private laboratory.

MDA inspectors do not inspect a facility unless an up-to-date water quality report is on file. Since annual inspections are required for license renewals, failure to test for water quality will result in nonrenewal of a farmer's license.

From a master list provided by the division, we randomly selected 28 Grade A farms and checked to see if water quality reports were being filed every three years. We found that:

- All of the 28 Grade A farms in our sample had their water quality tested for coliform bacteria within the last three years.

Only one of the 28 farms in our sample had a water supply with coliform bacteria at a level exceeding drinking water standards. That well was retested two and one-half months later and was within acceptable limits.

In addition to water quality tests, Grade A farms are inspected for sanitation and operating conditions. We checked to see if MDA was regularly inspecting Grade A farms, and found that all of the Grade A farms in our sample had been inspected within the past six months.

b. Manufacturing Grade Farms

Manufacturing Grade farms may operate with wells that do not meet standards ("unapproved wells") so long as the water is tested annually and is found to be "safe and sanitary".

About 6,000 of the 9,000 Manufacturing Grade farms in Minnesota have unapproved wells. Approved wells are tested every three years and unapproved wells must be tested annually.

From a master list provided by MDA, we randomly checked 47 Manufacturing Grade farms (14 with approved wells and 33 with unapproved wells) to see if water quality reports were being submitted as required. However, because the division was in the process of implementing a new computer system, its records were not current. While we are able to report that all 47 Manufacturing Grade farms in our sample had their water tested within the last three years, we were unable to verify that those farms with unapproved wells had their water quality tested within the past year.

For the most recent tests available, none of the 47 Manufacturing Grade farms had coliform levels exceeding drinking water standards. We also found that all but five of the 47 farms had been inspected within the past year. Although sanitary conditions were unacceptable on two farms, MDA inspectors found no problems relating to water quality.

c. Conclusions

MDA is doing an acceptable job of monitoring water quality on dairy farms. We note, however, that the only monitoring required is for coliform bacteria.[10] There are no water quality monitoring requirements for nitrates or pesticides, substances that have been found in Minnesota's ground water. In view of this, and the harmful consequences to humans if they consume these chemicals, we recommend:

- MDA should evaluate the danger posed by nitrate and pesticide contamination, and determine whether these substances should be included in its water testing program for dairy wells.

4. Food Processing

MDA's Food Inspection Division monitors the quality and proper representation of food, meat, poultry, and beverages sold in Minnesota. The division licenses and inspects 8,500 retail and wholesale food handlers and food processors including custom meat processors, canneries, bottlers, food storage warehouses, bakeries, egg handlers, and retail food establishments. The division inspects private wells serving these facilities, but it does not inspect restaurants or community water supplies, which are handled by the Department of Health or county and local governments.

There are no rules or laws setting well water monitoring requirements for food processors. MDA tries to inspect all supplies at least twice per year but special projects and investigations may disrupt this timetable. Water is tested for the following substances:

- All food processing plants with private wells are tested for coliform bacteria and nitrates.

- Canning factories' and frozen vegetable plants' wells are also tested for pesticides.

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[10]The milk itself must be examined for appearance and color and tested for coliform bacteria, somatic cells, sediments, antibiotics, and abnormal secretions, and may be tested for radionuclides and pesticides.

- Egg processors' wells are are also tested for iron.
- Bottled water factories wells are also tested for pesticides, several organic and inorganic compounds, total dissolved solids, fluoride concentration, radioactivity, and physical characteristics (color, odor, turbidity).

In addition, MDA made a special analysis of nitrates, pesticides, and bacteria in all 19 soft drink bottling plants in Minnesota in October 1986.

We examined a sample of food processors to determine if they were inspected and if water samples were taken. We found that all five bottled water plants, all ten canneries, and 31 of the other 33 food processors in our sample had been inspected at least once during the past year. Inspectors tested water in all of the inspections and no water quality problems were noted. However, the water samples were not all tested for the same contaminants. Water was tested in every instance for coliform bacteria, and some of the facilities were also tested for nitrates and pesticides.

Table 5.3 presents a compilation of all of the water quality samples analyzed by MDA in FY 1986. The table shows that contamination of water supplies above acceptable standards is rare. MDA reports that, as a rule, when it finds unacceptable levels of coliform bacteria or nitrates, it retests the well. If the results of the retest are still positive, MDA asks the firm to rechlorinate the well. If that does not work, the firm is asked to discontinue operations until it can provide a potable supply of water. In all of the FY 1986 cases where contamination was found, the problem was resolved when resampling revealed no contamination, when the food processor discontinued operations, or when new wells were drilled.

TABLE 5.3

WATER ANALYSES CONDUCTED BY FOOD INSPECTION DIVISION

Fiscal Year 1986

Type of Analysis	Number of Samples	Samples Exceeding Standards	
		Number	Percent
Coliform Bacteria	509	27[a]	5.3%
Nitrates	322	8[b]	2.5
Pesticides	30	0	0.0
Iron	16	0	0.0
Total Dissolved Solids	10	1[a]	10.0

Source: Minnesota Department of Agriculture, Food Inspection Division.

[a]Resamplings of these water supplies were all found to be within acceptable limits.

[b]These samples were obtained from three different food processors. Two have gone out of business and one has drilled a new well.

In general, problems cited by inspectors related to equipment and poor sanitary conditions such as dust, mold, or flaking paint near food production lines. Orders were then issued to the plant managers to correct the problem. Inspectors record a facility's failure to comply with orders issued on previous inspections as "second notice". The division reports that a second notice triggers a letter to the facility requesting that its representatives attend a hearing and show cause why their license should not be revoked. The division reports that most letters result in satisfactory actions to correct the violations. However,

- Our review of case files revealed a number of inspection reports with second or third notices, and one report with fifth and sixth notices for several violations. Despite this, only one formal notice of adverse findings was issued among the 47 facilities in our sample.

Accordingly, we recommend that:

- MDA should be more consistent in following its enforcement procedures.

MDA admits that its investigators have been lenient in enforcing corrections of minor violations. It says that its policy has changed and that it will no longer tolerate so many notices for the same violation without taking formal action. The division notes that between January 1985 and October 1986, formal administrative actions were taken against 28 firms. Four facilities were fined and three facilities closed as a result of those actions.

On the whole, MDA is doing an adequate job of testing for water quality in food processing facilities. MDA is conducting regular inspections and takes action when problems are found. However, because there are no rules covering the scheduling of inspections and water quality analyses, not all facilities in our sample were tested for the same substances during the past year.

5. Conclusions

Our analysis concludes that the Department of Agriculture is doing an adequate job of monitoring for the substances it is required to monitor. We are concerned, however, that the current program of testing only for coliform bacteria in dairy wells and bacteria and nitrates in most food processors may not be sufficient to protect the public health, in light of the findings that pesticides and other organic substances are present in Minnesota's ground water. We are also concerned that Minnesota has no regular program of monitoring for pesticides in private and public drinking water supplies. We suggest that such a program be developed.

C. DEPARTMENT OF NATURAL RESOURCES

The Department of Natural Resources (DNR) administers several programs that involve water resource management, but few that require water quality monitoring. The Division of Waters regulates the appropriation of water and protects water resources so that an adequate supply of water is maintained for consumption and recreational uses. The Fish and Wildlife Division works to maintain habitat so that fish and wildlife can survive and propagate. We discuss the DNR programs most related to water quality monitoring below.

