State of Illinois
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Illinois Environmental Protection Agency
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Illinois Integrated Water Quality Report and Section 303(d) List-2008

Clean Water Act Sections 303(d), 305(b) and 314

Water Resource Assessment Information and Listing of Impaired Waters

In memory of Gary Minton for 30 years of service to Illinois' water resources

Illinois Environmental
Protection Agency
Bureau of Water

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ILLINOIS INTEGRATED WATER QUALITY REPORT AND SECTION 303(d) LIST - 2008

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June 2008

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EXECUTIVE SUMMARY

This 2008 Integrated Report continues the reporting format first adopted in the 2006 reporting cycle. Prior to 2006, assessment information was reported separately in the Illinois Water Quality [Section 305(b)] Report and Illinois Section 303(d) List. The Integrated Report format is based on federal guidance for meeting the requirements of Sections 305(b), 303(d) and 314 of the Clean Water Act. Significant changes from the 2006 report are explained in the Introduction and throughout the report.

The basic purpose of this report is to provide information to the federal government and the citizens of Illinois on the condition of surface water and groundwater in the state. This information is provided in detail in the appendices and is summarized in Section C-3 and Section D.

Streams

For 2008, 15,569 stream miles, or 21.8 percent of the total 71,394 stream miles in Illinois have been assessed for attainment of at least one designated use. The degree of support (attainment) of a designated use in a particular stream segment is determined by an analysis of various types of information, including biological, physicochemical, physical habitat, and toxicity data. Each applicable designated use in each segment is assessed as Fully Supporting (good), Not Supporting (fair), or Not Supporting (poor). Waters in which at least one applicable use is not fully supported are called "impaired." For Illinois streams, the major potential causes of impairment, based on number of miles affected, are pathogens (fecal coliform bacteria) impairing swimming (*primary contact*) use, mercury and polychlorinated biphenyls in fish tissue or sediments impairing *fish consumption* use, and low dissolved oxygen, high nutrients, excessive siltation, physical-habitat alterations, and high suspended solids which impair *aquatic life* use. The major potential sources of impairment are atmospheric deposition of toxics, agriculture, hydromodification, municipal point sources, urban runoff/storm sewers, surface mining, and impacts from hydrostructure flow regulation/modification

Miles of Illinois Streams Assessed for at Least One Designated Use

305(b) Reporting Cycle (most recent year of data used)	Total Stream Miles Assessed	Percentage of All Illinois Stream Miles Assessed*
2000 Report (1998)	15,304	21.4
2001 Report (1999)	15,570	21.8
2002 Report (2000)	15,933	22.3
2004 Report (2003)	15,069	21.1
2006 Report (2004)	15,424	21.6
2008 Report (2006)	15,569	21.8

*Based on U.S. Geological Survey National Hydrography Dataset

The miles of streams rated Fully Supporting (good) for *aquatic life* use remained stable: 62.0 percent in 2006 and 61.0 percent in this 2008 reporting cycle. The percent of stream miles assessed as good, fair and poor for each use are shown below. Slight differences in assessment numbers may be attributable to random change or differences in how and where *aquatic life* use assessments were performed between the 2006 and 2008. For example, given that many *aquatic life* use assessments in streams are updated on a five-year cycle, it is possible that statewide comparisons at any shorter time period (e.g., between each consecutive reporting cycle) actually reflect the regional subset of waters most recently updated rather than a statewide pattern. Also, it is possible that improvements in assessment information or methods, such as the new macroinvertebrate index of biotic integrity used in this 2008 reporting cycle, contribute to year-to-year differences.

Changes in the methodology for assessing *fish consumption* use were made this year which took into consideration the existence of a mercury-based statewide fish-consumption advisory. As a result no stream miles were rated as fully supporting *fish consumption* use in 2008. For more details on the assessment of *fish consumption* use see Section C-2.

Percent of Illinois Stream Miles Assessed as Good, Fair and Poor in 2008

Designated Use	Miles Assessed	Percent Assessed	Percent Fully Supporting (Good) (2)	Percent Not Supporting (Fair) (2)	Percent Not Supporting (Poor) (2)	Percent Not Assessed
Aquatic Life	15,314	21.5	61.1	34.8	4.1	78.5
Fish Consumption	3,827	5.4	0.0	91.9	8.1	94.6
Indigenous Aquatic Life	85	100.0	38.2	55.1	6.7	0.0
Primary Contact	3,915	5.5	18.9	36.2	44.9	94.5
Public and Food Processing Water Supply	1,108	100.0	9.0	91.0	0.0	0.0
Secondary Contact(1)	740	1.0	100.0(3)	---	---	99.0
Aesthetic Quality(1)	0	0.0	---	---	---	100.0

Note: Numbers and percentages may not add up due to slight rounding errors.
1. Assessment guidelines are not yet fully developed; see section C-2 Assessment Methodology.
2. Percentages of Good, Fair and Poor indicate the percent of miles assessed.
3. By definition, Secondary Contact Use is "Fully Supporting" in all waters in which Primary Contact Use is "Fully Supporting"; otherwise, assessment guidelines are not yet developed for determining the level of use attainment.

Inland Lakes

For this 2008 report, a total of 147,361 lake acres were assessed for at least one designated use. This represents 46 percent of total lake and pond acreage (318,477) in the state. As with streams, each lake is assessed as Fully Supporting (good), Not Supporting (fair), or Not Supporting (poor), for each applicable designated use. Of the 141,941 lake acres assessed for *aquatic life* use in 2008, 69.4 percent were rated as Fully Supporting. This represents a nearly 16 percent increase from the 53.6 percent of lake acres rated as Fully Supporting (good) for *aquatic life* use in the 2006 reporting cycle. The percent of lakes (acres and numbers) assessed as good, fair and poor for each use are shown below.

Numbers and Acres of Illinois Inland Lakes Assessed for at Least One Designated Use

305(b) Reporting Cycle (most recent year of data used)	Number of Lakes Assessed	Total Acres Assessed	Percentage of All Illinois Lake Acres Assessed
2000 Report (1998)	348	154,795	48.6
2001 Report (1999)	369	156,994	49.3
2002 Report (2000)	369	150,707	47.3
2004 Report (2003)	465	154,048	48.4
2006 Report (2004)	359	146,732	46.1
2008 Report (2006)	366	147,361	46.3

Percent of Illinois Lakes Assessed as Good, Fair and Poor in 2008

Designated Use	Acres Assessed	Percent of Total Acres Assessed	Percent of Acres Fully Supporting (Good) (1)	Percent of Acres Not Supporting (Fair) (1)	Percent of Acres Not Supporting (Poor) (1)	Percent of Total Acres Not Assessed	Percent of Acres as Insufficient Information
Aesthetic Quality	141,941	44.8	6.8	66.9	26.3	52.5	2.7
Aquatic Life	141,941	44.8	69.4	30.6	0.00	52.5	2.7
Fish Consumption	86,879	27.3	7.9	92.1	0.0	72.7	0.0
Indigenous Aquatic Life	1,600	100.0	100.0	0.0	0.0	0.0	0.0
Primary Contact	1,814	0.6	60.2	39.8	0.0	99.4	0.0
Public and Food Processing Water Supply	76,603	99.8	6.3	93.7	0.0	0.2	0.0
Secondary Contact	1,092	0.3	100.0	0.0	0.0	99.7	0.0
Designated Use	**Number of Lakes Assessed**	**Percent of All Lakes Assessed(2)**	**Percent of Lakes Fully Supporting (Good) (1)**	**Percent of Lakes Not Supporting (Fair) (1)**	**Percent of Lakes Not Supporting (Poor) (1)**	**Percent of All Lakes Not Assessed(2)**	**Percent of Lakes as Insufficient Information**
Aesthetic Quality	345	0.4	13.3	72.5	14.2	99.5	0.1
Aquatic Life	345	0.4	89.0	10.7	0.3	99.5	0.1
Fish Consumption	95	0.1	2.1	96.8	1.1	99.9	0.0
Indigenous Aquatic Life	1	100.0	100.0	0.0	0.0	0.0	0.0
Primary Contact	15	0.02	46.7	53.3	0.0	99.98	0.0
Public and Food Processing Water Supply	76	95.0	23.7	76.3	0.0	5.0	0
Secondary Contact(3)	7	0.01	---(3)	---(3)	---(3)	99.99	0

