



Facing northwest across the City of Ashland, Chequamegon Bay and the Bayfield Peninsula with Lake Superior in the distance (Courtesy of the Carl Guell Slide Gallery)

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# Source Water Assessment For Ashland Water Utility

Ashland, Wisconsin  
March 27, 2003

A report by the  
Wisconsin Department of Natural Resources  
Bureau of Drinking Water and Groundwater



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## Summary

The 1996 amendments to the Safe Drinking Water Act require that States complete source water assessments for all public drinking water systems. The primary purpose of this assessment is to determine the relative susceptibility of Ashland's source water to contamination. For this assessment, susceptibility is defined as the likelihood that a contaminant of concern will enter a public water supply at a level that may result in adversely impacting human health. Source water is untreated water from streams, rivers, lakes, and groundwater aquifers. A susceptibility determination is based on a stepwise synthesis of information regarding the well or surface water intake vulnerability and the source water's sensitivity to a potential source of a contaminant of concern. Due to the vulnerable nature of surface water, most drinking water systems utilizing surface water are determined to have high levels of susceptibility to source water contamination.

Affordable, safe drinking water is essential to the health, development and stability of all communities. Conventionally, treatment has been the only step in maintaining safe drinking water for surface water systems. The quality of treated drinking water is a function of the pretreatment water quality. Little concern has been paid to a preventive approach of protecting the source water. One of the best ways to ensure safe drinking water is to develop a local program designed to protect the source of drinking water against potential contamination. Not only does this add a margin of safety, but it also raises the awareness of consumers and/or the community of the risks of drinking water contamination. It is expected that source water assessment results will provide a basis for developing a source water protection program.

The City of Ashland is located in northwestern Wisconsin along the southern shore of Lake Superior. Ashland Water Utilities relies solely upon source water from Lake Superior's Chequamegon Bay to provide drinking water to its more than 9,000 consumers.

A source water area is the area that contributes source water to the public drinking water system. Lake Superior drains approximately 49,300 square miles. Due to its size and diverse land uses, assessing the entire Lake Superior source water area is not a practical method for determining the individual susceptibility of Ashland's source water. In an attempt to improve source water quality at a practical scale, the WDNR delineated source water areas based on local watersheds that may specifically impact source water entering Ashland's intake. It is important to note that a source water area is only one potential factor in the quality and susceptibility of source water. Other factors may include unmanageable, lake-wide episodic events that have little to do with human activities.

Located in Eastern Bayfield and Northern Ashland Counties, Ashland's source water area is over 200 square miles. It includes land drained by the Bono Creek, Boyd Creek, Fish Creek, Baycity Creek and multiple unnamed tributaries to Chequamegon Bay. Clay soils predominate throughout causing erosion and runoff problems. Land cover is mostly naturally vegetated with some agriculture and the cities of Ashland and Washburn being the only major urban areas.

The city of Ashland has historically provided excellent quality drinking water to its customers. Treatment of source water includes microfiltration and chlorination.

As with most surface water systems, Ashland's source water is impacted by the source water area and highly susceptible to contamination. This is due to the confined nature of Chequamegon Bay and erodible soils and land uses found in the source water area. Contaminants of greater concern to Ashland's source water include microbial, volatile organic and synthetic organic contaminants as well as precursors of treatment by-products.

Source water protection for Ashland should begin with the formation of a source water protection team composed of local, regional and state officials. This group could plan and implement best management practices in the source water area to prevent source water contamination. Of particular concern is agriculture and pastureland draining into Bono, Boyd and Fish Creeks, urban development in the city of Ashland and sites of historical contamination.

A paper copy of the detailed assessment is available at the Ashland Public Library. An electronic version of the detailed assessment is accessible on the Wisconsin Department of Natural Resources website at <http://www.dnr.state.wi.us/org/water/dwg/gw/SWP.HTM>.

## **Introduction**

In 1996, the U.S. Congress amended the Safe Drinking Water Act to provide resources for states to conduct Source Water Assessments. Information about Wisconsin's Source Water Assessment Program can be found on the Wisconsin Department of Natural Resources (WDNR) website mentioned in the Executive Summary. In cooperation with other Great Lakes states, WDNR has developed a method--Wisconsin's Source Water Assessment Program, Appendix R (Assessment Protocol for Great Lake Sources)--for conducting Source Water Assessments for water supplies that use the Great Lakes as their water source. A source water assessment involves identifying a source water area, analyzing the sensitivity of the source to natural conditions, conducting potential contaminant source inventories and determining the susceptibility of the source to contamination.

The requirements for public water supplies in Wisconsin to meet U.S. Environmental Protection Agency maximum contaminant levels (MCLs) provide a base level of assurance of safe drinking water. However, all systems are vulnerable to some degree to potential contamination. With this in mind, susceptibility determinations were made qualitatively relative to other systems.

## **Purpose of this Assessment**

The purpose of this source water assessment is to determine the susceptibility of Ashland's source of drinking water to contamination and to make recommendations on how to help protect this valuable resource.

Safe, affordable drinking water in ample supply is essential to the health, development and stability of all communities. Conventionally, treatment has been the only step in maintaining safe drinking water for surface water systems and little concern has been paid to a preventive approach of protecting the source water. The quality and cost of treated drinking water is often a function of pretreatment source water quality.

Source water quality can be improved through the implementation of a source water protection program. A source water protection program is composed of four steps: assessment, planning, implementation and long term management. By assessing localized impacts on source water quality, this assessment completes the first step in a source water protection program. For more information on completing a source water protection program please visit <http://www.epa.gov/safewater/protect/protect.html> on the World Wide Web.

## **Source Water Contaminant Categories**

Source water can be contaminated by microbial, inorganic, synthetic organic, volatile organic, precursors of disinfection by-products and radioactive contaminants. These contaminants can enter source water through various means. Pathways of contamination can be split into two major categories, point source pollution and nonpoint source pollution. Point source pollution includes specific, identifiable dischargers of contaminants. Examples of these include industrial and municipal wastewater outfalls. Point source dischargers are more easily regulated and held accountable for contaminating source water. Non point source pollution comes from no specific source and diffusely enters source water. Examples of nonpoint source pollution include runoff from land cover and atmospheric deposition.

This assessment describes these general contaminant categories associated with potential contaminant sources. For a more detailed description of contaminants associated with potential contaminant sources please visit <http://www.epa.gov/OGWDW/swp/sources1.html> on the World Wide Web. For information on health effects and methods of protection from particular chemical contaminants please visit <http://www.epa.gov/safewater/hfacts.html> on the World Wide Web.