1. Division of Waters

DNR's primary water resource responsibility is to ensure an adequate water supply. The Division of Waters does this by issuing water appropriation permits for users of over 10,000 gallons of water per day and regulating activities in and around public waters. This includes issuing permits for construction activities such as ditches, dams, and reservoirs which divert water flow from its natural course. It also includes promulgating rules that govern shoreline activities which cause runoff and erosion and ultimately affect the quality of lakes and streams.

In order to monitor water availability, DNR has cooperated with the U.S. Geological Survey (USGS) in maintaining a network of surface and ground water observation stations. Surface water stations include 22 continuous record flow gauges and varying numbers of partial flow gauges depending on rainfall and flow conditions.

The division has been moving away from reliance on USGS' ground water monitoring stations and has instead been working with soil and water conservation districts to collect water samples from monitoring wells. For the year ended September 1986, DNR's ground water monitoring network consisted of 582 wells including 419 in the soil and water conservation district network, 155 in the USGS network, and eight metro area wells sampled by DNR staff.

USGS provides a 50 percent match for expenses associated with sampling the surface monitoring stations and wells in its network. The remainder of DNR's water monitoring expenses (approximately $175,000 per year) are paid from annual water user reporting fees.

Although the Division of Waters is primarily concerned with water quantity, it has been testing some wells for water quality to better understand the relationship between water use and water quality. Since approximately July 1985, the division has been collecting basic water quality data for 15 wells. These are to be used as baseline data for future projects. Water is currently tested for chlorides, phosphorus, nitrates, nitrites, ammonia, pH, alkalinity, temperature, hardness, and conductivity. Analysis is performed by DNR's laboratory.

DNR has also conducted studies involving water quality programs in several areas of the state. Recently, it has cooperated with USGS in a study of the Anoka sand plain in east central Minnesota. The objectives of the study were to establish a data base to assess long-term changes in the region's ground water quality and to study relationships among climatic conditions, land use, and ground water quality.[11] The Anoka sand plain includes both agricultural and urban areas. DNR hopes to draw some inferences about the relative contributions of agricultural chemicals and urban septic systems to ground water contamination. One hundred wells in east central Minnesota were sampled from one to three times over a two-year period. A final report is expected in June 1987.

DNR's Division of Waters sometimes finds that its decisions about water quantity also affect water quality. Many times decisions to issue permits for diversions of water

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[11]USGS has conducted several studies of surface and ground water hydrology and quality in specific areas of the state. For a description of these studies, see U.S. Geological Survey, *Water-Resources Activities of the U.S. Geological Survey in Minnesota, Fiscal Year 1985*, Open-file report 86-133 (1986).

hinge on the effects that the diversions will have on the receiving waters' quality. So DNR is increasingly involved in monitoring and modeling the effects that changing water quantity has on water quality.

2. Division of Fish and Wildlife

Water quality monitoring is performed by both the Fisheries Section and the Ecological Services Section of the Division of Fish and Wildlife. Fisheries staff annually conduct water quality tests on approximately 500 lakes as part of DNR's lake survey program. The Ecological Services Section conducts the water quality analysis for Fisheries in its laboratory, as well as running a number of other programs related to water quality. Ecological Services' activities include:

- Environmental reviews of fishing lakes and streams.
- Pollution investigations (e.g., fish kills).
- Laboratory analyses.
- Mapping and sounding of lakes.
- Administration of an aquatic nuisance control permit program.
- Lake aeration permit review.
- Studying acid rain in northern Minnesota.

The Ecological Services Section monitors water quality on a sample of fish lakes and conducts ecological surveys on the state's major rivers. For a number of years, the section has monitored water quality in-depth on 15 representative fish lakes. Because of funding cutbacks, DNR is not currently monitoring water quality on those lakes but plans to resume within the next few years.

As we discuss elsewhere, there is currently little integration between DNR's lake management needs and PCA's lake water quality monitoring program. There is also no integrated data management system enabling each agency to use the other's findings.

3. Special Investigations

Since DNR manages over 5 million acres of state parks and forests, it sometimes has to deal with the effects of pollution on state-owned lands. State lands are sometimes used by individuals and companies to illegally dispose of hazardous materials. In addition, lands purchased by the state may include abandoned dumps or other sites used to improperly dispose of hazardous materials. Finally, DNR activities may themselves be the cause of water contamination; leakage of an arsenic-based pesticide commonly known as "grasshopper bait" is one example.

DNR is currently working at three sites on state-owned lands that are on the state's superfund list. Department staff must coordinate monitoring and clean-up activities with PCA and consultants. DNR also investigates reports from its staff and from concerned citizens about possible contamination by hazardous materials.

Staff from the Division of Waters have also conducted inventories of abandoned wells in southeastern Minnesota. DNR found over 120 abandoned wells on its property, but has not yet properly abandoned them. DNR would like to survey more state-owned land for abandoned wells.

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APPENDIX A

AGENCY RESPONSIBILITIES FOR WATER ISSUES

This appendix describes some of the other agencies that play a major role in water resource management and water quality control. The federal government develops and enforces water quality standards and provides technical support and financial assistance to state and local governments. State agencies implement and enforce federal policies and standards as well as specific state programs and policies. There are also several interstate compacts through which states coordinate planning and policies. Many local government units play important roles in implementing federal and state regulations and developing policies and programs to address local water issues. Local governments are also responsible for supplying drinking water and disposing of sewage and solid waste.

A. FEDERAL AGENCIES

1. Environmental Protection Agency

The Environmental Protection Agency (EPA) has major responsibility for enforcing federal water pollution laws. EPA develops standards for discharge of pollutants into surface waters and for determining when water is safe to drink. The agency also plays an important role in protecting ground water from contamination by regulating the storage and disposal of solid and hazardous wastes and the manufacture and use of pesticides. In order to receive federal funds for most pollution control programs, states must, at a minimum, adhere to EPA standards. Finally, EPA oversees administration of the federal superfund law which provides for the cleanup of pollution resulting from hazardous waste disposal.

a. Wastewater Treatment

Discharge of untreated (or inadequately treated) municipal sewage and industrial waste into lakes and streams is a major source of surface water pollution. To reduce pollution from these "point sources", Congress passed the Federal Water Pollution Control Amendments of 1972 (also called "The Clean Water Act"). These amendments provided federal assistance for area waste treatment research and planning and construction grants for up to 75 percent of the cost of waste treatment works.[1] EPA designates state agencies to administer construction grants and regulate the activities of wastewater treatment plants. In Minnesota, the Pollution Control Agency is the designated state agency for administering these programs.

States must file regional waste treatment management plans with EPA that provide for control of all point and non-point sources of pollution. The annually updated plans must establish construction priorities and regulatory mechanisms to control pollution.

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[1] P.L. 92-500. Federal support has since been reduced to 55 percent of the construction costs. Minnesota has a separate state grants program that provides up to 50 percent of construction costs for facilities not receiving federal grants.