1. The percentages of Good, Fair and Poor indicate the percent of lake acres (or lake numbers) assessed.
2. The percent of all lakes assessed is based on a statewide total of 91,456 lakes and ponds, except for Indigenous Aquatic Life (which applies to only one lake) and Public and Food Processing Water Supply (which applies to only 80 lakes in Illinois).
3. By definition, Secondary Contact Use is "Fully Supporting" in all waters in which Primary Contact Use is "Fully Supporting"; otherwise, assessment guidelines are not yet developed for determining the level of use attainment.

The major potential causes of impairment based on number of lake acres affected are mercury and polychlorinated biphenyls in fish tissue or sediments impairing fish consumption use, and phosphorus (total), aquatic algae, and total suspended solids impairing aquatic life and aesthetic quality uses. The major potential sources of impairment are atmospheric deposition of toxics, crop production (crop land or dry land), littoral/shore area modifications (nonriverine), other recreational pollution sources, runoff from forest/grassland/parkland, contaminated sediments, urban runoff/storm sewers, municipal point source discharges, and on-site treatment systems (septic systems and similar decencentralized systems).

Lake Michigan

Lake Michigan is monitored annually through a cooperative agreement between the city of Chicago Department of Water and Illinois EPA Bureau of Water. The State of Illinois has jurisdiction over approximately 1,526 square miles of open water and 63 shoreline miles of Lake Michigan bordering Cook and Lake counties in the northeastern corner of the state. At least one use was assessed in 151 square miles of Lake Michigan.

Assessments of *aquatic life* use were unchanged from the 2006 reporting cycle. About ten percent of the total Lake Michigan waters in Illinois were assessed, and all were rated as Fully Supporting for the following uses: *aquatic life* use, *primary contact* (swimming) use, *secondary contact* use, and *public and food processing water supply* use. However, *fish consumption* use in the Illinois portion of Lake Michigan is assessed as Not Supporting (Poor) due to contamination from polychlorinated biphenyls and mercury. In addition, all Lake Michigan beaches in Illinois were assessed as Not Supporting (poor) for *primary contact* use due to bacterial contamination from *Escherichia coli* bacteria. The Individual use-support summary for all Lake Michigan-basin waters is shown below.

Statewide Individual Use-Support Summary for Lake Michigan-Basin Waters

Lake Michigan Bays and Harbors; Units: Square Miles

Designated Use	Total Size	Total Assessed		Size Fully Supporting (Good)	Size Not Supporting (Fair)	Size Not Supporting (Poor)	Size Not Assessed
		Size	%				
Aesthetic Quality(1)	2.5	0	0	0	0	0	2.5
Aquatic Life	2.5	2.46	98.3	2.40	0	0.06	0.05
Fish Consumption	2.5	2.46	98.3	0	0	2.46	0.05
Primary Contact	2.5	0	0	0	0	0	2.5
Secondary Contact(1)	2.5	0	0	0	0	0	2.5

Statewide Individual Use-Support Summary for Lake Michigan-Basin Waters (continued)

Lake Michigan Open Water; Units: Square Miles

Designated Use	Total Size	Total Assessed Size	Total Assessed %	Size Fully Supporting (Good)	Size Not Supporting (Fair)	Size Not Supporting (Poor)	Size Not Assessed
Aesthetic Quality(1)	1,526	0	0.0	0	0	0	1,526
Aquatic Life	1,526	151	9.9	151	0	0	1,375
Fish Consumption	1,526	151	9.9	0.0	0	151	1,375
Primary Contact	1,526	151	9.9	151	0	0	1,375
Public and Food Processing Water Supplies	151	151	100	151	0	0	0
Secondary Contact(1)	1,526	151(2)	9.9 (2)	151(2)	0(2)	0(2)	1,375

Lake Michigan Shoreline; Units: Miles

Designated Use	Total Size	Total Assessed Size	Total Assessed %	Size Fully Supporting (Good)	Size Not Supporting (Fair)	Size Not Supporting (Poor)	Size Not Assessed
Aesthetic Quality(1)	63	0	0.0	0	0	0	63
Aquatic Life	63	0	0.0	0	0	0	63
Fish Consumption	63	63	100	0	0	63	0
Primary Contact	63	63	100	0	0	63	0
Secondary Contact(1)	63	0	0.0	0	0	0	63

1. Assessment guidelines are not yet fully developed; see section C-2 Assessment Methodology.
2. By definition, Secondary Contact Use is "Fully Supporting" in all waters in which Primary Contact Use is "Fully Supporting"; otherwise, assessment guidelines are not yet developed for determining the level of use attainment.

Groundwater

Year-to-year evaluation of the Illinois EPA ambient network of community water supply[1] (CWS) wells (not limited to just the probabilistic network) have shown fluctuations of volatile organic compounds (VOCs) (Cobb and Sinnot, 1987; and Clarke R.P., and R.P. Cobb, 1998). However, analyses of data collected from 1990 to the present shows a statistically significant increasing trend of CWS wells with VOC detections per year. The results show the importance of doing long-term monitoring so that trend analysis can be performed. More importantly, this data shows an increasing trend of groundwater degradation. Illinois EPA is continuing to evaluate this groundwater monitoring data to determine the causes and potential sources of this trend. However, the potential sources located adjacent to the wells with detections are chemical/petroleum processing/storage facilities. This makes these potential sources the most threatening out of the prevalent sources. The causal data also show total xylenes and 1,1,1-trichloroethane as the top ranked VOCs detected in network wells determined under the Not Supporting classification.

[1] "Community water supply" means a public water supply which serves or is intended to serve at least 15 service connections used by residents or regularly serves at least 25 residents.

In addition, research conducted by the Illinois State Water Survey (ISWS) indicates that chloride (Cl^-) concentrations are increasing in municipal wells in the outermost counties of the Chicago metropolitan area, with road salt runoff likely the largest potential source of contamination. In the vast majority of municipal wells in DuPage, Kane, McHenry, and Will counties, Cl^- concentrations have been increasing. More than half of the wells in these four counties have rate increases greater than 1 milligram per liter per year (mg/L/yr) and approximately 13% have increases greater than 4 mg/L/ yr. On the other hand, Cl^- concentrations have not been increasing in most municipal wells in Cook and Lake counties (Kelly and Wilson, 2004).

The results show that of the 356 CWS probabilistic network wells:

- **8 (2.2 %)** were determined to be Not Supporting ("poor") due to the elevated levels of nitrate (4 out of 8) and dichloromethane (4 out of 8). All of these wells draw their water from shallow sand & gravel aquifers, except for one, which is using a deep well from the Cambrian/Ordovician bedrock aquifer in the northern part of the state);
- **83 (23.3 %)** were determined to be Not Supporting ("fair") due to statistically significant increases of total dissolved solids (TDS) and chloride above background, detections of VOCs, nitrate (total nitrogen) greater than 3 mg/l, or pesticides and transformation products that have exceeded the non-degradation criteria, but have not exceeded the health-based Groundwater Quality Standards (GWQS); and
- **265 (74.5 %)** were determined to be Fully Supporting ("good"), which show no detections of any of the above analytes. However, trend analyses for VOC's also shows that there is a statistically significant increase in the number of CWS wells with VOC detections, despite the fact that the number of CWS analyzed for VOC's over the same time period declined, and the detection limit remained constant.