- *Microbial contaminants*, such as viruses and bacteria, which may come from sewage treatment plants, septic systems, agricultural livestock operations, and wildlife. Microbial contaminants can lead to widespread acute illnesses in customers of a contaminated drinking water system. Examples of microbial contaminants include *Giardia*, *Cryptosporidium* and *E. coli*.
- *Inorganic contaminants*, such as salts and metals, which can occur naturally or result from among other sources: urban storm water runoff, industrial or domestic wastewater discharges, oil and gas production, mining, or farming. Among other detrimental health affects, inorganic contaminants can

negatively impact various organs and the circulatory system in the human body. Some examples of inorganic contaminants include nutrients such as nitrogen and phosphorous and heavy metals such as cadmium, lead and mercury.

- *Synthetic organic contaminants*, such as industrial products, pesticides and herbicides, which may come from a variety of sources such as agriculture, storm water runoff, industrial activities, landfills, wastewater treatment facilities and residential areas. As well as being carcinogenic, synthetic organic contaminants can negatively impact the nervous system, liver and kidneys and affect development. Some examples of synthetic organic contaminants include the pesticides atrazine and lindane, as well as industrial products such as polychlorinated bi-phenyls (PCBs).
- *Volatile organic contaminants*, such as petroleum products, solvents, cleaners and degreasers, which may come from industrial activities, petroleum production, gas stations, urban storm water runoff, wastewater treatment facilities and septic systems. As well as being carcinogenic, volatile organic contaminants can negatively impact the nervous system, liver and kidneys and affect development. Some examples of volatile organic contaminants include benzene, vinyl chloride and styrene.
- *Precursors of disinfection by-products* lead to the formation of carcinogenic by-products during source water treatment. Some examples of precursors of disinfection by-products include dissolved organic carbon and bromide. Likely sources of dissolved organic carbon are from agricultural and urban storm water runoff.
- *Radioactive contaminants*, can be naturally occurring or be the result of oil and gas production and mining activities. Radioactive contaminants are carcinogenic. Some examples of radioactive contaminants include radium and uranium.

## Hydrologic Setting

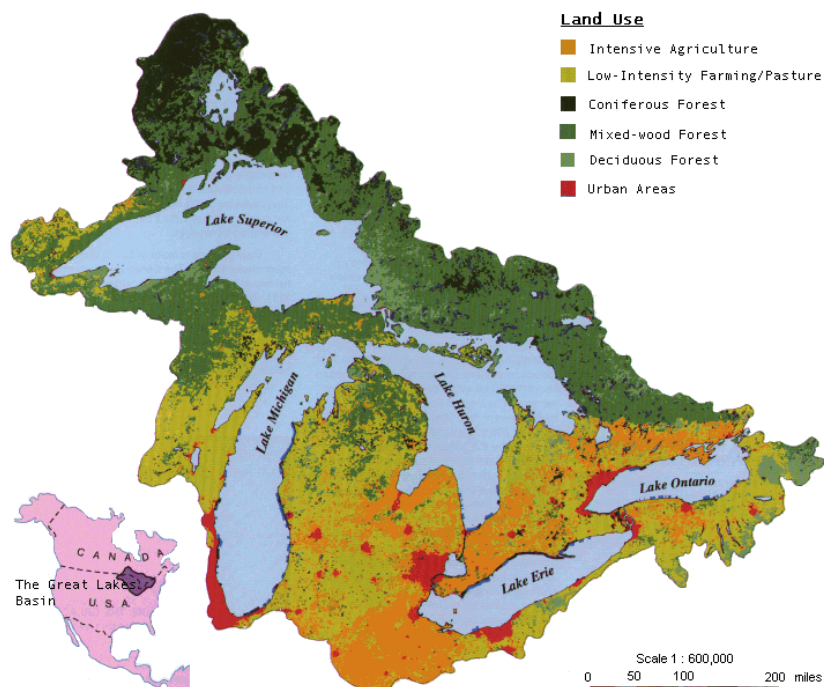
### Description of the Source Water Area

As shown in Figure 1, the Great Lakes drains over 200,000 square miles of varying land uses. The size and variety of land uses found in this drainage basin make a basin-wide assessment impractical and ineffective at identifying impacts on Ashland's source water. In response to this, the WDNR identified smaller local

source water areas that contribute source water to Lake Superior in close proximity to the drinking water intakes. Source water areas are composed of one or more established watersheds that discharge near the surface water intakes. Source water areas for this assessment were delineated based on WDNR surface watersheds, not groundwater basins. Generally, groundwater basin boundaries are similar to their surface water counterparts but may vary due to geology.

As shown in Figure 2, Ashland's source water area is located in Northwestern Wisconsin South of the Bayfield

Figure 1: The Great Lakes Drainage Basin

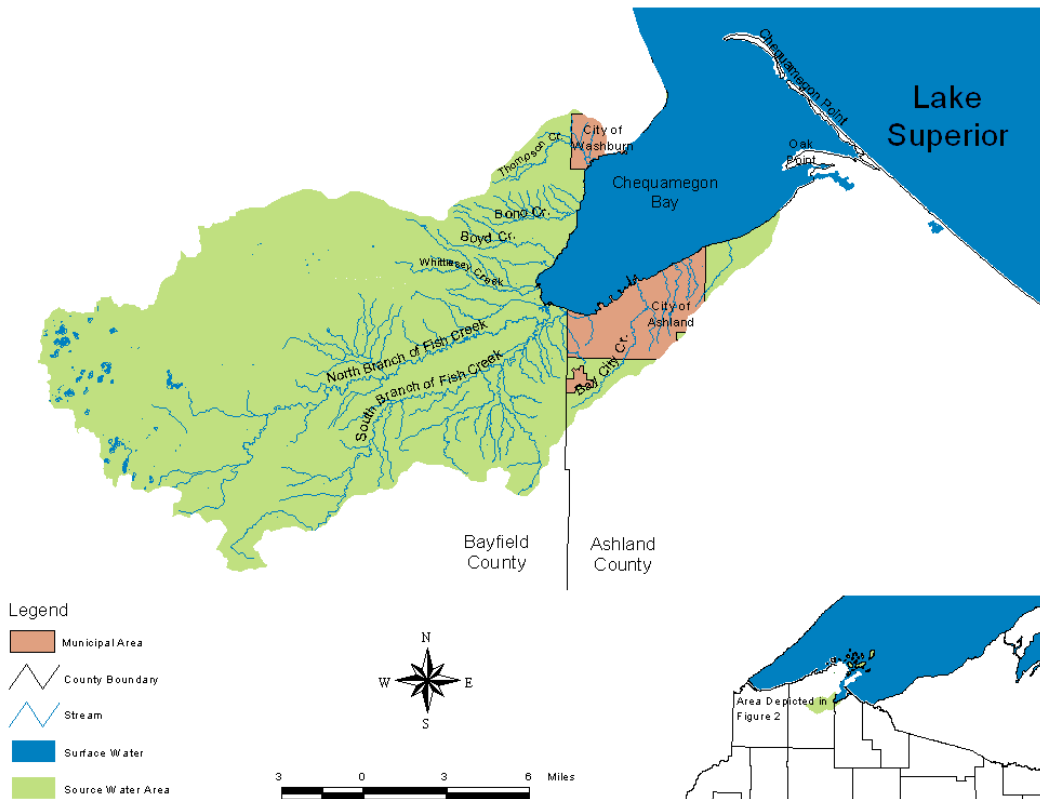


Peninsula. It includes portions of Northern Ashland and Eastern Bayfield Counties. Ashland and Washburn are the only large municipal areas in the source water area.