EPA is responsible for establishing standards for the discharge of effluents from point sources into surface waters. To aid in this task, EPA conducts research on the effects of different types of pollutants under different types of conditions. States are required to submit bi-annual reports to EPA on their progress in meeting these standards and the overall level of the state's water quality. States may adopt their own standards or requirements so long as they are at least as stringent as EPA's standards.

EPA is responsible for overseeing the administration of the National Pollutant Discharge Elimination System (NPDES). NPDES is a mechanism to improve the nation's water quality by requiring all industrial and municipal dischargers of effluent into surface waters to obtain a discharge permit. Each permit contains effluent standards, plant operating requirements, and enforcement procedures to ensure that effluent standards are met. Designated state agencies may administer the NPDES program according to EPA guidelines.[2]

b. Drinking Water

Polluted water poses a threat to human health. The Safe Drinking Water Act of 1974 requires EPA to establish national primary drinking water standards and maximum contaminant levels, which may be revised as new evidence becomes available.[3] The presence of contaminants in public water supplies in excess of these standards requires treatment of the water supply to reduce the contamination to an acceptable level.[4] Congress passed significant amendments to the Safe Drinking Water Act in 1986. These amendments require EPA to accelerate its program for establishing primary drinking water standards.

States that have adopted drinking water standards at least as stringent as federal standards and have adequate procedures to enforce those standards may be delegated primary responsibility for enforcing federal regulations and standards. In Minnesota, the Department of Health is the designated agency for enforcing safe drinking water standards.

EPA makes grants and loans for up to 75 percent of state expenditures for carrying out public water system supervision programs. Grants may also be made for carrying out ground water protection programs and for special studies and demonstration projects designed to improve technologies for providing safe drinking water.[5]

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[2]In Minnesota, the Pollution Control Agency has been authorized to administer NPDES permits.

[3]P.L. 93-523.

[4]U.S. Code, Title 42 §300g-1. Primary drinking water standards refer to standards affecting the public health, such as setting maximum levels for substances believed to cause disease or death. This is contrasted with secondary drinking water standards which related to physical characteristics of water such as color, odor, hardness, turbidity, etc.

[5]U.S. Code, Title 42 §§300j-2, 300j-3. The 1986 amendments established new grant programs including grants for state plans to protect aquifers which are the sole source of a community's drinking water supply (Title II §203) and grants to protect wellhead areas from contamination (Title II §205).

c. Pesticides

Pesticide use has become an important issue in water quality control because it has been identified as a potential source of ground water pollution. The Federal Insecticide, Fungicide, Rodenticide Act of 1972 (FIFRA) gives EPA regulatory authority over the production, distribution and application of pesticides.[6] All pesticides and pesticide production facilities must be registered with EPA. To be registered, a pesticide must be correctly labeled, must be viewed as likely to warrant the claims made for it by its manufacturer, and must not adversely affect the environment.

Applicators of pesticides must be certified. EPA delegates primary enforcement responsibilities to states that have standards at least as stringent as EPA's standards. EPA provides funds for training state enforcement personnel. In Minnesota, the Department of Agriculture is the designated state agency for enforcing pesticide laws.

d. Solid and Hazardous Waste

Disposal of solid and hazardous wastes in landfills or other sites has been recognized as an important source of ground water (and to a lesser extent, surface water) contamination. The Resource Conservation and Recovery Act of 1976 gives EPA responsibility for setting policy and overviewing enforcement of the management of solid and hazardous wastes.[7] EPA establishes standards applicable to the generation, transporting, treatment, storage and disposal of hazardous wastes.[8] All facilities for treating, storing or disposing of hazardous wastes must receive a permit. EPA establishes rules concerning procedures and conditions for obtaining permits.

States may administer permits and enforce EPA regulations if state regulations are at least as stringent as EPA's and if EPA determines that the state provides for adequate enforcement and compliance with hazardous waste regulations. EPA issues grants to states to assist them in developing and implementing their regulatory programs. In Minnesota, the Pollution Control Agency is the designated state agency for issuing solid and hazardous waste disposal permits and enforcing state and federal regulations. EPA may issue civil penalties or bring criminal action against violators of hazardous waste rules.

EPA assists states in preparing solid waste management plans directed towards conserving and reusing materials and converting waste materials to energy, thereby reducing the need to dispose of solid wastes and reducing the potential for pollution. To be acceptable, plans must require that solid wastes be converted to energy or disposed of in sanitary

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[6]P.L. 92-516.

[7]P.L. 94-580. This act was amended and its provision strengthened by Congress in 1984. P.L. 98-616. Solid waste means garbage, refuse, sludge from wastewater treatment plants, animal waste, earthen fill, and other discarded material. Hazardous waste means any refuse, sludge or other solid waste material which may cause an increase in mortality or serious illness or otherwise pose a substantial present or potential hazard to human health or the environment when improperly treated, stored, transported, disposed, or otherwise managed. U.S. Code, Title 42 §6903.

[8]U.S. Code, Title 42 §§6922-6924. The 1984 amendments extended EPA authority to regulating the use and abandonment of underground storage tanks. U.S. Code, Title 42, §6991b.

landfills or in some other environmentally sound manner. States with acceptable plans are eligible for federal grants to assist them in implementing their plans. EPA also makes training and research grants available to state and local governments, educational institutions and other organizations for solid waste management, resource recovery, and development of waste-to-energy technologies.

The programs listed above seek to prevent the pollution by solid and hazardous wastes. The Comprehensive Environmental Response, Compensation and Liability Act (commonly known as the "superfund" law) deals with the release of previously stored or disposed substances to the environment.[9] EPA is responsible for developing and maintaining a national contingency plan for responding to releases of hazardous wastes to the environment. This plan includes determining priorities for cleanup of hazardous waste sites and ranking sites in terms of those priorities. It specifies procedures and techniques for identifying, removing, and remedying releases of hazardous substances.

2. Other Federal Agencies

Although EPA has the major regulatory responsibility for protecting the quality of the nation's waters, other federal agencies operate programs to assist state and local governments with planning and management of water-related problems. In addition, some federal agencies have regulatory responsibilities that, although not directly related to water, include regulations for ensuring the safety of water supplies.

a. Department of Agriculture

The United States Department of Agriculture (USDA) operates several programs that relate to water quality. The Agricultural Stabilization and Conservation Service administers various land use programs to protect and conserve farmlands, wetlands, and forests. The Agricultural Conservation Program provides grants to farmers for up to 75 percent of the cost of environmental protection and conservation programs on their land. The Water Bank Program provides assistance for preservation and protection of wetlands used by waterfowl for nesting and breeding.

The Soil Conservation Service is an agency in USDA that gives technical and financial assistance to farmers and state and local governments to reduce soil erosion and sedimentation, prevent flooding, conserve water, and improve water quality. Grants are typically funneled through soil and water conservation districts. The Farmers Home Administration provides loans to farmers, including loans for soil and water resource improvements. It also provides loans to communities and businesses for water and waste disposal services. Finally, USDA is responsible for inspecting meat, poultry, egg, cheese and other food processing plants. This includes ensuring that water supplies used in food processing are safe.

b. United States Geological Survey

The U.S. Geological Survey (USGS) of the Department of the Interior performs surveys, investigations and research concerning geology, topography, geothermal energy, mineral and water resources, river quality assessment, and water use. USGS produces reports and maps that assist in understanding surface and ground water hydrology. It also conducts

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[9] P.L. 96-510.

special studies of ground water quantity, quality, and flow in specified areas. These reports and studies help state and local agencies manage water use, evaluate the effects of hazardous waste spills and leaks, and locate safe alternatives to polluted public water supplies. USGS and the Minnesota Department of Natural Resources share a network of wells used for monitoring ground water levels.

c. Army Corps of Engineers

The U.S. Army Corps of Engineers regulates all construction projects in the navigable waterways of the United States. It also promulgates regulations governing the transportation and dumping of dredged materials in navigable waters.