Results of the most recent sampling period (138 samples collected from October 2004 through September 2006) from the Illinois Department of Agriculture's (IDA) dedicated pesticide monitoring network wells indicate that parent pesticides (the term pesticides includes herbicides) were detected in eight of the 138 samples (5.8 percent). Atrazine was detected in six samples, and metolachlor was detected in three samples. None of those samples had concentrations above levels of health concern. One or more of the atrazine transformation products (note: the term transformation is used interchangeably with the term degradation and/or metabolites) (desethylatrazine, desisopropylatrazine, and desethyldeisopropyl atrazine) was present above the minimum reporting levels in 14.5 percent of the samples. In 2004, IDA added transformation product metabolites of the chloroacetanlide herbicides (alachlor, acetochlor, and metolachlor) to the list of analytes. One or more of these transformation products was detected in more than 50 percent of the samples. Although none of the pesticides detected exceed Illinois' health-based groundwater standards, the non-degradation standard of 35 Ill. Adm. Code 620.301 has been exceeded. Therefore, 50 percent of these wells have shown a diminishment in beneficial use. Thus, these wells would be assessed as Not Supporting "fair."

Illinois groundwater resources are being degraded. Degradation occurs based on the potential or actual diminishment of the beneficial use of the resource. When contaminant levels are detected (caused or allowed) or predicted (threat) to be above concentrations that cannot be removed via ordinary treatment techniques, applied by the owner of a private drinking water system well, potential or actual diminishment occurs. At a minimum, private well treatment techniques consist of chlorination of the raw source water prior to drinking.

PART A: INTRODUCTION

A-1. Reporting Requirements

The 2008 Integrated Report format satisfies the requirements of sections 305(b), 303(d) and 314 of the Federal Water Pollution Control Act Amendments of 1972 (PL 92-500) and subsequent amendments (hereafter, collectively called the Clean Water Act or CWA). According to Section 305(b) of the Clean Water Act, corresponding regulations in Title 40 of the Code of Federal Regulations and guidance provided by the United States Environmental Protection Agency (USEPA), each state, territory, tribe, and interstate commission (hereafter collectively called state) must report to USEPA on the quality of the surface water (e.g., lakes, streams, wetlands) and groundwater resources in their jurisdiction. Specifically, states must report the resource quality of their waters in terms of the degree to which the beneficial uses[2] of those waters are attained. States are also required to report the reasons (causes and sources) if beneficial uses are not attained. In addition, states are required to provide an assessment of the water quality of all publicly owned lakes, including the status and trends of such water quality as specified in Section 314(a)(1) of the Clean Water Act.

Section 303(d) of the Clean Water Act requires states to submit to USEPA a list of water quality-limited waters (i.e., waters where uses are impaired), the pollutants causing impairment to those waters and a priority ranking for the development of Total Maximum Daily Load[3] (TMDL) calculations (including waters targeted for TMDL development within the next two years). This list is often called the 303(d) List.

The Integrated Report process has two major phases corresponding to the requirements noted above. In the first phase use attainment assessments are conducted for all waters and all designated uses for which data are available to make assessments. As part of that process all potential causes (both pollutant and nonpollutant causes) and sources of impairment are identified. These assessment results, which include all use attainment assessments and all potential causes and sources of use impairment for all assessed waters, are shown in Appendix B. The next phase involves categorizing waters based on whether any uses are impaired, whether pollutant or nonpollutant causes are identified and whether or not a TMDL is required. A subset of all assessed waters and causes of impairment is identified as the 303(d) List (Appendix A). It includes only those waters which have uses that are impaired by pollutants and which require a TMDL. Each entry on the 303(d) List is a unique combination of a water body segment (also known as an assessment unit[4]) and pollutant cause of impairment that requires a separate loading calculation. Also, as part of this second phase, each segment-pollutant combination on the 303(d) List is prioritized for TMDL development and a two-year schedule for TMDL development is created. TMDLs are only conducted for causes of impairment which are

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[2] Beneficial uses, also called designated uses, are discussed in more detail in Section B-2 Water Pollution Control Program, Illinois Surface Water Quality Standards.

[3] Total Maximum Daily Load calculations determine the amount of a pollutant a water body can assimilate without exceeding the state's water quality standards or impairing the water body's designated uses.

[4] An assessment unit is a lake, a stream segment, or an open-water area, harbor or shoreline segment of Lake Michigan for which a use attainment assessment is made.

classified as pollutants such as metals or pesticides. Nonpollutant causes of impairment such as dissolved oxygen or habitat degradation are not components of Illinois' 303(d) List submission;.

The distinction between pollutant and nonpollutant is critical in this process. Section 502(6) of the Clean Water Act, defines a pollutant as *"dredged spoil, solid waste, incinerator residue, sewage, garbage, sewage sludge, munitions, chemical wastes, biological materials, radioactive materials, heat, wrecked or discarded equipment, rock, sand, cellar dirt and industrial, municipal, and agricultural waste discharged into water."* In general, pollutants are substances, chemicals, materials or wastes and their components that are discharged into the water. Pollution, as defined by the Clean Water Act Section 502(19), is *''the man-made or man-induced alteration of the chemical, physical, biological, and radiological integrity of a water body.''* This is a broad term that encompasses many types of changes to a water body, including alterations that do not result from the introduction of a specific pollutant or the presence of pollutants at a level that causes impairment. In other words, all waters impaired by human intervention suffer from some form of pollution. In some cases, the pollution is caused by the presence of a pollutant and a TMDL is required. For assessment purposes, Illinois EPA classifies almost all causes of impairment as pollutants. The classification of each cause of impairment is shown in the guidelines for identifying potential causes of impairment related to each use (Tables C-5, C-8, C-10 and C-12). Some nonpollutant causes such as (excessive) aquatic algae or (low) dissolved oxygen may in turn be caused by pollutants. Whenever these nonpollutant causes are identified, we attempt to determine if a pollutant is ultimately responsible for the impairment.

While pollutant causes of impairment are addressed by the Agency's TMDL program, nonpollutant causes are addressed by other agency programs such as 319 grants for nonpoint source pollution control activities and other grant programs.

To the extent possible, this 2008 Illinois Integrated Report Assessment and Listing Methodology is based on USEPA's *Guidance for 2006 Assessment, Listing and Reporting Requirements Pursuant to Sections 303(d), 305(b) and 314 of the Clean Water Act* issued July 29, 2005 and additional guidance contained in a USEPA memorandum from Diane Regas, office of Wetlands, Oceans and Watersheds, regarding *Information Concerning 2008 Clean Water Act Sections 303(d), 305(b), and 314 Integrated Reporting and Listing Decisions,* issued October 12, 2006.

A-2. Major Changes from the 2006 Report Methodology and Format

Some changes have been made during this assessment cycle to improve the clarity, accuracy and defensibility of assessments and listings. Major changes include:

- A new macroinvertebrate Index of Biotic Integrity (mIBI) has been incorporated into the assessment of <u>aquatic life</u> use in streams. The mIBI, which has been under development for several years, provides a more comprehensive assessment of the health of the macroinvertebrate community than does the older Macroinvertebrate Biotic Index (MBI). Therefore, when a macroinvertebrate sample has been collected which allows the calculation of an mIBI score, the MBI score is not independently used in the assessment process. The

MBI score will still be used when it is not possible to calculate an mIBI score. See Section C-2, Aquatic Life – Streams for more information.