### Hydrology

As shown in Figure 2, the source water area drains into Chequamegon Bay south of Houghton Point via Bono Creek, Boyd Creek, Whittlesley Creek, the North and South Branches of Fish Creek, Bay City Creek and a few unnamed tributaries to Lake Superior east of the city of Ashland. These streams drain an area of relatively flat, impermeable red clay soils. This results in heavy sedimentation of these streams and occasional flooding problems.

Figure 2: Source Water Area



### Land cover

Land cover can play a major role in source water quality. Spatial data in Figure 3 was generated from interpretations of aerial photographs taken from 1971 to 1982.

- *Urban*

Urban areas depicted in Figure 3 include residential, industrial and commercial activities. Contaminants associated with residential land cover include synthetic organic, volatile organic, inorganic, precursors of disinfection by-products and microbial contaminants. Due to high concentrations of impermeable surfaces, such as streets, driveways, parking lots, sidewalks and roofs, urban areas have increased potential to create large quantities of runoff during and following precipitation events. Runoff from residential areas transports contaminants associated with this land cover into source water. These contaminants can also enter source water from residential areas through point source discharges and atmospheric deposition.

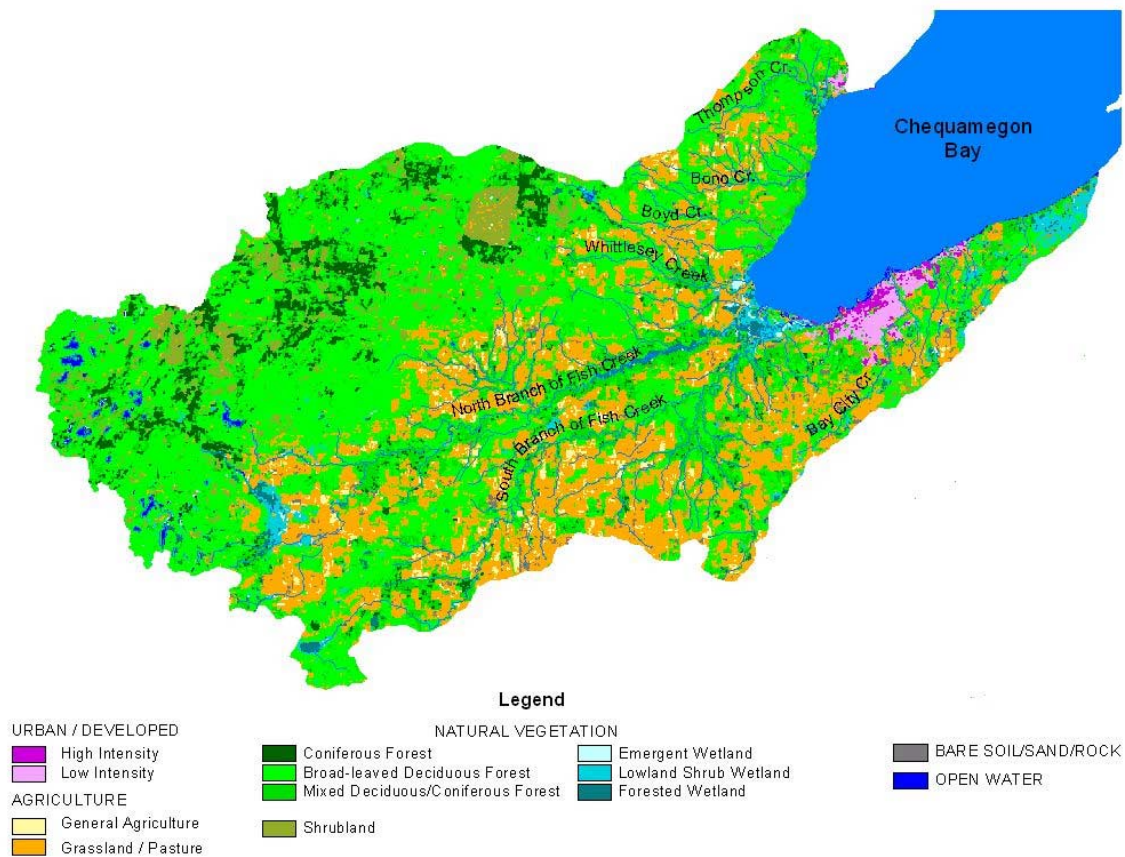
As shown in Figure 3, there is very little urban area outside the cities of Ashland and Washburn. The WDNR identified urban and construction site runoff as negatively impacting source water in Bay City Creek.

- *Agricultural*

For this assessment agricultural land cover includes cropland, pasture, orchards and nurseries. Agricultural practices generally cause the land to be more susceptible to erosion and runoff than naturally vegetated land. Due to common practices and activities, agricultural land cover can be a major source of inorganic, treatment by-product precursors, microbial and synthetic organic contaminants.

The source water area contains a mixture of agricultural activities. Agriculture is concentrated in land drained by the south branch of the Fish Creek. Stream bank pasturing, barn yard runoff, cropland runoff and stream bank pasturing are agricultural activities identified by the WDNR as negative impacts on Bono Creek, the south branch of Fish Creek and multiple tributaries to the north branch of Fish Creek.

Figure 3: Land Cover



- *Natural vegetation*

For this assessment, natural vegetation includes wetlands, woodlands and some unused lands. Generally, natural vegetation has positive impacts on source water. These impacts include increased infiltration of precipitation into the ground, decreased quantity of storm water runoff, removal of contaminants from source water, reduced potential for erosion and less drastic fluctuations of streamflow. Forested land used for timber production can contaminate source water with excessive levels of sediment and volatile organic contaminants.