The majority of the Corps' responsibilities involve water resource development projects. The Corps plans and builds dams, reservoirs, levees, harbors, waterways and locks to protect areas from flooding, reduce transportation costs, supply water for municipal and industrial use, generate hydroelectric power, create recreational areas, improve water and wildlife quality and protect the shorelines of oceans and lakes. The Corps has primary authority for structures or works affecting navigable waters, for the discharge of dredged or fill material in navigable waters and for the transportation of dredged materials to ocean dumping grounds.

d. Other Federal Programs

The Bureau of Land Management of the Department of the Interior is responsible for managing resource development and mineral exploration on all federally owned lands. Among its responsibilities are managing development on wild and scenic rivers and controlling erosion on public lands.

The U.S. Department of Transportation regulates the interstate transportation of hazardous materials to reduce the occurrence of spills that contaminate the environment. It also operates a centralized national system for reporting unintentional releases of hazardous materials to the environment and enforces equipment and operating safety regulations for the interstate transportation of all materials by pipeline.

The Food and Drug Administration of the U.S. Department of Health and Human Services regulates grade A dairy farms, bottled water and beverage plants, and other types of food processors. Its activities include establishing procedures for inspecting facilities including testing water supplies to ensure they are safe.

The Council on Environmental Quality conducts research, analyzes trends, and makes recommendations to the President on national policies which promote environmental quality.

The Federal Emergency Management Agency is an independent agency which develops and implements plans and procedures related to peacetime and wartime emergencies. It administers the National Flood Insurance Program and works with state and local government officials to effectively manage flood plains to reduce the potential for flooding.

B. INTERSTATE COMMISSIONS AND ASSOCIATIONS

Minnesota belongs to three interstate commissions which play an advisory role in managing water resources, controlling pollution and coordinating development along rivers and lakes which form interstate borders. These are the Great Lakes Commission, the South Dakota-Minnesota Boundary Waters Commission, and the Minnesota-Wisconsin Boundary Areas Commission.[10] These commissions are empowered to conduct studies, collect data and make recommendations relating to such issues as maintaining water quality, reducing erosion, conserving water, restricting land use and development, improving navigation, diverting waters, and controlling flooding. Their recommendations are not binding on state and local government agencies.

There are also several associations among the states sharing water boundaries. Minnesota belongs to the Upper Mississippi River Basin Association, the Missouri Basin States Association and the Red River Water Resources Council. These associations provide communication forums and coordinate joint activities such as lobbying the federal government and applying for federal grants. They have no regulatory or legal authority.

C. STATE AGENCIES

1. Pollution Control Agency

The Pollution Control Agency (PCA) was established by the Legislature in 1967, replacing the existing Water Pollution Control Commission.[11] Its director and nine-member citizen board are appointed by the Governor. PCA is responsible for administering and enforcing all state laws relating to water pollution. It is also responsible for administering several federal programs.

PCA has three programmatic divisions: Air Quality, Water Quality, and Solid and Hazardous Wastes. The latter two have programs for protecting the quality of surface and ground water, respectively. These programs focus on:

- the development of water quality standards,
- the issuance of permits for the discharge of municipal sewage and industrial wastes into state waters,
- regulating the storage and disposal of solid and hazardous wastes,
- monitoring water quality and investigating incidents of pollution,
- cleaning up polluted water,

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[10]Minn. Stat. §§1.21, 1.31, and 114.13.

[11]Minn. Stat. Chap. 116.

- administering federal and state grants, and
- providing assistance to local government agencies in pollution abatement.

PCA's water-related programs are discussed in Chapter 4.

2. Department of Health

The Minnesota Department of Health (MDH) is responsible for ensuring that water consumed by the public is safe. MDH is primarily concerned with drinking water, although it is also responsible for ensuring the safety of swimming pools and public beaches. Whereas PCA is concerned with cleaning up polluted waters and protecting them from further pollution, MDH is concerned with protecting the public health by ensuring the safety of drinking water. Both agencies monitor water quality. PCA's efforts are focused on monitoring water quality near known or suspected points of pollution, such as landfills and municipal sewage treatment plants. MDH's efforts are focused on monitoring the quality of treated water that is consumed by the public. MDH's major water-related programs are described in Chapter 3.

3. Department of Natural Resources

The Division of Waters of the Department of Natural Resources (DNR) is responsible for managing water resources to ensure that an adequate supply of water is available for drinking and other uses.[12] It does this by controlling the appropriation and use of surface and ground water. DNR regulates activities which change the course of public waters, such as construction, repair or removal of dams and reservoirs. DNR is also responsible for maintaining lake levels.

a. Water Appropriation Permits

It is unlawful to appropriate any waters of the state without a permit issued by the Department of Natural Resources. Domestic water supplies serving fewer than 25 persons are exempt from this requirement. More than 5,000 permits are currently held.

b. Protection of Waters

Permits are also required for works in public waters. "Works" includes construction, alteration, removal or abandonment of dams, reservoirs or other waterway obstructions. It includes activities such as excavation, filling in land and putting culverts in a stream. DNR, through the issuance of works permits, tries to preserve bodies of water for fish and wildlife and for public recreation. DNR also has the authority to establish and maintain lake levels.

DNR is responsible for inspecting all dams in the state. There are approximately 1,200 dams in Minnesota. DNR constructs and repairs dams on state-owned property and issues grants to local governments for repairing or reconstructing dams. DNR's regulatory authority overlaps that of the U.S. Army Corps of Engineers, which is responsible for works permits and dam construction on navigable waters. The two agencies have an

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[12]Minn. Stat. Chap. 105.

agreement whereby DNR issues permits for inland waters and lakes and the Corps has jurisdiction on protected navigable waters.

DNR issues permits for drainage of public waters and wetlands. Local governments cannot drain a water body or begin work activity in a body of water until DNR certifies that the body of water is not classified as "public waters" or, if it is public waters, until DNR approves the project. In general, drainage of wetlands to promote agriculture or development is prohibited, unless the benefits from drainage exceed the public benefits of maintaining the wetland.

DNR administers three land use programs. The shoreland management program develops standards and oversees local zoning and development along lake and river shorelines.[13] The flood plain management program oversees development in flood plains of rivers.[14] The wild and scenic rivers program oversees local government regulation of development and recreational activities (such as campsites) along designated "wild and scenic rivers".[15]

c. Fish and Wildlife Protection

DNR is responsible for the management of public waters to benefit fish and wildlife.[16] In this regard, DNR may conduct investigations to determine the status and requirements for survival of any plant or animal species. The Ecological Services Section of the Division of Fish and Wildlife examines the effects of water pollution on fish and wildlife. It monitors water quality and conducts ecological surveys in lakes and rivers. It also investigates the effect of major pollution spills and kills of fish and wildlife. DNR cooperates with PCA and MDH in collecting fish specimens and analyzing them for diseases and the presence of pesticides, mercury, PCBs, and other toxic substances.