- Dissolved oxygen (which is a cause of impairment used to indicate low dissolved oxygen) has been changed from a pollutant to a nonpollutant cause of impairment. Although low dissolved oxygen may be caused by pollutants, the impairment does not result from the discharge of dissolved oxygen into the water. Furthermore, federal regulations in CWA Section 502(6) do not define dissolved oxygen or low dissolved oxygen as a pollutant. Because only pollutant causes of impairment appear on the 303(d) List this means that all entries of dissolved oxygen have been delisted. However, dissolved oxygen will still be identified as a cause of impairment in Appendix B when data so indicate. Illinois EPA will also continue to use other criteria to determine those situations where pollutants such as total phosphorus contribute to low dissolved oxygen and those pollutant causes will be placed on the 303(d) List. We will also list Cause Unknown (which means pollutant unknown) as a cause of impairment in those situations where a pollutant is suspected of contributing to low dissolved oxygen but where that pollutant could not be identified from existing data. Changing dissolved oxygen from a pollutant to a nonpollutant resulted in a few waters being removed from the 303(d) List. Each of these cases was reviewed carefully to determine whether these segments are impaired by pollutants or pollution.

- We have stopped using total nitrogen, as a cause of impairment for ***aquatic life*** use. Total nitrogen appeared as nitrogen (total) on previous 303(d) Lists. We do not have a standard for total nitrogen related to aquatic life. In streams, we typically do not have total nitrogen data. The methods, criteria and the manner in which nitrogen was reported as a cause of impairment of ***aquatic life*** use have changed many times over previous assessment cycles. These criteria had never been shown to be related to ***aquatic life*** use impairment in any scientific study and had never been used or proposed as water quality standards. Illinois now believes that the criteria by which it placed total nitrogen on previous 303(d) Lists were not scientifically valid. Illinois does not believe that a scientifically valid criterion currently exists for determining when nitrogen is causing an impairment of ***aquatic life*** use in this state. While there is some scientific debate over the contribution of nitrogen to nutrient impacts, we believe that nutrient impacts can best be assessed by using criteria for total phosphorus and total phosphorus data are more widely available than nitrogen data. Furthermore, total nitrogen was not listed as a cause of impairment based on any evidence of excessive plant or algal growth. Total nitrogen was only listed as a cause of impairment when biological or other data indicated that ***aquatic life*** use was impaired. At that point in the assessment process, inappropriate criteria for total nitrogen were used to infer that total nitrogen was a potential cause of that ***aquatic life*** use impairment.

  Because Illinois now believes that those previous listings of total nitrogen were based on flaws in the listing methodology, we have deleted and delisted total nitrogen as a cause of impairment for all water bodies. However, this delisting will not affect the basis upon which these waters were assessed as impaired and will not cause any waters to be changed to an unimpaired status. Illinois has not placed any water body on the 303(d) List solely because of high levels of total nitrogen. Also, the vast majority of water body segments where total nitrogen was listed as a cause have remained on the 303(d) List even after this cause was deleted because most of the time there are other pollutant causes listed as well. In a few instances, where total nitrogen was the only pollutant cause listed, there was a potential for an entire water body segment to be removed from the 303(d) List. Each of these cases was reviewed carefully to determine whether these segments are impaired by pollutants or pollution.

We will continue to use the water quality standard for total ammonia nitrogen to indicate toxic impacts from ammonia.

- For assessing attainment and listing causes of impairment for *aquatic life* use, changes were made for three parameters that have undergone standards revision. See Section B-2, Revisions to Illinois General Use Water Quality Standards for more information on these changes.

  1) The Illinois Pollution Control Board eliminated the numeric standard for total dissolved solids (TDS) for general use waters as part of a revised standard for sulfates. Therefore, total dissolved solids is no longer used in the assessment of *aquatic life* use attainment and has been deleted and delisted as a cause of *aquatic life* use impairment for all waters.

  2) The Illinois Pollution Control Board adopted a revised standard for sulfates in general use waters that is intended to protect *aquatic life* use. The previous standard for sulfates was intended to protect agricultural uses and, therefore, was not previously used as a criterion for determining attainment or causes of *aquatic life* use impairment. The new sulfate standard is used in this cycle for determining attainment and causes of *aquatic life* use impairment.

  3) The Illinois Pollution Control Board adopted a revised standard for dissolved oxygen in general use waters that is considered more appropriate for protecting aquatic life than the previous standard. The new standard is used in this cycle for determining attainment and causes of *aquatic life* use impairment.

- Because of proposed comprehensive changes to the Secondary Contact and Indigenous Aquatic Life Standards (see Section B-2), no new assessments of *indigenous aquatic life* use have been made in this cycle. All previous assessments of *indigenous aquatic life* use, which were approved in the 2006 cycle, have been carried forward to 2008 without change.

- For this cycle we changed the guideline we use for indicating that sedimentation/siltation is impairing aquatic life use in streams (Table C-4 and Table C-5). The previous guideline was substrate >34% silt/mud. However, a reevaluation resulted in changing it to >75% silt/mud. For each of our other habitat guidelines (SHAP and QHEI metrics), we use the worst-case (called “Poor”) category to indicate the potential for aquatic life use impairment. However, >34% silt/mud was originally considered fair and >75% was considered poor, based on the 85th and 98th percentiles of statewide data, respectively (see Illinois Water Quality Report 2000). Using >75% is more consistent with both SHAP and QHEI.

- Several nonpollutant causes of impairment were added to Table C-5 as potential causes of *aquatic life* use impairment in streams to indicate impacts from hydromodification and other habitat changes.

- Changes were made in the methodology for assessing *fish consumption* use that give greater weight to the statewide fish-consumption advisory for mercury. This resulted in fewer waters being assessed as Fully Supporting *fish consumption* use.

- In previous assessment cycles Illinois EPA had used the term Impairment Unknown when we were not able to identify a potential cause of impairment for *aquatic life* use. This terminology was based on USEPA's Assessment Database. The term Impairment Unknown has been changed to Cause Unknown in the Assessment Database and Illinois EPA has changed all former instances of Impairment Unknown to Cause Unknown. This does not constitute a delisting or affect the 303(d) List in any way.

- For TMDL prioritization and scheduling, Illinois EPA uses watershed boundaries based on USGS ten-digit hydrologic units. All waters within each hydrologic unit are given the same TMDL priority and scheduled for TMDL development at the same time. In this cycle those 10-digit hydrologic unit watershed boundaries were updated based on a recently revised geographic dataset developed by the USDA Natural Resource Conservation Service. This resulted in some waters being placed in a different watershed than in previous cycles and may have caused a change in TMDL priority for those waters.

A-3. Primary Data Sources, Data Quality and Time Periods Covered

Data Used for This Assessment Cycle

In general, data that became readily available since the 2006 Integrated Report were considered, and we updated relevant assessments as appropriate. Because water-resource data take time to gather and process, each assessment cycle reflects up to a two-year data lag. Surface water assessments in this 2008 report are based primarily on biological, water, sediment, physical habitat, and fish-tissue information collected through 2005 (some in 2006) from various monitoring programs (Illinois EPA 2007a). These programs include: the Ambient Water Quality Monitoring Network, Intensive Basin Surveys, Facility-Related Stream Surveys, the Fish Contaminant Monitoring Program, the Ambient Lake Monitoring Program, the Illinois Clean Lakes Monitoring Program, the Volunteer Lake Monitoring Program, the Lake Michigan Monitoring Program, TMDL monitoring and other outside sources. Use attainment was assessed or updated only for surface waters where new information became available since the last report (i.e., 2006 report, based mostly on data through September 2003). All assessments in the 2006 report which were not updated also appear in the 2008 report. Those assessments are the same as in the 2006 report except where changes in methodologies were applied retroactively to all assessments (see Section A-2) or where errors were discovered in previous assessments. These older assessments are based on the most recent data available. Although the Intensive Basin

Monitoring program generally revisits each major basin in the state on a five-year basis, limited state resources make it impossible to monitor all water bodies in each basin every five years.

