

Wellhead Protection Plan and Remediation

Issue: High nitrates in city well

In 1985 the City of Chippewa Falls began to see elevated nitrate levels in the groundwater supplying its east wellfield, which provides the City with approximately 60 percent of its water.

By 1994, nitrate levels began to persistently exceed the federal safe drinking water standard of ten parts per million.¹ The city looked at options to improve water quality, including installing barrier wells to pump high nitrate water out and taking drinking water from the Chippewa River. The city had been working on a Groundwater Protection Plan since the late 1980s but had not adopted a plan or ordinance.

The city began groundwater monitoring studies in 1985 to try to identify the source of nitrate contamination. Shortly after, they began work on their first approach to groundwater protection: a proactive wellhead protection plan. Later, the city directly addressed the source of nitrate contamination with a second suite of three additional steps: a new well, nitrate removal system, and a lawsuit against a fertilizer cooperative.

First Approach: Chippewa Falls Wellhead Protection Plan established

In 1990 the county together with the city and some neighboring townships began work on the [Duncan Creek Priority Watershed \(DCPW\)](#) project. An outcome of this project was a management plan for the watershed which recommended a wellhead protection(WHP) program for the county.

The county received funding to prepare a wellhead protection plan in 1993; \$40,000 was in grants through WDNR and \$8,000 was from the City of Chippewa Falls. The cost for ongoing groundwater monitoring studies conducted between 1985 and 1995 funded by the City totaled \$160,700.³ A consultant had previously delineated and mapped recharge areas, and [time of travel zones](#) for city wells; this information was used



The City of Chippewa Falls, which is located in rural northwestern Chippewa County, receives 100 percent of its drinking water from groundwater. City soils are deep outwash deposits, which are fairly permeable and allow contaminants to reach groundwater easily.

as the basis for two wellhead protection zones around each wellfield; a more restrictive zone closest to the well and a less restrictive zone around this zone (see table below).

By 1996 when the funding for the DCPW project ended, a model wellhead protection plan and ordinance describing the two wellhead protection zones had been written for the county. This ordinance can be used in any town, village or city in the county, as well as any community in the state. The City of Chippewa Falls and Chippewa County collaborated on and adopted this ordinance knowing it would help ensure the protection of their groundwater.

Additional measures

A newsletter was also published and distributed annually to all residents within the five year zone of contribution to the city's wells between 1996 and 1999. The newsletter explained ground water movement, present problems and future concerns, and explained how activities on individuals' property can impact ground water quality.²

The city also conducted a Contaminant Source Inventory in 1995 for each wellfield to identify potential sources of groundwater contamination. Between 1962 and 1995 about 285 acres of land were purchased by the city to protect the west wellfield from contamination. This land, which makes up most of the 30-day time of travel in the west wellfield, is left forested or open so that the land is not used for practices that could contaminate the wells.

Why worry about nitrates?

- Nitrates form in groundwater because of nearby fertilizer use, barnyard runoff, and septic systems.
- Nitrates are especially harmful to infants who can develop "blue baby syndrome" after drinking water high in nitrates.
- Pregnant women who drink nitrate-contaminated water during pregnancy are more likely to have babies with birth defects.⁵
- A high nitrate level may mean that your water also has bacteria or farm chemicals.⁵

Reflections on Wellhead Protection Program

Weaknesses

The WHP ordinance does not address pre-existing land uses that are still contaminating the groundwater in the recharge area. One of these uses is a fertilizer plant (see below). Even today, some practices of the existing industries are not sound engineering. These land uses would not have been allowed if the wellhead protection ordinance had been in effect before these industries were located in the recharge area.

There are some farms operating in the five to ten year time of travel area that are unregulated by the ordinance and their cropping practices have the potential to contaminate groundwater. Monitoring wells and private wells in the area have shown there is high nitrate in the five to ten year time of travel zone from the wellfields.

The wellhead protection ordinance does not address quantity of water. This could leave the recharge area open to uses that consume large quantities of water that may result in drawdown of the aquifer.

Strengths

By 2001 the city met safe drinking water standards and nitrate was near 6.7 parts per million after treatment and blending.³ The city and

county worked together to protect groundwater. Because some of the recharge area of the municipal wells is not in the city limits, that area is still protected under the county ordinance. In the well recharge area, land uses are now regulated to prevent potentially damaging practices from contaminating drinking water. Some land uses are prohibited. When a conditional use is allowed, the operation must follow Best Management Practices.

As of 1996, all municipal wells in Wisconsin are required to have Wellhead Protection Plans including delineation of well recharge areas. Chippewa Falls' WHP plan exceeds this requirement in two ways: it has an ordinance to help implement its plan, and the recharge areas are based on time travel to the well, rather than a fixed radius around the well, which is less accurate.

Definition: "Time of travel" zone
(Also known as "zone of concentration" or "zone of contribution")

A specific area of land, where water soaking into the ground reaches the well after a specific period of time. For example, a drop of water entering the ground in an area defined as a five year time of travel would take five years to reach the well.