4. Department of Agriculture

The Minnesota Department of Agriculture (MDA) is responsible for regulating the use of fertilizers and pesticides. Chemicals contained in fertilizers and pesticides are a source of both ground and surface water pollution. MDA also monitors the water used in dairy and food processing. MDA houses the Soil and Water Conservation Board, which distributes state and federal grants to control erosion and address other local water resource problems.

a. Regulation of Agricultural Chemicals

MDA's Agronomy Services Section regulates agricultural chemicals. MDA regulates fertilizers by issuing permits for storage facilities and inspecting those facilities. MDA also checks that products are properly labeled. Fertilizer use per se is not regulated. Regulation is more stringent in the case of pesticides. MDA registers

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[13]Minn. Stat. §105,485.

[14]Minn. Stat. §§104.01-104.07.

[15]Minn. Stat. §§104.31-104.40; P.L. 90-542; P.L. 92-560.

[16]Minn. Stat. §97.48.

products used in Minnesota, inspects storage, distribution and disposal facilities, and licenses commercial applicators. It takes enforcement actions if pesticides are not properly stored, used or disposed.

b. Dairy and Food Processing Wells

As part of its responsibility for guaranteeing dairy product quality and protecting the public health, MDA's Dairy Division monitors well water used for dairy processing. About 20,000 wells are tested for bacteria on a one-to-three-year schedule. The Food Inspection Division tests wells of food processing firms, such as canneries and bottlers, for bacteria, nitrates and, in some instances, other substances.

c. Soil and Water Conservation

The Soil and Water Conservation Board (SWCB) is composed of twelve members, including seven soil and water conservation district supervisors selected by the Governor, the deputy vice president of the University of Minnesota Institute of Agriculture, Forestry and Home Economics, the director of the University of Minnesota Agricultural Extension Service, the director of the Pollution Control Agency and the commissioners of the departments of Natural Resources and Agriculture. SWCB is responsible to the Commissioner of Agriculture.[17]

The responsibilities of SWCB include disbursing both state and federal grants to soil and water conservation districts to prevent and control erosion, sedimentation, pollution and other water resource problems. SWCB provides technical assistance, facilitates the interexchange of ideas, and develops research and public information programs on soil erosion, sedimentation, agriculturally related pollution, water conservation practices, and flooding.

SWCB grant programs include:

- federal cost sharing grants for erosion control administered by the U.S. Agricultural Stabilization and Conservation Service,
- general purpose grants for administrative and technical support to soil and water conservation districts, including training and public education programs,
- the Reinvest in Minnesota Program for purchases of highly erodable marginal cropland to remove those lands from production, thereby reducing erosion and protecting water quality,
- cost sharing grants to individual land occupiers for up to 75 percent of the cost of projects relating to the control of soil erosion, reduction of sediment, or protection of water quality,
- grants to local governments for up to 50 percent of the cost of projects aimed at solving sediment and erosion control problems occurring on stream banks, lakeshores or roadside sites,
- floodplain management grants of up to 75 percent of the cost of flood control projects in the Southern Minnesota River Basin, and

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[17]Minn. Stat. Chap. 40.

- grants to soil and water conservation districts to enable them to review and comment upon requests for water use and works permits filed with DNR.

5. Environmental Quality Board/State Planning Agency

The Environmental Quality Board (EQB) is made up of the directors of the State Planning Agency and the Pollution Control Agency, the Commissioners of Health, Agriculture and Transportation, a representative of the Governor's Office, and five public members appointed by the Governor. The representative of the Governor's Office serves as Chairman.[18]

The Environmental Division of the State Planning Agency (SPA) provides staff and technical support for EQB. SPA also provides technical support to other agencies and administers the Land Management Information Center, a computerized information bank for land management data.

EQB is responsible for reviewing programs of state agencies that significantly affect the environment and for coordinating those programs that are interdepartmental in nature. EQB may resolve conflicts involving state agencies with regard to programs, regulations, permits, and procedures significantly affecting the environment.[19]

EQB is specifically required to coordinate public water resource management and regulation activities and comprehensive long-range water resource planning among the state agencies having jurisdiction in that area. EQB also is responsible for coordinating water planning activities of local, regional, and federal bodies with state water resource plans and strategies.

EQB has recently formed a Water Resource Committee to oversee coordination of state agency water resource programs and planning. It consists of representatives from the departments of Agriculture, Health, and Natural Resources, the Pollution Control Agency, the Soil and Water Conservation Board, the Water Resources Board, the University of Minnesota, the Southern Minnesota River Basins Council,[20] and two citizen members of EQB.

6. Water Resources Board

The Water Resources Board (WRB) is composed of five citizen members appointed by the Governor. WRB:

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[18]Minn. Stat. Chap. 116C. The Deputy Director of the State Planning Agency is EQB's current chairman.

[19]Minn. Stat. Chap. 116C.

[20]The Southern Minnesota River Basins Council is an advisory council to EQB charged with developing a comprehensive environmental conservation and development plan and coordinating state and local interests in the region.

- settles disputes among agencies or individuals in proceedings involving questions of water policy including questions about the use, disposal, pollution, or conservation of water,
- approves or rejects petitions to establish watershed districts, and
- reviews watershed management plans required in the Twin Cities Metropolitan Area and permitted in the outstate counties.[21]

WRB is required to develop guidelines for the contents of outstate comprehensive water plans and coordinate state agency assistance to counties and local units of government involved in preparing plans. WRB must also conduct an active program of information and education concerning the plans. The State Planning Agency is assisting WRB with its review.

7. Other State Agencies

a. Waste Management Board

The Waste Management Board (WMB) was established in 1980 to ensure proper disposal of hazardous waste.[22] WMB is responsible for developing a statewide plan for hazardous waste disposal. Originally, this plan was to include selecting a site for hazardous waste disposal. In 1984, the Legislature imposed a moratorium on permanent site selection and shifted the emphasis of hazardous waste control toward developing alternatives to land disposal of solid and hazardous wastes, such as recycling and recovery methods and the development of conversion and treatment technologies.

b. Minnesota Geological Survey

The Minnesota Geological Survey (MGS) is situated at the University of Minnesota, Twin Cities campus. Established by the Legislature in 1872, MGS is a research agency which collects and analyzes information about Minnesota's geology. MGS receives copies of all well drillers' logs. Those whose accuracy MGS can verify are entered into a data base which is used by MGS and other agencies for geological and hydrological mapping.

c. Department of Public Safety

The Division of Emergency Services of the Department of Public Safety assists in the identification, organization and training of community resources so that communities can effectively prepare for and respond to disasters and other emergencies, including flooding, nuclear power plant accidents, chemical splills, and other hazardous materials accidents. Part of this effort involves providing for emergency water supplies when accidents, spills or improper storage or handling of hazardous materials threatens the safety of existing water supplies. The division operates emergency response teams and provides emergency response training to communities.[23]

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[21]Minn. Stat. Chap. 110B.

[22]Minn. Stat. §115A.05.