In 2008, stream assessments of *aquatic life* use, which rely primarily on data from Intensive Basin Surveys, were updated for stream segments in these basins: Mississippi River North, Mississippi River North Central, Mississippi River Central, Mississippi River South Central, Mississippi River South, Green River, Kankakee/Iroquois Rivers, Upper Illinois/Mazon Rivers, Vermilion River (Illinois River Basin), Mackinaw River, Spoon River, Cache River and Saline River/Bay Creek basins. These basins were sampled in either 2004 or 2005. In a few cases, where other data were available for waters outside these basins, we used that data to update assessments as well. Water chemistry data from the Ambient Water Quality Monitoring Network from 2002 through 2005 were also used in some of those assessments. A few assessments of aquatic life use in streams were updated based on Facility-Related Stream Survey data from 2004 and 2005.

All use attainment assessments on Lake Michigan were updated with Lake Michigan Monitoring Program data from years' 2003 through 2005.

Assessments of *indigenous aquatic life* use in streams were not updated in this cycle because proposed comprehensive changes to the Secondary Contact and Indigenous Aquatic Life Standards (see Section B-2) have not yet been approved by the Illinois Pollution Control Board. *Indigenous aquatic life* use was not updated this cycle for Lake Calumet because no new data were available.

Assessments of *primary contact* use and *secondary contact* use in streams were updated with Ambient Water Quality Monitoring Network data from years 2002 through 2006. Because there were no new fecal coliform samples collected in lakes since the last report, no new assessments of *primary contact* use or *secondary contact* use were made for inland lakes.

Assessments of *fish consumption* use were generally updated with Fish Contaminant Monitoring Program data from years' 2005 and 2006. In some cases older data may also have been used.

Aquatic life use and *aesthetic quality* use in lakes were updated with Ambient Lake Monitoring Program and Illinois Clean Lakes Monitoring Program data from years 2004 and 2005.

Public and food processing water supply use in streams was updated from a variety of data sources covering a period of 2001 through 2006. The same is true for inland lakes except that some updates may involve data as old as 1999.

Non-agency data sources such as the Lake County Health Department, the city of Chicago, the Metropolitan Water Reclamation District of Greater Chicago, the U.S. Geological Survey, TMDL contractors and others were also used for the assessment of various uses and water bodies.

Similarly, data were collected on groundwater resources throughout the state to detect impairments. Groundwater-quality monitoring programs include the Ambient Network of

Community Water Supply Wells, Pesticide Monitoring Subnetwork of the Community Water Supply Wells Network, Rotating Monitoring Network, and Dedicated Pesticide Monitoring Well Network.

Solicitation of Information

For assessing Illinois surface waters, Illinois EPA routinely considers data from three outside sources, including: 1. biological data (from streams) collected by the Illinois Department of Natural Resources as part of the Cooperative Intensive Basin Survey program described in Section C-1; 2. physicochemical water data provided by the city of Chicago for Lake Michigan (data from the city of Chicago was not received for this cycle); and,
3. physicochemical water data provided by the Lake County Public Health Department (Inland Lake data). We also retrieve data from the United States Geological Survey's Long Term Resource Monitoring Program (*http://www.umesc.usgs.gov*) that focuses on the Upper Mississippi River and from the Survey's National Stream Water Quality Network monitoring program (*http://nwis.waterdata.usgs.gov*) for use in assessments.

In June, 2007, Illinois EPA developed "*Guidance for Submittal of Surface Water Data For Consideration in Preparing the 2008 Integrated Report on Illinois Water Quality, including the List of Clean Water Act Section 303(d) Impaired Waters*" (Illinois EPA 2007b). This guidance and associated data-solicitation information were made available on the Illinois Environmental Protection Agency website (*www.epa.state.il.us/water/water-quality/guidance.html*) by June 15, 2007. The guidance describes the required format for data packages and associated quality assurance documentation and provides instructions on how and when (by August 15, 2007) to submit data for consideration for assessments in this report. Postcards requesting water quality monitoring data with reference to the submittal guidance on the web site were sent to over 400 individuals and organizations representing watershed groups, wastewater facilities, environmental consultants, universities, environmental groups, governmental organizations, participants on various Illinois EPA workgroups, and people who commented on previous 303(d) Lists. Data sets were received from nine external organizations by August 15, 2007: the Conservation Foundation (DuPage River/Salt Creek Workgroup), Tri-County Regional Planning Commission (Peoria), City Water Light and Power, National Park Service, Rock River Water Reclamation District, Sinnissippi Coalition for Restoration of the Environment (SCORE), Fox River Study Group, Thorn Creek Basin Sanitary District, Sierra Club, North Shore Sanitary District and Wheaton Sanitary District. Additional data sets received and/or requested after the August 15 deadline included the Metropolitan Water Reclamation District of Greater Chicago (MWRDGC), Conservation Foundation (DuPage River/ Salt Creek Workgroup - continuous monitoring data) and Lake Michigan bacteria/beach closing information from Lake County Public Health Department and USEPA Beach Advisory and Closing On-line Notification (BEACON). All submitted data that met Illinois EPA Quality Assurance/Quality Control requirements were considered for assessments in this report. Datasets which were not used in this report include the following:

- Lake Springfield data submitted by City Water Light and Power were collected under our Volunteer Lake Monitoring Program (VLMP). Currently, we do not use VLMP data in our assessments, but have plans to use selected, high-quality data sets in the future.

Quality Assurance Issues

Based on Illinois EPA's review of surface-water results analyzed by Illinois EPA laboratories, some available data failed to meet quality control criteria or failed to meet data quality objectives. The following results of analyses performed by the Illinois EPA Champaign laboratory were not used: ammonia collected from 01/01/1997 through 06/30/2006; phenols and total Kjeldahl nitrogen data collected from 01/01/1999 through 12/31/2003; and phosphorus, nitrate/nitrite, chloride, alkalinity, sulfate, cyanide, chlorophyll, total suspended solids, volatile suspended solids and total dissolved solids collected from 10/01/2002 through 12/31/2003. For the analytes listed above, the Illinois EPA Division of Laboratories and the Illinois EPA Bureau of Water reviewed results of samples collected after 12/31/2003 to determine usability for the assessments and cause identifications represented in this integrated report.

PART B: BACKGROUND INFORMATION

B-1. Total Waters

Illinois has abundant water resources (Table B-1). The U. S. Geological Survey's National Hydrography Dataset (NHD 1:100,000 scale) shows approximately 70,475 miles of streams within the state's borders, including major rivers such as the Big Muddy, Cache, Des Plaines, Embarras, Fox, Illinois, Kankakee, Kaskaskia, Little Wabash, Rock, Sangamon, and Vermilion rivers. In addition, the NHD shows 918 miles of large rivers forming the state's western (Mississippi River), eastern (in part, Wabash River), and southern (Ohio River) borders. Throughout this document, streams and rivers are collectively referred to as streams.

More than 91,400 inland lakes and ponds exist in Illinois, 3,256 of which have a surface area of six acres or more (Illinois Department of Natural Resources, 1999). About three-fourths of Illinois' inland lakes are man-made, including dammed stream and side-channel impoundments, strip-mine lakes, borrow pits, and other excavated lakes. Natural lakes include glacial lakes in the northeastern counties, sinkhole ponds in the southwest, and oxbow and backwater lakes along major rivers.