Chippewa Falls and Chippewa County Wellhead Protection District				
	Time of Travel	Permitted Uses	Conditional Uses	Prohibited Uses
Zone one	30 day time of travel	<ul style="list-style-type: none"> ✓ Parks, playgrounds, beaches, with no on-site wastewater disposal systems or holding tanks; ✓ Wildlife and woodland areas ✓ Biking, hunting, skiing, nature equestrian and fitness trails ✓ Municipally sewered residential development ✓ Agricultural crop production with nutrient management 		<p>Applies to Zones one and two: Buried hydrocarbon, petroleum or hazardous chemical storage tanks, cemeteries, chemical manufacturers, coal storage, dry cleaners, industrial lagoons and pits, etc.</p>
Zone two	5 year time of travel	<ul style="list-style-type: none"> ✓ All uses in zone one ✓ Parks, playgrounds, beaches with onsite wastewater discharged to a holding tank or municipal sewer ✓ Single family residences on minimum lot size with less than 8,000 gallons per day of sewage ✓ Residential use of above ground LP gas tanks less than 1,000 gallons for heating ✓ Municipally sewered commercial and industrial establishments with less than 20 gallons or 160 pounds of regulated substances in use, storage or production at a time 	<p>May request a permit for any use not explicitly prohibited</p>	

Second approach: New well & nitrate removal system and lawsuit

In 1995, the city needed to add another well, which cost \$115,000 to install. Nitrate levels were lowest in well number five. The city could have used water from well five to blend with other water to get the overall nitrate level below the federal safe drinking water level. However as nitrate levels began trending up, blending would only have been a stopgap measure.

In January 1997 the water utility still needed to take an additional step and install a \$2.2 million dollar, (costing \$170 per person), nitrate removal system in the east well-field after nitrate levels failed to decrease.^{1,3} Annual costs for chemicals, labor, and maintenance are about \$81,000.

Through testing and collaboration with The Department of Agriculture Trade and Consumer Protection (DATCP) the city later found that nitrates were coming from a nearby agricultural fertilizer distributor and a possibly from a rendering plant with on-site lagoon. These industries were located less than 100 meters from the wellfield. DATCP had been monitoring spills from the fertilizer cooperative for three years before 1999 when the city learned that it was a major source of nitrate in the drinking water. Chippewa Falls filed a lawsuit against the local fertilizer cooperative in 2000 after they refused to admit liability and participate in remediation efforts.

The lawsuit was settled out of court after three years of litigation; continuing with the case would have cost the city too much and was unlikely to recover the entire costs of cleanup, monitoring and new well construction much less result in additional compensation. The city opted for a monetary settlement and continued monitoring of the fertilizer plant by DATCP.

Reflections on Lawsuit and Remediation

Strengths

The fertilizer cooperative was required to pay the city a sum of \$525,000. 'The City of Chippewa Falls benefited from the settlement in two ways. The settlement award of \$525,000 partially reimbursed the city for the cost of the nitrate removal system. In addition, the city

succeeded in increasing the attention to the potential for continued nitrate contamination from the cooperative site.'¹

DATCP has also forced the original owners of the fertilizer cooperative to continue pay for ongoing investigation and monitoring at the site, as well as sampling of city wells.

The fertilizer cooperative is now under new ownership and management and required to file reports with DATCP on the amount and type of fertilizer and agricultural chemicals handled and applied.

Weaknesses

The settlement did not include discussion to relocate the fertilizer plant and there have still been spills under the new managers. They are doing more loading and unloading on concrete but dust flies, builds up on the ground and then soaks into the ground. Equipment is parked outdoors where rain falls on it and carries fertilizer and other agricultural chemical residue off it. There are similar concerns with liquid fertilizer because of leaking tanks and disposal of contaminated rainwater from containment areas. This industry has inherent problems for groundwater contamination.

Future

Through the well testing there have been detections of other agricultural chemicals and breakdown products of agricultural chemicals such as atrazine, metalochlor, acetochlor but not over the MCL. This is not surprising since the presence of nitrate is often a precursor to other chemicals due to its relatively rapid infiltration into groundwater. City well testing will continue with frequency determined by contaminant levels and trends.

The WHP ordinance will prevent future additional sources of potential groundwater contamination in the wellhead protection area, possibly maintain open space and wildlife habitat, and improve intergovernmental cooperation. Chippewa Falls has not noticed a significant improvement in groundwater quality since the ordinance was enacted, but it often takes decades for soils and groundwater to be cleansed of contaminants.

Portage County in central Wisconsin implemented a similar WHP ordinance before Chippewa County did. Their program has been

successful in deterring some groundwater unfriendly businesses from locating in the wellhead protection zones. This is part of why Chippewa Falls expects to prevent future contamination; new land uses that could contribute will not be allowed in the recharge area.

Chippewa Falls' experience shows that a WHP ordinance is more effective if implemented before contamination is a problem. However most Wisconsin communities do not have WHP ordinances; hopefully they will implement them before they experience drinking water contamination.

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Timetable of wellhead protection events 1985 - 2005