[23]Minn. Stat. Chap. 12.

d. Department of Transportation

The Minnesota Department of Transportation (MnDOT) constructs and maintains projects that have consequences for water quality and supply. For example, runoff from highways into nearby streams and lakes may be a source of pollution and/or flooding. Runoff may especially be a problem at highway and bridge construction sites. MnDOT's Hydraulics Section of its Technical Services Division addresses environmental concerns. MnDOT monitors water quality to determine the impact of highways on nearby waters. MnDOT also monitors water quality at highway rest stops.

D. METROPOLITAN AGENCIES

1. Metropolitan Waste Control Commission

The Metropolitan Waste Control Commission (MWCC) was created in 1969 by the Legislature to facilitate the economic and efficient collection, treatment and disposal of sewage and waste in the seven-county Twin Cities metropolitan area.[24] MWCC assumed ownership of previously existing treatment works and waste facilities in the metropolitan area and is responsible for constructing, maintaining and operating a coordinated metropolitan area waste treatment and disposal system. All municipalities are required to pay fees to and coordinate sewage treatment and disposal with MWCC.[25]

a. Metropolitan Council

The Metropolitan Council was created to coordinate planning and development in the seven-county Twin Cities metropolitan area.[26] The Council is responsible for preparing a long range policy plan for solid waste management in the metropolitan area, including overseeing county plans for solid waste treatment and disposal.

The Metropolitan Council is required to prepare a comprehensive development guide for the metropolitan area.[27] As part of this guide, the council has developed comprehensive plans for water quality protection and water resource management. These plans provide goals and implementation strategies for controlling point and non-point source pollution in each of the region's watersheds and for assuring an adequate supply of water for the

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[24]Minn. Stat. Chap. 473. The MWCC was originally called the Metropolitan Sewer Board. It was renamed in 1974.

[25]Minn. Stat. §§473.513, 473.517.

[26]Minn. Stat. §473.122.

[27]The Metropolitan Council is also the local agency designated by EPA to prepare area-wide waste treatment management plans for the Twin Cities metropolitan area.

metropolitan area.[28] The Metropolitan Council also reviews watershed management plans required for metropolitan counties under the Metropolitan Surface Water Management Act.

E. LOCAL WATER DISTRICTS

There are several types of special purpose districts in Minnesota which address local water issues. Some of these districts have taxing authority, the authority to secure funds by obtaining grants or issuing bonds, and authority to regulate water use within the district. Each type of district has a specified purpose, although district programs, projects, and authorities may overlap.

1. Soil and Water Conservation Districts

There are 91 soil and water conservation districts in Minnesota. Most are coterminous with counties, but some larger counties are divided into two districts.[29]

Soil and Water Conservation Districts distribute state and federal funds to local individuals and governments to control erosion. Districts may conduct surveys and investigations related to soil and water conservation and implement programs to reduce or prevent erosion, sedimentation, siltation and agriculturally related pollution. They may construct and operate structures and works of improvement. Seventy-five percent of the funds must be spent on priority projects involving erosion and sedimentation control. They have no taxing authority.

2. Watershed Districts

Watershed districts are special purpose units of local government created to deal with water resource problems. They are established by petition and approval by the Water Resources Board.[30] There are currently 38 watershed districts which cover about 23 percent of the area of the state.

Districts may be created to control flooding, improve stream channels for drainage or navigation, reclaim or fill wet and flooded lands, provide water supplies for irrigation, divert watercourses, conserve water supplies for public uses, regulate waste disposal, control or alleviate soil erosion, protect or enhance water quality, protect and regulate ground water use, or provide hydroelectric power. District managers are initially appointed by WRB and subsequently by the counties affected by the district. Terms are three years. Managers must adopt an overall plan which, after a hearing, must be approved by WRB.

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[28] *Water Resource Management Development Guide*, Metropolitan Council, September 1982; and *Water Resources Management: Development and Use*, Metropolitan Council, August 1985.

[29] Minn. Stat. Chap. 40.

[30] Minn. Stat. Chap. 112.

Watershed district managers may survey, construct, repair or operate any dam, ditch, drain, sewer, or water supply system. They may regulate or conserve the use of water within the district and regulate the use of streams, ditches or watercourses for sewage disposal and pollution prevention. Districts may issue bonds or levy taxes, within prescribed limits, to pay for administrative and operational expenses including construction and maintenance of projects.

3. Sanitary Districts

Sanitary districts may be created for areas not situated within a single municipality for the purpose of creating an adequate and efficient solid waste or sewage disposal system. No district may be created within 25 miles of a first-class city unless the city approves.[31] Districts are created by PCA pursuant to a petition filed by the governing bodies of all municipalities and towns in the proposed district. There are currently seven sanitary districts in Minnesota. Each district is governed by a board of five members elected by residents of the district for three-year terms.

Sanitary districts may construct, improve and operate any system required to regulate and control sewage, garbage or refuse disposal or prevent water pollution. A district may regulate and control the construction, maintenance and use of privies, cesspools, septic tanks or toilets and may prohibit the use of any facilities for the reception or disposal of human or animal waste that are not connected with a district disposal system.

Sanitary districts may enact ordinances, prescribe regulations, and take other appropriate action related to the purpose of the district. District ordinances supersede any ordinances of other governmental subdivisions included in the district. No systems or facilities for sewage or garbage disposal may be constructed or operated by other governmental subdivisions without the approval of the district board. The district board prescribes service charges for persons or premises connected with the system. It may levy taxes on all taxable property within the district.

4. Rural Water User Districts

Rural Water User Districts may be created outside the seven-county Twin Cities metropolitan area to assist communities in conserving, contolling and distributing water supplies.[32] They are created by the district court subsequent to a petition and public hearing. They have the powers of a public corporation, including the construction, maintenance and operation of works and the charging of fees. They cannot levy taxes. There are currently five rural water user districts in Minnesota.

5. Lake Improvement Districts

Lake Improvement Districts are created by county boards upon petition of 26 percent of the property owners within a proposed district or upon the county board's own initiative. Districts are created after a public hearing and upon a finding by the county board that

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[31]Minn. Stat. §§115.18-115.37.

[32]Minn. Stat. Chap. 110A.

creation of the district will benefit the public welfare and the property included in the district.[33] Counties may jointly create lake improvement districts. County boards may collect taxes, special assessments or service charges from benefited property within the district to pay for lake improvement projects. They may delegate powers to a district, including water quality management. District board members are initially appointed by the county board and subsequently elected by property owners. There are currently three lake improvement districts in Minnesota.

6. Drainage and Conservancy Districts

Drainage and Conservancy Districts may be created by a district court of any county included in a proposed district, following a public hearing pursuant to a request of 50 residents (or 25 percent, whichever is less) of the proposed district.[34] The district may be created to improve water flow in streams, to regulate the disposal of waste materials in streams, to provide for irrigation, or to prevent flooding. Each district is governed by a board which must prepare a plan for the improvements for which the district was created. The plan must be approved by the Department of Natural Resources. The board may charge rates for water use to compensate it for the costs of improving water supplies. The board may also assess the costs of constructing, maintaining and operating any improvements to the counties included in the district in proportion to the benefits received by each county. There are currently three drainage and conservancy districts in Minnesota. In 1985, the Legislature amended the procedures for establishing and improving drainage systems.[35] Under the new procedures, it is unlikely that additional drainage and conservancy districts will be established.