Illinois is bordered by one of the Great Lakes, Lake Michigan. The state has jurisdiction over approximately 1,526 square miles of open water and 63 miles of Lake Michigan shoreline, bordering Cook and Lake counties in the northeastern corner of the state. Lake Michigan is the third largest of the Great Lakes and is the largest body of fresh water located entirely within the boundaries of the United States. With the exception of the polar ice caps, the Great Lakes form the largest freshwater system on earth.

There are approximately 5,534 groundwater dependent public water supplies in the state, of which 1,195 are community water supplies. The Illinois Department of Public Health estimates approximately 400,000 residences of the state are served by private wells. To assess the groundwater resources of the state, the Illinois EPA utilizes three primary aquifer classes that were developed by O'Hearn and Schock (1984). These three principal aquifers are sand and gravel, shallow bedrock and deep bedrock aquifers. O'Hearn and Schock defined a principal aquifer as having a potential yield of 100,000 gallons per day per square mile and having an area of at least 50 miles. Approximately 58 percent (32,000 square miles) of the state is underlain by principal aquifers. Of these, about 33 percent (18,500 square miles) are major shallow groundwater sources. The following are numbers of community water supply (CWS) wells that withdraw from these aquifers: Out of 4,651 CWS wells, 43.8 % (2,036) utilize a sand & gravel aquifer; 24.4 % (1,134) utilize a shallow bedrock aquifer; 20.4 % (947) utilize a deep bedrock aquifer, 5.2 % (242); and 6.3 % (292) are undetermined.

Table B-1. Illinois Atlas.

Topic	Value	Scale	Source
State Population in year 2000	12,419,293		US Census Bureau
State Surface Area (sq. mi.)	56,250		
Major Watersheds	33		USGS
Total Stream Miles	71,394	1:100,000	NHD
Interior Stream Miles	70,475	1:100,000	NHD
Perennial Streams[2]	30,246	(1)	(1)
Intermittent Streams[2]	54,741	(1)	(1)
Ditches and Canals[2]	1,034	(1)	(1)
Border Stream Miles	918	1:100,000	NHD
Mississippi River	585	1:100,000	NHD
Ohio River	130	1:100,000	NHD
Wabash River	203	1:100,000	NHD
Inland Lakes and Ponds	91,456	(1)	(1)
Total Acreage	318,477	(1)	(1)
Total Inland Lakes (6 acres and more)	3,256	(1)	(1)
Total Inland Lake Acreage (6 acres and more)	253,224	(1)	(1)
Publicly-Owned Inland Lakes	1,279	(1)	(1)
Publicly-Owned Lake Acreage	154,333	(1)	(1)
Inland Lakes over 5,000 Acres	4	(1)	(1)
Acreage of Inland Lakes over 5,000 Acres	61,545	(1)	(1)
Lake Michigan		(1)	(1)
Illinois Shoreline Miles	63	(1)	(1)
Illinois Square Miles	1,526	(1)	(1)
Total Shallow Water Wetlands Acreage	720,000	(1)	(1)
Active CWS Facilities	1,779	N/A	SDWIS
Surface Facilities	93	N/A	SDWIS
Groundwater Facilities	1,055	N/A	SDWIS
Mixed Facilities	7	N/A	SDWIS
Purchase Facilities	162	N/A	SDWIS
Active CWS Wells	3,368	N/A	SDWIS
Confined Wells	2,069	N/A	SDWIS
Unconfined Wells	1,056	N/A	SDWIS
Undetermined Wells	246	N/A	SDWIS

NHD = National Hydrography Dataset
SDWIS = Safe Drinking Water Information System
1. 1999 Inventory of Illinois Surface Water Resources, Illinois Department of Natural Resources, Division of Fisheries, April 2000
2. Numbers for perennial and intermittent stream miles do not equal total stream miles because of different sources.

B-2. Water Pollution Control Program

Illinois Surface Water Quality Standards

Water pollution control programs are designed to protect the beneficial uses of the water resources of the state. Each state has the responsibility to set water quality standards that protect these beneficial uses, also called "designated uses." Illinois waters are designated for various uses including aquatic life, wildlife, agricultural use, primary contact (e.g., swimming, water skiing), secondary contact (e.g., boating, fishing), industrial use, drinking water, food-processing water supply and aesthetic quality. Illinois' water quality standards provide the basis for assessing whether the beneficial uses of the state's waters are being attained.

The Illinois Pollution Control Board is responsible for setting water quality standards to protect designated uses. The Illinois EPA is responsible for developing scientifically based water quality standards and proposing them to the Illinois Pollution Control Board for adoption into state rules and regulations. The federal Clean Water Act requires the states to review and update water quality standards every three years. Illinois EPA, in conjunction with USEPA, identifies and prioritizes those standards to be developed or revised during this three-year period.

The Illinois Pollution Control Board has established four primary sets (or categories) of narrative and numeric water quality standards for surface waters (Tables B-2 through B-4). Each set of standards is intended to help protect various designated uses established for each category (Table B-5).

- *General Use Standards* (35 Ill. Adm. Code Part 302, Subpart B) - These standards apply to almost all waters of the state and are intended to protect aquatic life, wildlife, agricultural, primary contact, secondary contact, and most industrial uses. <u>*Primary contact*</u> use is defined as "*any recreational or other water use in which there is prolonged and intimate contact with the water* [where the physical configuration of the water body permits it] *involving considerable risk of ingesting water in quantities sufficient to pose a significant health hazard, such as swimming and water skiing*" (35 Ill. Adm. Code 301.355). Secondary contact is "*any recreational or other water use in which contact with the water is either incidental or accidental and in which the probability of ingesting appreciable quantities of water is minimal, such as fishing, commercial and recreational boating, and any limited contact incident to shoreline activity*" (35 Ill. Adm. Code 301. 380). These General Use standards are also designed to ensure the aesthetic quality of the state's aquatic environment and to protect human health from disease or other harmful effects that could occur from ingesting aquatic organisms taken from surface waters of the state. Tables B-2 and B-3 show General Use standards.

- *Public and Food Processing Water Supply Standards* (35 Ill. Adm. Code Part 302, Subpart C) - These standards protect surface waters of the state for human consumption or for processing of food products intended for human consumption. These standards apply at any point at which water is withdrawn for treatment and distribution as a potable water supply or for food processing. See Table B-2 for these standards.

- *Secondary Contact and Indigenous Aquatic Life Standards* (35 Ill. Adm. Code 302, Subpart D) - These standards are intended to protect limited uses of those waters not suited for general use activities but are nonetheless suited for *secondary contact* uses and capable of supporting *indigenous aquatic life* limited only by the physical configuration of the body of water, characteristics, and origin of the water and the presence of contaminants in amounts that do not exceed these water quality standards. Secondary Contact and Indigenous Aquatic Life standards apply only to waters in which the General Use standards and the Public and Food Processing Water Supply standards do not apply: about 86 miles of canals, channels and modified streams and Lake Calumet (Figure B-1), in northeastern Illinois (35 Ill. Adm. Code 303.441). These include:

  a) The Chicago Sanitary and Ship Canal;
  b) The Calumet-Sag Channel;
  c) The Little Calumet River from its junction with the Grand Calumet River to the Calumet-Sag Channel;
  d) The Grand Calumet River;
  e) The Calumet River, except the 6.8 mile segment extending from the O'Brien Locks and Dam to Lake Michigan;
  f) Lake Calumet;
  g) The South Branch of the Chicago River;
  h) The North Branch of the Chicago River from its confluence with the North Shore Channel to its confluence with the South Branch;
  i) The Des Plaines River from its confluence with the Chicago Sanitary and Ship Canal to the Interstate 55 bridge; and
  j) The North Shore Channel, excluding the segment extending from the North Side Sewage Treatment Works to Lake Michigan.