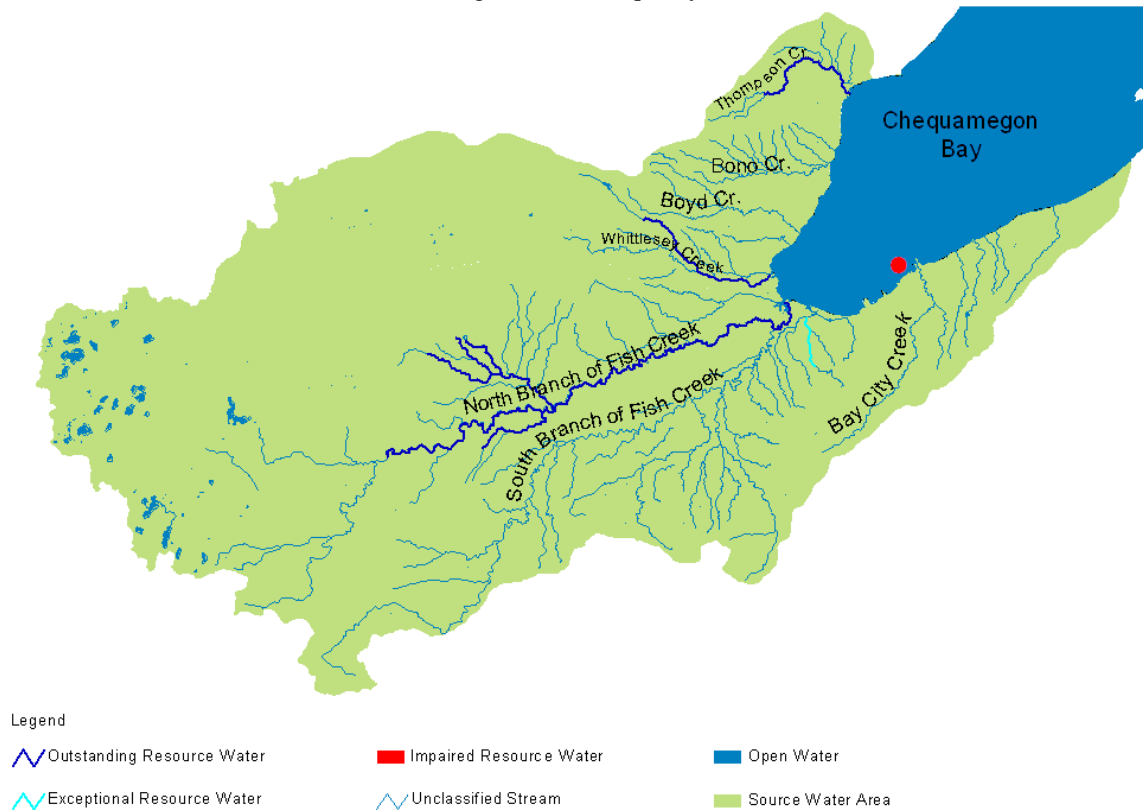


Natural vegetation makes up a large portion of the source water area land cover. Timber harvesting practices have been identified by the WDNR as negatively impacting source water in the north branch of Fish Creek.

*Water quality*

As shown in Figure 4, water quality varies throughout the source water area. Portions of Whittlesley Creek and the main branch and some tributaries of the north branch of Fish Creek are considered to be outstanding resource waters. Outstanding resource waters are defined as a lake or stream having excellent water quality, high recreational and aesthetic value, high quality fishing and is free from point and nonpoint source pollution. Most streams in the source water area do have problems with turbidity. The WDNR has delineated nearshore waters at Kehler Park in Ashland as impaired. This is due to historic contamination of lakefront property by a gasification plant. This contamination source is discussed below in the section on potential contaminant sources.

Figure 4: Water quality



Description of Lake Superior and Chequamegon Bay

*Bathymetric and shoreline features*

Chequamegon Bay is a shallow sandy bay relatively isolated from Lake Superior by the Bayfield Peninsula to the northwest and Chequamegon Point to the northeast. Lake Superior and the bay are connected across a 2-mile stretch of open water between the tip of Chequamegon Point and Houghton Point on the Bayfield Peninsula. The shallow nature of Chequamegon Bay has multiple negative impacts on source water quality. These include warmer summer and autumn water temperatures, more easily suspended lakebottom sediments and less dilution of contaminants entering the bay. The shoreline near the Ashland intake has been altered from its natural features by historical fill and multiple large shipping docks. These docks may slow the spread and dilution of contaminants from shoreline sources, such as the gasification plant mentioned previously.



### *Circulation patterns*

Circulation patterns in Chequamegon Bay have not been comprehensively studied, but some important information based on Lake Superior circulation patterns, direction of river discharge plumes and local observations can be gleaned. The major factor in water flow in the bay is wind. The prevailing westerly winds work in tandem with the natural counterclockwise circulation of lakes in the earth's Northern Hemisphere. Colder and cleaner lake water enters and mixes with bay water at the inlet of the bay and travels southwest along the protected eastern shore of the Bayfield Peninsula. This flow reaches the southernmost portion of the bay at the discharge of Fish Creek and rotates to the east towards the city of Ashland. Following the shoreline the current heads northeast towards Oak and Chequamegon Points prior to repeating this path or mixing with Lake Superior water, which flows southeast beyond the bay. Due to the shallow nature of Chequamegon Bay, this circulation pattern does not develop strong momentum and can be quickly disrupted by easterly winds. The normal counter clockwise circulation pattern in the bay negatively impacts source water by drawing the discharge of the Fish Creek and Bay City Creek east along the shoreline towards the drinking water intake.

Another disturbance to this circulation pattern occurs when the bay experiences Lake Superior seiches. These are similar to a tide but do not occur with any regularity. Wind is again the major factor in the occurrence of seiches. Sustained strong winds can create a difference of water level from one side of the lake to the other. This difference oscillates back and forth and results in lake water surges in and out of the bay. This can reverse water flow miles upstream of the mouth of Fish Creek causing water to temporarily flow upstream. The affect of these Lake Superior seiches on source water quality has not been widely studied.

### *Water quality*

Water quality in Lake Superior is generally very high, but as previously discussed the location of Ashland's drinking water intake in Chequamegon Bay creates differences in source water quality relative to lake wide water quality levels. The northern and western portions of the bay generally experience cleaner water than the southern and eastern portions. This can be attributed to the mixing of clean Lake Superior water to the northwest and the more protected streams draining into the western side of the bay.

It is important to note that water quality of source water at the intakes is based almost entirely on monitoring that occurs at the drinking water intakes. Few contaminants have been comprehensively monitored in source water at the intakes. Water clarity, a general indicator of water quality, at the intake drops significantly during spring months when meltwater runs off the frozen source water area soils into Chequamegon Bay and during heavy summer and fall rainstorms. Windstorms frequently diminish water clarity by suspending lake bottom sediments. Sediments can be suspended quickly and will remain so for a couple of days prior to settling out of the water column. Water clarity is highest during winter ice over. Coliform, an indicator of microbial contamination is frequently detected in the source water entering the intake. Of 13 tests for the microbial contaminant *Giardia*, one returned positive. Prior to activation of the new microfiltration treatment plant, total trihalomethanes, a category of treatment by-products caused by chlorination of dissolved organic carbon in the source water during treatment, had not exceeded maximum contaminant levels, but had historically been detected at relatively high levels in the finished drinking water. After the new microfiltration plant went on line, total trihalomethane concentrations in treated drinking water have dropped markedly. Low levels have been detected of a volatile organic contaminant typically associated with burning of grass, wood, charcoal and plastics as well as vinyl chloride disposal, polystyrene insulation, aerosol propellants and chlorinated swimming pools.