7. Lake Conservation Districts

There are two lake conservation districts created by special legislation. They became effective upon approval of the affected municipal governments. Their powers include regulating boating, lake access, de-icing, weed control and other activities in and around the lake and conducting research and other activities to control pollution.[36]

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[33]Minn. Stat. §§378.401-378.56. If 25 percent of the property owners oppose a district's creation, approval is suspended pending a referendum.

[34]Minn. Stat. §§111.03-111.07.

[35]Minn. Stat. Chap. 106A.

[36]Laws of Minn., 1967, Chap. 907; Laws of Minn., 1971, Chap. 355.

APPENDIX B

EXISTING DRINKING WATER STANDARDS

MICROBIOLOGICAL CONTAMINANTS

Microbiological organisms were the first drinking water contaminants to arouse concern. The first federal standards to control these "microbials" date back to 1914. Cholera has been under control in this country since the 1870s, and typhoid since about 1910. Two types of microbial-related contaminants are now subject to regulation under the Safe Drinking Water Act.

Interim Maximum Contaminant Levels in Force:	Principal Health Effects:
Total Coliforms (Coliform bacteria, fecal coliform, streptococcal, and other bacteria)	Although not necessarily in themselves disease-producing organisms, coliforms can be indicators of organisms that cause assorted gastro-enteric infections, dysentery, hepatitis, typhoid fever, cholera, and othe diseases of surface water; also interferes with the disinfection process

INORGANIC CHEMICALS

Most inorganic chemicals, such as arsenic and fluoride, are present naturally in water from geological sources. Others, such as lead, enter the water as the result of human intervention.

Interim MCLs in Force For:	Principal Health Effects:
Arsenic	Dermal and nervous system toxicity effects
Barium	Circulatory system effects
Cadmium	Kidney effects
Chromium	Liver/kidney effects
Lead	Central and peripheral nervous system damage; kidney effects; highly toxic to infants and pregnant women
Mercury	Central nervous system disorders; kidney effects
Nitrate and Nitrite	Methemoglobinemia ("Blue-Baby Syndrome")
Selenium	Gastro-intestinal effects
Silver	Skin discoloration (Argyria)

Final Revised MCL in Force For:	Principal Health Effects:
Fluoride	Skeletal damage

ORGANIC CHEMICALS

The organic chemicals listed here--except trihalomethanes, a chlorination by-product--fall into two main categories: synthetic organic chemicals (SOCs) and volatile synthetic organic chemicals (VOCs). In scientific terms, "volatile" means capable of being readily vaporized, evaporating readily at normal temperatures.

Synthetic Organic Chemicals

SOCs are synthetic organic compounds used in the manufacture of a wide variety of agricultural and industrial products. The best-known SOCs are pesticides and herbicides.

Interim MCLs in Force For:	Principal Health Effects:
Endrin	Nervous system/kidney effects
Lindane	Nervous system/liver effects
Methoxyclor	Nervous system/kidney effects
2,4-D	Liver/kidney effects
2,4,5-TP Silvex	Liver/kidney effects
Toxaphene	Cancer risk

Volatile Organic Chemicals

VOCs are a broad class of synthetic chemicals used commercially as degreasing agents, paint thinners, varnishes, glues, dyes, and pesticides. They are most commonly used in urban industrial areas, where they can contaminate ground water if improperly disposed.

No interim MCLs are yet in force for VOCs, but RMCLS (now known as MCL Goals) have been promulgated, and MCLs have been proposed.

Other Organics (Disinfection By-Products):

Interim MCLs in Force For:	Principal Health Effects:
4 Types of Trihalomethanes	Cancer risk

RADIONUCLIDES

Radionuclides are radioactive compounds sometimes found in drinking water. Radionuclides get into drinking water drawn from ground-water wells. On occasion, these wells can become contaminated by uranium and radon deposits that occur naturally in the soil of various regions. In a few cases, man-made radionuclides--from radioactive waste--can be the source of contamination. Like other drinking water contaminants, radionuclides pose a threat to human health when ingested.

Interim MCLs in Force For:	Principal Health Effects:
Gross alpha particle activity	Cancer
Beta particle and photon radioactivity from man-made radionuclides	Cancer

Radium-226	Bone cancer
Radium-228	Bone cancer

MISCELLANEOUS

Monitoring Regulations in Force For:	Health Effects:
Sodium monitoring and reporting	Hypertension
Monitoring of distribution systems for corrosion and other problems	Lead poisoning and other problems

SECONDARY

Non-enforceable secondary standards exist for the following:

Contaminant:	Effects:
pH	Water should not be too acidic or too basic; must fall between 6.5 and 8.5 on the pH scale
Chloride	Taste; corrosion of pipes
Copper	Taste; staining of porcelain
Foaming agents	Aesthetic
Sulfate	Taste and laxative effects
Total dissolved solids (Hardness)	Taste; possible relation betwen low hardness and cardiovascular disease; Also an indicator of corrosivity (Lead problems); can damage plumbing and limit effectiveness of soaps and detergents
Zinc	Taste
Fluoride	Dental fluorosis (A brownish discoloration of the teeth)
Color	Aesthetic; consumers turn to alternative supplies
Corrosivity	Aesthetic; also health related
Iron	Taste
Manganese	Taste
Odor	Aesthetic

Source: "Regulated Contaminants and Their Health Effects", *EPA Journal*, Vol. 12, No. 7, September 1986, p. 27.

APPENDIX C

PROPOSED DRINKING WATER STANDARDS

EPA already has a head start on many of the regulatory tasks mandated in the 1986 amendments to the Safe Drinking Water Act.

Maximum Contaminant Levels (MCLs) and Maximum Contaminant Level Goals (MCLGs, formerly known as Recommended Maximum Contaminant Levels--or RMCLs) have been proposed for a whole range of drinking water contaminants.

MCLGs, like RMCLs before them, are to be set at a level at which, in the judgment of the EPA Administrator, "no known or anticipated adverse effects on the health of persons occur and which allows an adequate margin of safety." MCLGs and RMCLs are known as "Health Goals" both because they are unenforceable and because they do not take feasibility factors, such as cost and available technology, into account.