  See Table B-2 for these standards.

- *Lake Michigan Basin Water Quality Standards* (35 Ill. Adm. Code 302, Subpart E) - These standards protect the beneficial uses of the open waters, the harbors and waters within breakwaters, and the waters within Illinois jurisdiction tributary to Lake Michigan, except for the Chicago River, North Shore Channel, and Calumet River. See Table B-4 for these standards.

Figure B-1. Waters in which "Secondary Contact and Indigenous Aquatic Life Water Quality Standards" apply.

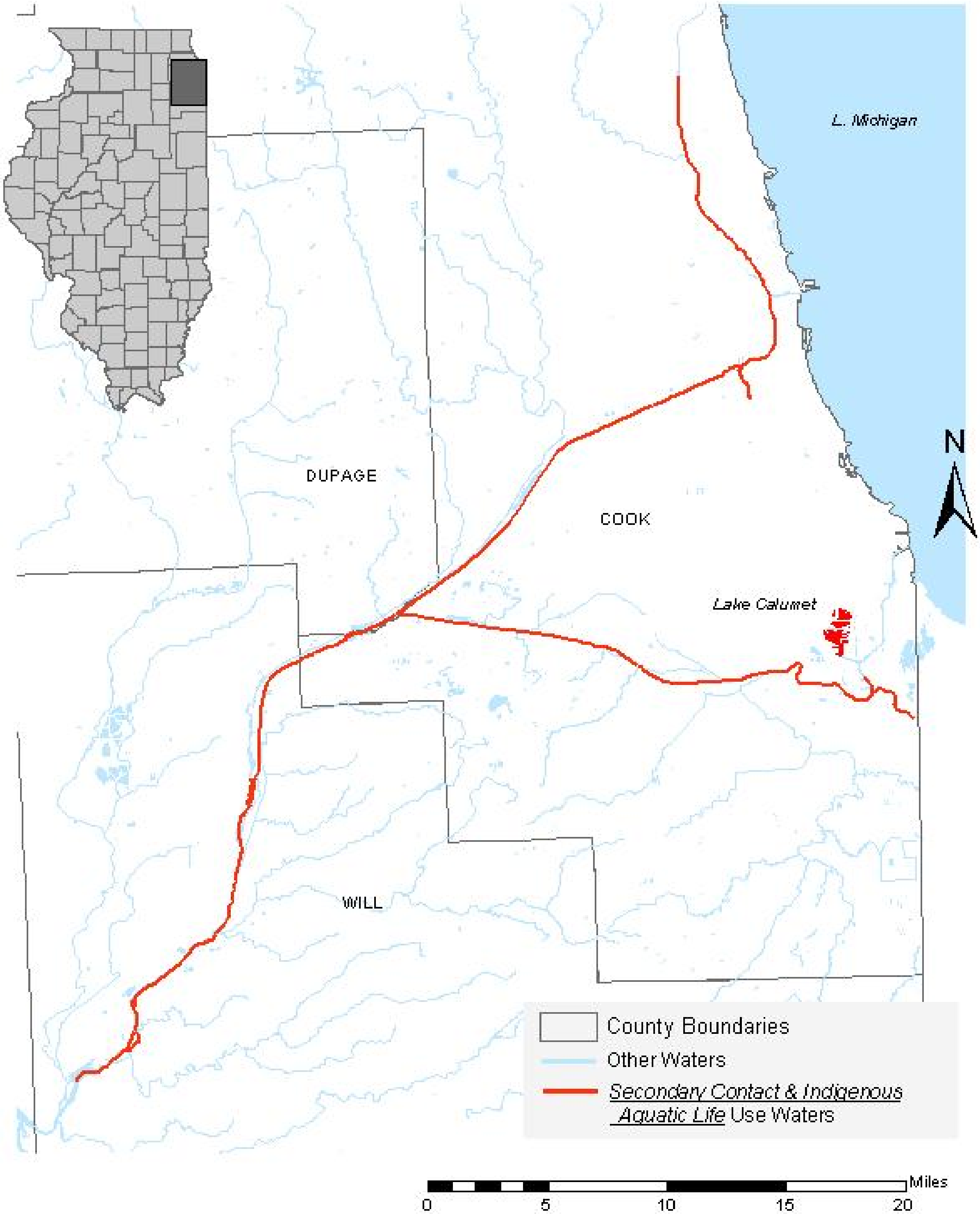


Table B-2. Illinois Surface Water Quality Standards[1].

PARAMETER	UNITS	GENERAL USE	PUBLIC AND FOOD PROCESSING WATER SUPPLY	SECONDARY CONTACT AND INDIGENOUS AQUATIC LIFE
pH	SU	6.5 minimum 9.0 maximum	---	6.0 minimum 9.0 maximum
Dissolved Oxygen	mg/L	**For most waters[2]:** March-July $\geq$ 5.0 min. & $\geq$ 6.0 7-day mean[2] Aug.-Feb $\geq$ 3.5 min, $\geq$ 4.0 7-day mean[2], & $\geq$ 5.5 30-day mean[2]. **For waters with enhanced protection [2]:** March-July $\geq$ 5.0 min & $\geq$ 6.25 7-day mean[2] Aug.-Feb $\geq$ 4.0 min, $\geq$ 4.5 7-day mean[2], & $\geq$ 6.0 30-day mean.[2]	---	4.0 minimum [3]
Arsenic	µg/L	(4)	50	1000
Barium	µg/L	5000	1000	5000
Boron	µg/L	1000	---	---
Cadmium	µg/L	(4)	10	150
Chloride	mg/L	500	250	---
Chromium (Total)	µg/L	---	50	---
Chromium (Trivalent)	µg/L	(4)	---	1000
Chromium (Hexavalent)	µg/L	(4)	---	300
Copper	µg/L	(4)	---	1000
Cyanide	mg/L	(4)	---	0.1
Fluoride	mg/L	1.4	---	15.0
Iron (Total)	µg/L	---	---	2000
Iron (Dissolved)	µg/L	1000	300	500
Lead (Total)	µg/L	---	50	100
Lead (dissolved)	µg/L	(4)	---	---
Manganese	µg/L	1000	150	1000
Mercury	µg/L	(4)	---	0.5
Nickel	µg/L	(4)	---	1000
Phenols	µg/L	100	1.0	300
Selenium	µg/L	1000	10	1000
Silver	µg/L	5.0	---	100
Sulfate	mg/L	2000[5]	250	---
Total Dissolved Solids	mg/L	---	500	1500
Total Residual Chlorine	µg/L	(4)	---	---
Zinc	µg/L	(4)	---	1000
Fecal Coliform Bacteria				
May-Oct.	count/100 ml	200[6], 400[7]	2000[6]	---
Nov.-April	count/100 ml	---	2000[6]	---

PARAMETER	UNITS	GENERAL USE	PUBLIC AND FOOD PROCESSING WATER SUPPLY	SECONDARY CONTACT AND INDIGENOUS AQUATIC LIFE
Total Ammonia Nitrogen	mg/L	15(4)	---	---
Un-ionized Ammonia Nitrogen	mg/L	---	---	0.1
Nitrate Nitrogen	mg/L	---	10	---
Oil and Grease	mg/L	---	0.1	15.0
Total Phosphorus	mg/L	0.05 (8)	---	---
Temperature	°C	2.8° maximum rise in water temperature(9)		37.8° max.& shall not exceed 34°more than 5% of time
Aldrin	µg/L	---	1	---
Dieldrin	µg/L	---	1	---
Endrin	µg/L	---	0.2	---
Total DDT	µg/L	---	50	---
Total Chlordane	µg/L	---	3	---
Methoxychlor	µg/L	---	100	---
Toxaphene	µg/L	---	5	---
Heptachlor	µg/L	---	0.1	---
Heptachlor epoxide	µg/L	---	0.1	---
Lindane	µg/L	---	4	---
Parathion	µg/L	---	100	---
2,4-D	µg/L	---	100	---
Silvex	µg/L	---	10	---
Benzene	µg/L	(4)	---	---
Ethylbenzene	µg/L	(4)	---	---
Toluene	µg/L	(4)	---	---
Xylene(s) (total)	µg/L	(4)	---	---

mg/L = milligrams per liter µg/L = micrograms per liter (---) Means no numeric standard specified.