### **Susceptibility Assessment**

For the purposes of Wisconsin's source water assessments, susceptibility is defined as the likelihood that a contaminant of concern could enter a public water supply at a level that may result in adversely impacting human health. A susceptibility determination is based on a stepwise synthesis of information regarding the surface water intake's vulnerability and the source water's sensitivity to a potential contaminant source.

### Methodology

For a detailed explanation of the protocol for Great Lake source water assessments please see Appendix R of Wisconsin's Source Water Assessment Program Plan Appendices.

An initial survey was performed on the Ashland source water area to assess local impacts to the source water. The initial survey included interviewing Ashland Water Utility employees, conducting a sensitivity analysis, delineation of a critical assessment zone and reviewing existing data. The initial survey revealed that source water quality was frequently susceptible to contamination.

A more in-depth study of the source water area was carried out to determine what activities and areas within the source water area affect the source water's susceptibility to particular types of contaminants. This more in-depth study reviewed the distribution of potential contaminant sources in the source water area, historical data, localized water quality of tributaries and background water quality levels and characteristics of Chequamegon Bay.

### Sensitivity Analysis

Sensitivity is defined as the likelihood that source water will be impacted by contaminants due to the intrinsic physical attributes of the source water area. Sensitivity is determined from the natural setting of the source water and indicates the natural protection afforded the source water. Factors in sensitivity include hydrologic characteristics of the source water area, proximity, direction and quantity of discharge relative to the intake and degree of dilution afforded by distance from shore and depth of intake. Based on the Great Lakes Protocol for conducting a sensitivity analysis, calculated sensitivity is the product of the intake's distance from shore and the depth of water at the intake. It is important to keep in mind that this does not take into account numerous site-specific variables. Relative levels of calculated sensitivity include moderate, high and very high. Ashland municipal water supply has one surface water intake located in Southeastern Chequamegon Bay. The calculated sensitivity of the intake is very high.

### Critical Assessment Zone

In keeping with the Great Lakes protocol, a critical assessment zone was delineated based upon the intakes calculated sensitivity. Any land, particularly shoreline, which is within the delineated critical assessment zone, must be part of an in-depth assessment. The zone is a circle centered on the intake. The size of the circle depends on the calculated sensitivity rating. The critical assessment zone for the intake encompasses a small portion of Ashland's northern shorefront.

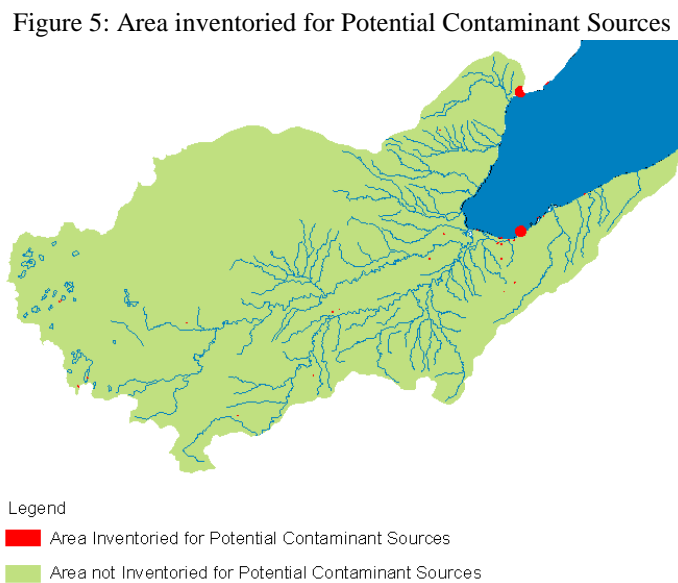
### Potential Contaminant Source Inventory

A major component of the susceptibility determination is based on the distribution of potential contaminant sources in the source water area. A high density of potential contaminant sources in the source water area would indicate a higher probability of contaminating source water. Source water from a source water area with a low density of potential contaminant sources would be less likely to become contaminated.

It is important to understand that a potential contaminant source is not necessarily a source of contaminants. It has the potential to become a source of contaminants but if managed properly won't impact the source water.

Data used in the significant potential contaminant source inventory includes area-wide and localized information sources. Area-wide locational data are displayed in Figures 6 and 7. Information for the remainder of the potential contaminant sources was inventoried only within source water areas for ground

water systems. These areas of localized potential contaminant source inventories are shown on Figure 5. Information concerning the distribution of localized significant potential contaminant sources is not



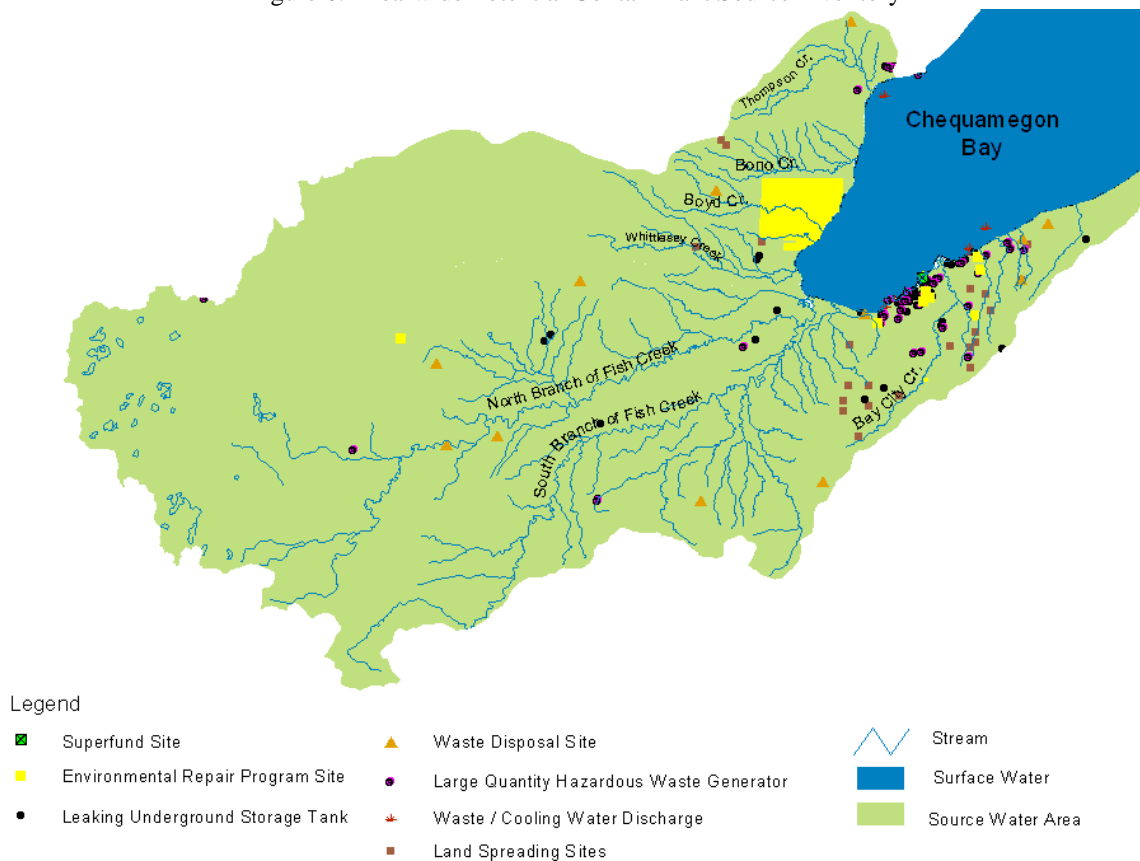
available for land outside of the red areas in Figure 5. Potential contaminant sources inventoried within these areas are shown on Figure 8.