MICROBIOLOGICAL CONTAMINANTS

RMCLs Proposed:	Principal Health Effects:
Giardia lamblia	Gastro-enteric disease (Giardiasis; sometimes known as "Backpacker's Disease")
Viruses	Gastro-enteric and other disease

INORGANIC CHEMICALS

RMCLs Proposed:	Principal Health Effects:
Arsenic	Dermal and nervous system toxicity effects
Asbestos	Possible cancer
Barium	Circulatory system effects
Cadmium	Kidney effects
Chromium	Liver and kidney disorders
Copper	Gastro-intestinal disturbances
Lead	Central and peripheral nervous system damage; kidney effects; highly toxic to infants and pregnant women
Nitrate	Methemoglobinemia ("Blue Baby Syndrome")
Nitrite	Methemoglobinemia ("Blue Baby Syndrome")
Selenium	Selenosis (Liver damage from very high doses; other effects from lower doses)

ORGANIC CHEMICALS

Volatile Organic Chemicals

MCLs Proposed For:	Principal Health Effects:
Benzene	Cancer
Carbon tetrachloride	Possible cancer
p-Dichlorobenzene	Possible cancer
1,2-Dichloroethane	Possible cancer
1,1-Dichloroethylene	Liver/Kidney effects
1,1,1-Trichloroethane	Nervous system efects
Trichloroethylene	Possible cancer
Vinyl chloride	Cancer

RMCLs Proposed:	Principal Health Effects:
Chlorobenzene	Nervous system/liver effects
Trans-1,2-dichloroethylene	Liver/kidney effects
Cis-1,2-dichloroethylene	Liver/kidney effects

Final RMCLs in Place For:	Principal Health Effects:
Benzene	Cancer
Carbon Tetrachloride	Possible cancer
1,1-Dichloroethylene	Liver/kidney effects
1,2-Dichloroethane	Possible cancer
Trichloroethylene	Possible cancer
1,1,1-Trichloroethane	Nervous system effects
Vinyl chloride	Cancer

Synthetic Organic Chemicals

RMCLs Proposed For:	Principal Health Effects:
Acrylamide	Possible cancer
Alachlor	Possible cancer
Aldicarb, aldicarb sulfoxide, and aldicarb sulfone	Nervous system effects

Synthetic Organic Chemicals, Continued

Chlordane	Possible cancer
Carbofuran	Nervous system effects
Dibromochloropropane (DBCP)	Possible cancer
1,2-Dichloropropane	Liver/kidney effects
Epichlorohydrin	Possible cancer
Ethyl benzene	Liver/kidney effects
Heptachlor	Possible cancer
Heptachlorepoxide	Possible cancer
Pentachlorophenol	Liver/kidney effects
Polychlorinated biphenyls (PCBs)	Possible cancer
Styrene	Liver effects
Toluene	Nervous system/liver effects
Xylene	Nervous system effects

RADIONUCLIDES

EPA is now considering proposal of a Maximum Contaminant Level for the most significant of all the radionuclides linked to the contamination of drinking water: radon.

This colorless, odorless, tasteless gas occurs naturally in several types of rock and soil found in certain parts of the U.S. These can contaminate adjacent ground water with radon. Wells pump this radon-laden water into homes. When it is heated or agitated by showers or washing machines, this dissolved gas can be released into the air.

This presents a health problem, especially in air-tight dwellings, because the inhalation of radon gas may greatly increase the risk of lung cancer. Thus, radon is a drinking water contaminant that is dangerous not when drunk, but when breathed. And preliminary health data suggest that it may be one of the most harmful to human health.

A Maximum Contaminant Level for uranium is also under consideration.

Also on EPA's agenda is revision of its existing interim MCLs for other radionuclides, including radium-226 and radium-228.

All of EPA's interim MCLs for other categories of contaminants will be subjected to a similar process of review and updating.

Source: "Regulated Contaminants and Their Health Effects", *EPA Journal*, Vol. 12, No. 7, September 1986, p. 28.

STUDIES OF THE PROGRAM EVALUATION DIVISION

Evaluation reports can be obtained free of charge from the Program Evaluation Division, 122 Veterans Service Building, Saint Paul, Minnesota 55155, 612/296-4708.

77-01 *Regulation and Control of Human Service Facilities, February 1977*
77-02 *Minnesota Housing Finance Agency*, April 1977
77-03 *Federal Aids Coordination*, September 1977
78-01 *Unemployment Compensation*, February 1978
78-02 *State Board of Investment: Investment Performance*, February 1978
78-03 *Department of Revenue: Assessment/Sales Ratio Studies*, May 1978
78-04 *Department of Personnel*, August 1978
79-01 *State-sponsored Chemical Dependency Programs*, February 1979
79-02 *Minnesota's Agricultural Commodities Promotion Councils*, March 1979
79-03 *Liquor Control*, April 1979
79-04 *Department of Public Service*, April 1979
79-05 *Department of Economic Security, Preliminary Report*, May 1979
79-06 *Nursing Home Rates*, May 1979
79-07 *Department of Personnel: Follow-up Study*, June 1979
80-01 *Board of Electricity*, January 1980
80-02 *Twin Cities Metropolitan Transit Commission*, February 1980
80-03 *Information Services Bureau*, February 1980
80-04 *Department of Economic Security*, February 1980
80-05 *Statewide Bicycle Registration Program*, November 1980
80-06 *State Arts Board: Individual Artists Grants Program*, November 1980
81-01 *Department of Human Rights*, January 1981
81-02 *Hospital Regulation*, February 1981
81-03 *Department of Public Welfare's Regulation of Residential Facilities for the Mentally Ill*, February 1981
81-04 *State Designer Selection Board*, February 1981
81-05 *Corporate Income Tax Processing*, March 1981
81-06 *Computer Support for Tax Processing*, April 1981
81-07 *State-sponsored Chemical Dependency Programs: Follow-up Study*, April 1981
81-08 *Construction Cost Overrun at the Minnesota Correctional Facility - Oak Park Heights*, April 1981
81-09 *Individual Income Tax Processing and Auditing*, July 1981
81-10 *State Office Space Management and Leasing*, November 1981
82-01 *Procurement Set-Asides*, February 1982
82-02 *State Timber Sales*, February 1982
82-03 *Department of Education Information System*,* March 1982
82-04 *State Purchasing*, April 1982
82-05 *Fire Safety in Residential Facilities for Disabled Persons*, June 1982
82-06 *State Mineral Leasing*, June 1982

83-01 *Direct Property Tax Relief Programs*, February 1983
83-02 *Post-Secondary Vocational Education at Minnesota's Area Vocational-Technical Institutes*,* February 1983
83-03 *Community Residential Programs for Mentally Retarded Persons*,* February 1983
83-04 *State Land Acquisition and Disposal*, March 1983
83-05 *The State Land Exchange Program*, July 1983
83-06 *Department of Human Rights: Follow-up Study*, August 1983
84-01 *Minnesota Braille and Sight-Saving School and Minnesota School for the Deaf*,* January 1984
84-02 *The Administration of Minnesota's Medical Assistance Program*, March 1984
84-03 *Special Education*,* February 1984
84-04 *Sheltered Employment Programs*,* February 1984
84-05 *State Human Service Block Grants*, June 1984
85-01 *Energy Assistance and Weatherization*, January 1985
85-02 *Highway Maintenance*, January 1985
85-03 *Metropolitan Council*, January 1985
85-04 *Economic Development*, March 1985
85-05 *Post Secondary Vocational Education: Follow-Up Study*, March 1985
85-06 *County State Aid Highway System*, April 1985
85-07 *Procurement Set-Asides: Follow-Up Study*, April 1985
86-01 *Insurance Regulation*, January 1986
86-02 *Tax Increment Financing*, January 1986
86-03 *Fish Management*, February 1986
86-04 *Deinstitutionalization of Mentally Ill People*, February 1986
86-05 *Deinstitutionalization of Mentally Retarded People*, February 1986
86-06 *Public Employee Pensions*, May 1986
87-01 *Aid to Families with Dependent Children*, January 1987
87-02 *Water Quality Monitoring*, February 1987
Minnesota Employment and Training Programs (in progress)
County Human Services (in progress)

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*These reports are also available through the U.S. Department of Education ERIC Clearinghouse.