*Animal feeding operations*

Animal feeding operations are agricultural operations where animals are kept and raised in confined situations. Animal feeding operations generally congregate animals, feed, manure, dead animals, and production operations on a relatively small area of land. Feed is brought to the animals rather than the animals grazing or otherwise seeking feed in pastures. Animal waste and wastewater can enter water bodies from spills or breaks of waste storage structures (due to accidents or excessive rain), and manure spreading practices. Animal feeding operations have the potential to contribute pollutants such as inorganic, synthetic organic, microbial contaminants as well as hormones and antibiotics to the source water.

There are no animal feeding operations shown on Figure 6, because these only include only the larger animal feeding operations (over 1,000 animal units), which are regulated for wastewater discharge. This does not provide an accurate distribution of the more common smaller animal feeding operations located in the source water area. A limited distribution of smaller animal feeding operations in the source water area is depicted in Figure 8. Animal feeding operations, stream bank pasturing, barnyard runoff, feedlot runoff and manure spreading were identified by the WDNR as negative impacts on several streams in the source water area.

Figure 6: Area-wide Potential Contaminant Source Inventory



*Landfills*

In the past landfills were unregulated and were common sources of contaminants. Some of these are now classified as Bureau of Remediation and Repair Tracking System sites, which are discussed below.

Licensed landfills are now strictly regulated and monitored. Closed and active landfills are frequently sources for inorganic, synthetic organic and volatile organic contaminants in source water.

Landfills shown in Figure 6 and 7 include currently licensed landfills and sites listed on the Registry of Closed Waste Disposal Sites.

#### *Wastewater treatment facilities*

Discharging sites shown on Figure 6 and 7, include municipal and industrial operations for treatment and cooling water. Municipal Wastewater Treatment Facilities (WWTFs) can be sources of inorganic, microbial, synthetic organic and volatile organic contaminants as well as hormones, pharmaceuticals and other organic contaminants that have been linked to developmental and reproductive defects in animals. Following treatment, effluent is frequently discharged through an outfall directly into surface water. Typical treated and disinfected sewage contains low concentrations of contaminants. A municipal WWTF may be inundated with more raw sewage than it can process. In the event of this a bypass or sanitary sewer overflow occurs. This allows untreated sewage to enter directly into surface water. A typical bypass may contain high concentrations of contaminants associated with urban runoff and WWTFs. Contaminants associated with industrial WWTFs are dependent upon the specific industry but may include microbial, volatile organic, inorganic and synthetic organic contaminants. Cooling water dischargers are not generally considered to be potential contaminant sources.

#### *WDNR's Bureau of Remediation and Redevelopment Tracking System*

The WDNR Remediation and Redevelopment Program keeps track of sites where chemical contamination of soil, surface water and/or groundwater has occurred. The Bureau of Remediation and Redevelopment Tracking System (BRRTS) is the Department's database for tracking the status of investigation and cleanup activities at these sites. There are several types of sites that are tracked by BRRTS, including leaking underground storage tank sites, Environmental Repair Program sites, spill sites and Superfund sites. For information on specific contamination sites in Wisconsin please visit BRRTS at, <http://www.dnr.state.wi.us/org/aw/rr/brrts/index.htm> on the World Wide Web.

- Leaking Underground Storage Tank sites

A Leaking Underground Storage Tank (LUST) site is defined as a leaking underground storage tank that has contaminated soil and/or groundwater with petroleum. As of 9/02/02, there are 69 LUST sites in the City of Ashland listed on BRRTS.

- Environmental Repair Program sites

Environmental Repair Program (ERP) sites are sites other than LUSTs that have contaminated soil and/or groundwater. Often, these are old historic contaminant releases to the environment. As of 9/02/02, there are 24 ERP sites in the city of Ashland.

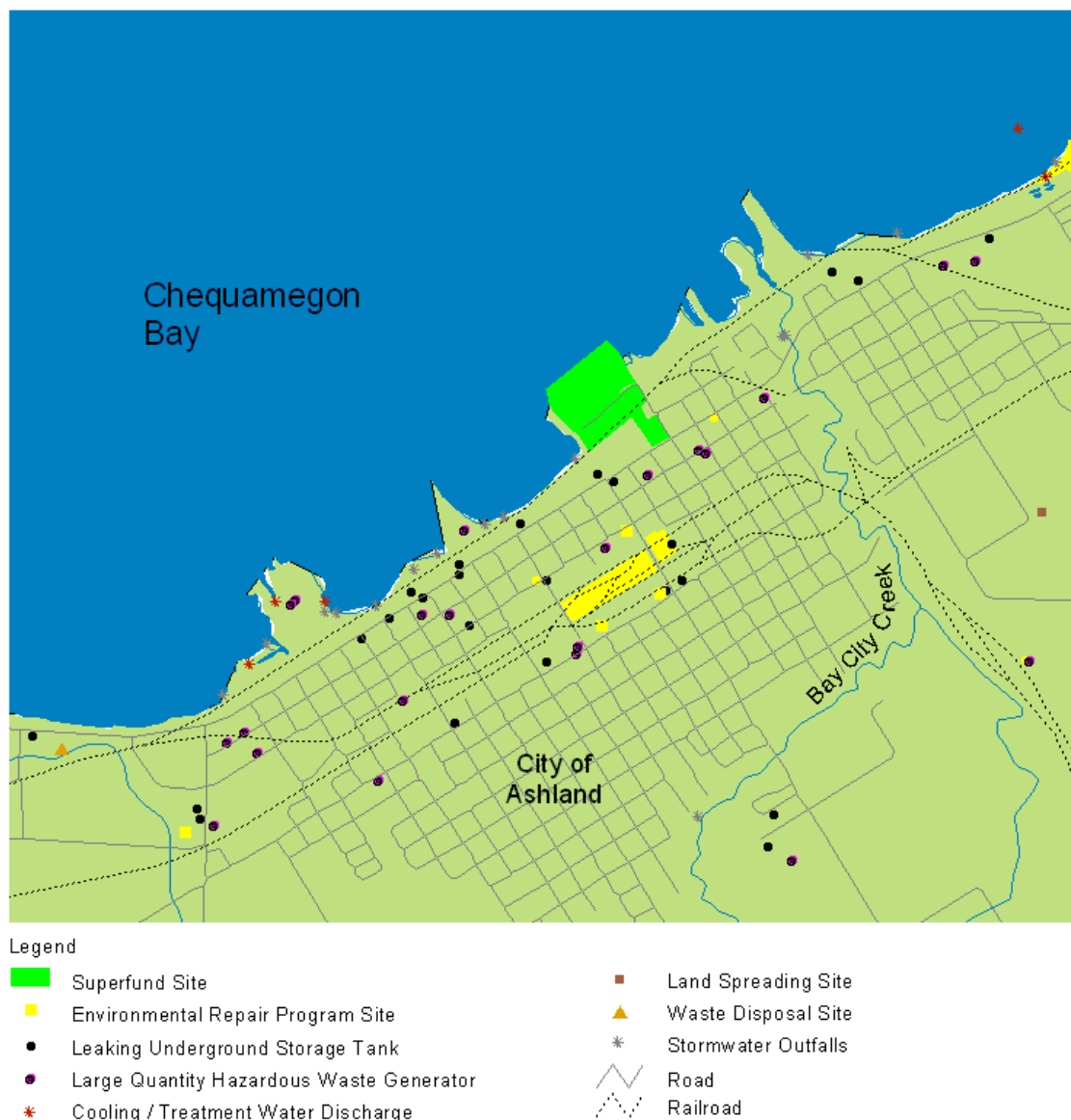
- Spill sites

Spills are defined as a discharge of hazardous substances that may adversely impact, or threaten to adversely impact public health, welfare or the environment. It is important to note that the number of unreported spills is unknown, but is probably well beyond those spills that are reported. From August of 1978 to May of 2000, there have been 58 spills reported in the City of Ashland. Of these, at least 2 entered into storm sewers and 13 entered directly into surface water. For information on particular spills please visit the previously mentioned BRRTS Internet site.

- Superfund sites

Superfund sites are highly contaminated areas that have been set aside for cleanup by the USEPA. For more information on the Superfund program and individual sites please see, <http://www.epa.gov/superfund/> on the World Wide Web. As shown on Figure 8 there is one Superfund site in the source water area. This site is a potential source of synthetic organic and volatile organic contaminants. It is of particular concern because of its proximity to the drinking water intake. For more information concerning the Ashland/Northern States Power Lakefront Superfund site please visit <http://oaspub.epa.gov/oerrpage/mapbasic?SITEID=0507952> on the World Wide Web.

Figure 7: Potential Contaminant Source Inventory near Intake



*Hazardous Waste Generators*

Hazardous waste generators are defined as facilities, which handle materials classified as hazardous waste. Hazardous waste is defined as any substance that is toxic to humans. Contaminants associated with hazardous waste generators are site specific. Hazardous waste generators include a wide array of facilities ranging from hospitals and schools to manufacturing and industrial operations.

As shown in Figures 6 and 7, there are many large quantity hazardous waste generators in the source water area, particularly in the City of Ashland. This does not account for the more numerous smaller quantity hazardous waste generators. For a more complete image visit USEPA’s Enviromapper on the World Wide Web at <http://maps.epa.gov/enviro/html/mod/enviromapper/index.html>.

### *Transportation Related Activities*

Transportation related activities have the potential to contaminate source water both through contaminants from maintenance and operation or from cargo spills. Examples of transportation related activities include highways, railroads, rail yards, harbors, shipping lanes and airports. These can all be sources of inorganic, volatile organic and synthetic organic contaminants. Contaminants from cargo spills are dependent upon particular cargoes, but generalizations can be made based on local economies.

Ashland was at one time a major hub for transportation and shipping for the Great Lakes. This economy has declined substantially and with it transportation related potential contaminant sources. The network of railroads, shipping ports and highways currently receive relatively minimal traffic compared to historical traffic.

### *Land Spreading Sites*

Land spreading sites depicted in Figures 6 and 7 are sites approved for land spreading of industrial and municipal waste. Land spreading sites are not necessarily active every year. Contaminants typically associated with industrial land spreading sites vary depending on local economy. Municipal sites frequently are associated with microbial contaminants.

### *Boating Related Activities*

Boating related activities are potential sources of synthetic organic, volatile organic, inorganic and microbial contaminants to the source water. Contaminants can enter directly into the source water through spills or indirectly through runoff from marinas and shipyards where many cleaning agents, paints, petroleum products and other chemicals are commonly stored and used. For more information on the effects of and preventive measures for boating related activities please visit <http://www.epa.gov/owow/nps/mmsp/index.html> on the World Wide Web. Recreational boating is popular in Chequamegon Bay. There is one large marina and a boat launch located near the drinking water intake.

### *Construction Sites*

Due to uncovered material, handling of toxic chemicals and exposed ground construction sites can heavily impact the source water. They are potential sources of inorganic, volatile organic and synthetic organic contaminants. The City of Ashland has been experiencing high levels of development. Runoff from construction sites was identified as a negative impact on Bay City Creek. Most contaminated runoff from construction sites and urban activities in the city of Ashland enters directly into Chequamegon Bay through stormsewer outfalls located along Bay City Creek and through nearshore outfalls.

### *Localized Agricultural and Bulk Storage Potential Contaminant Sources*

Localized agricultural and bulk storage activity locations for this assessment are shown in Figure 8. Agricultural activities include active farming operations, animal feedlots, agricultural irrigation and lined and unlined manure storage facilities. These activities are potential sources of synthetic organic, inorganic and microbial contaminants. Bulk storage activities include feed mills, agricultural co-ops, 500 gallon and larger petroleum and chemical storage sites and road salt storage sites. Contaminants associated with storage facilities are largely site-specific, but generally they are potential sources of inorganic, synthetic organic and volatile organic contaminants.

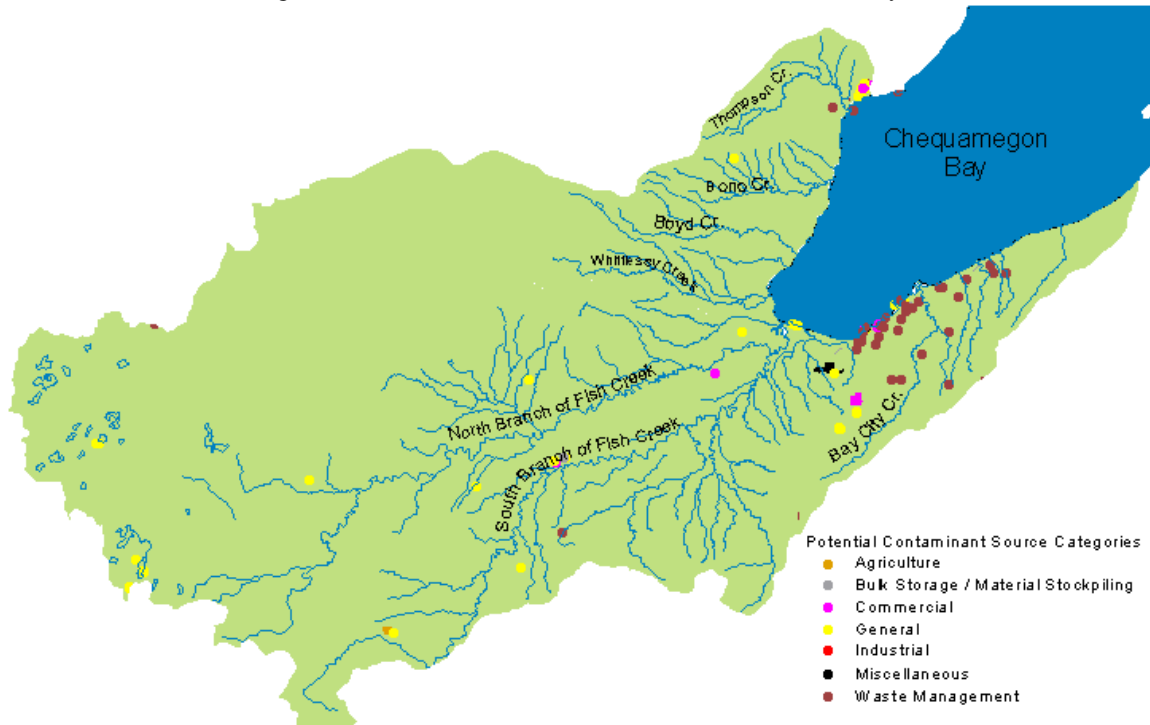
### *Localized Commercial Potential Contaminant Sources*

Localized commercial activities locations for this assessment are shown in Figure 8. Commercial activities include airports, auto body shops, boat yards, car washes and Laundromats in unsewered areas, cemeteries, dry cleaners, gas service stations, machine/metal working shops, motor vehicle repair shops, paint shops, photo processing facilities, jewelry and metal plating facilities, printing facilities, rail yards, rail road tracks, scrap/junk yards and seed production plants. These activities are frequently associated with inorganic and volatile organic contaminants.

### Localized General and Industrial Potential Contaminant Sources

Localized general and industrial activities for this assessment are shown in Figure 8. General activities include above-ground and below-ground storage tanks, municipal and non-municipal sewer lines, sewage holding tanks, septic tanks, sumps, drainfields, mounds and dry wells. These activities are potential sources for synthetic organic, volatile organic, inorganic and microbial contaminants. Industrial activities include asphalt plants, industrial chemical production facilities, electronic product manufacturers, electroplating / metal finishing facilities, furniture or wood manufacturing / refinishing / stripping facilities, foundries / smelting plants, mining operations / mine waste sites, paper mills, petroleum and chemical pipelines, plastics manufacturer / molding facilities, wood preserving facilities. These activities are potential sources of volatile organic, synthetic organic and inorganic contaminants.

Figure 8: Localized Potential Contaminant Source Inventory



### Localized Waste Management and Miscellaneous Potential Contaminant Sources

Localized waste management and miscellaneous activities and contaminant conduits are shown in Figure 8. Waste management activities include municipal incinerators, injection wells, sludge spreading sites, solid waste transfer stations and wastewater lagoons. These activities are potential sources of inorganic, synthetic organic, microbial and volatile organic contaminants. Miscellaneous sources include fire training facilities, golf courses, gasification plants, laboratories and military installations. These sources are associated with microbial, synthetic organic and volatile organic contaminants.

### Description of Ashland Public Drinking Water Treatment System

Ashland Water Utility reliably provides high quality drinking water for its customers. Source water enters the treatment plant through the original intake located in Chequamegon Bay. Upon entering the treatment plant, source water undergoes micro-filtration to remove contaminants and chlorination to disinfect prior to distribution.

### Susceptibility Determination

As with most surface water systems, Ashland's source water quality is significantly impacted by local factors and highly susceptible to contamination. This is due to physical characteristics of eastern Chequamegon Bay, fluctuations in source water quality experienced at the intake and potential contaminant sources in the source water area. As discussed in the section concerning Chequamegon water quality, little



is known concerning concentrations of particular contaminants occurring in the source water at the intakes, but based on general water quality indicators contaminants from the source water area frequently reach the Ashland drinking water intake. Ashland's source water is particularly susceptible to synthetic organic, volatile organic, precursors of treatment by-products and microbial contamination.

### **Recommendations**

Source water protection should begin with the formation of a team composed of local, regional and state members to more completely assess impacts to source water and implement best management practices to prevent source water contamination. The following is a preliminary list of negative impacts on source water that could be dealt with in a source water protection program.

- Historic contamination sites such as the Environmental Repair Program sites and Superfund site in the city of Ashland.
- Runoff from urban areas and construction sites in the Bay City Creek.
- Livestock related activities including: manure management, barnyard runoff, feedlot runoff, pasture, streambank pasturing and livestock access to streams on land drained by the branches of the Fish Creek and Bono Creek.
- Cropland runoff from land drained by the branches of the Fish Creek and Bono Creek

As mentioned previously a comprehensive source water protection plan is beyond the scope of this assessment. The source water protection team may consider using resources provided by the USEPA at <http://www.epa.gov/safewater/protect/sources.html> on the World Wide Web for overall source water protection planning. This website offers general source water information, financial assistance contacts, source water protection case studies, contaminant source inventories and contingency planning among other subjects. For specific information concerning best management practices and dealing with potential contaminant sources please visit <http://www.epa.gov/ogwdw/protect/swpbull.html> on the World Wide Web.

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