1. 35 Ill. Adm. Code 302.
2. Applies to the dissolved oxygen concentration in the main body of all streams, in the water above the thermocline of thermally stratified lakes and reservoirs, and in the entire water column of unstratified lakes and reservoirs. Additional dissolved oxygen criteria are found in 35 Ill Adm. Code 302.206, including the list of waters with enhanced dissolved oxygen protection (Appendix D) and methods for assessing attainment of dissolved oxygen minimum and mean values.
3. Excluding the Calumet-Sag Channel, which shall not be less than 3.0 mg/L at any time.
4. Acute and Chronic Standards (see Table B-3).
5. At any point where water is withdrawn or accessed for purposes of livestock watering, the average of sulfate concentrations must not exceed 2,000 mg/L when measured at a representative frequency over a 30 day period, otherwise the sulfate standard is based on hardness and chloride values as explained in the table below:

Hardness (mg/L)	And/ Or	Chloride (mg/L)	Sulfate Standard
≥ 100 but ≤ 500	and	≥ 25 but ≤ 500	C = [1276.7 + 5.508 (hardness) – 1.457 (chloride)] * 0.65
≥ 100 but ≤ 500	and	≥ 5 but < 25	C = [-57.478 + 5.79 (hardness) + 54.163 (chloride)] * 0.65
< 100	or	<5	The sulfate standard is 500 mg/L
>500	and	≥ 5 and ≤ 500	The sulfate standard is 2000 mg/L

Where, C = sulfate concentration

6. Geometric mean based on a minimum of 5 samples taken over not more than a 30-day period.
7. Not to be exceeded by more than 10% of samples in any 30-day period.
8. Standard applies in any reservoir or lake $\geq$20 surface acres and in streams at the point of entry into these lakes or reservoirs.
9. In addition, the water temperature at representative locations in the main river shall not exceed maximum limits in the following table during more than one percent of the hours in the 12-month period ending with any month. Moreover, at no time shall the water temperature at such locations exceed the maximum limits in the following table by more than 1.7^{o} C (3^{o} F).

Month	**^{o} C**	**^{o} F**	**Month**	**^{o} C**	**^{o} F**
JAN.	16	60	**JUL.**	32	90
FEB.	16	60	**AUG.**	32	90
MAR.	16	60	**SEPT.**	32	90
APR.	32	90	**OCT.**	32	90
MAY	32	90	**NOV.**	32	90
JUNE	32	90	**DEC.**	16	60

Table B-3. Illinois Acute and Chronic General Use Water Quality Standards[1].

Constituent	Acute Standard[2]	Chronic Standard[3], [7]
Arsenic (trivalent, dissolved) (µg/L)	360 X 1.0*=360	190 X 1.0*=190
Cadmium (dissolved) (µg/L)	exp[A+Bln(H)] X {1.138672-[(lnH) X (0.041838)]}*, where A=-2.918 and B=1.128	exp[A+Bln(H)] X {1.101672-[(lnH) X (0.041838)]}*, where A=-3.490 and B=0.7852
Chromium (hexavalent, total) (µg/L)	16	11
Chromium (trivalent, dissolved) (µg/L)	exp[A+Bln(H)] X 0.316*, where A=3.688 and B=0.8190	exp[A+Bln(H)] X 0.860*, where A=1.561 and B=0.8190
Copper (dissolved) (µg/L)	exp[A+Bln(H)] X 0.960*, where A=-1.464 and B=0.9422	exp[A+Bln(H)] X 0.960*. where A=-1.465 and B=0.8545
Cyanide[4] (µg/L)	22	5.2
Lead (dissolved) (µg/L)	exp[A+Bln(H)] X {1.46203-[(lnH) X (0.145712)]}*, where A=-1.301 and B=1.273	exp[A+Bln(H)] X {1.46203-[(lnH) X (0.145712)]}*, where A=-2.863 and B=1.273
Mercury[5] (dissolved) (µg/L)	2.6 X 0.85*=2.2	1.3 X 0.85*=1.1
Nickel (dissolved) (µg/L)	exp[A+Bln(H)] X 0.998*, where A=0.5173 and B=0.8460	exp[A+Bln(H)] X 0.997*, where A=-2.286 and B=0.8460
Total Residual Chlorine (µg/L)	19	11
Zinc (dissolved) (µg/L)	exp[A+Bln(H)] X 0.978*, where A=0.9035 and B=0.8473	Exp[A+Bln(H)] X 0.986*, where A=-0.8165 and B=0.8473
Benzene[6] (µg/L)	4200	860
Ethylbenzene (µg/L)	150	14
Toluene (µg/L)	2000	600
Xylene(s) (µg/L)	920	360
Total Ammonia Nitrogen (Early Life Stage Present Period: March through October[8]) (mg/L)	$\frac{0.411}{1 + 10^{7.204-pH}} + \frac{58.4}{1 + 10^{pH-7.204}}$	When water temperature ≤14.51°C $\left\{\frac{0.0577}{1+10^{7.688-pH}}+\frac{2.487}{1+10^{pH-7.688}}\right\}(2.85)$ When water temperature >14.51°C $\left\{\frac{0.0577}{1+10^{7.688-pH}}+\frac{2.487}{1+10^{pH-7.688}}\right\}\left(1.45*10^{0.028*(25-T)}\right)$ Where T = Water Temperature, degrees Celsius
Total Ammonia Nitrogen (Early Life Stage Absent Period: November through February[8]) (mg/L)	$\frac{0.411}{1 + 10^{7.204-pH}} + \frac{58.4}{1 + 10^{pH-7.204}}$	When water temperature ≤7°C $\left\{\frac{0.0577}{1+10^{7.688-pH}}+\frac{2.487}{1+10^{pH-7.688}}\right\}\left(1.45*10^{0.504}\right)$ When water temperature >7°C $\left\{\frac{0.0577}{1+10^{7.688-pH}}+\frac{2.487}{1+10^{pH-7.688}}\right\}\left(1.45*10^{0.028(25-T)}\right)$ Where T = Water Temperature, degrees Celsius
Total Ammonia Nitrogen (mg/L)	Total ammonia nitrogen must in no case exceed 15 mg/L	The subchronic standard = 2.5 times the chronic standard.

Footnotes for Table B-3

Where: Exp(x) = base of natural logarithms raised to x power and
ln(H) = natural logarithm of hardness of the receiving water in mg/L
* = conversion factor multiplier for dissolved metals

1. 35 Ill. Adm. Code 302.
2. Not to be exceeded except where a zone of initial dilution is granted.
3. Except for Total Ammonia Nitrogen, not to be exceeded by the average of at least four consecutive samples collected over any period of at least four days except where a mixing zone is granted.
4. STORET No. 718. Available cyanide is determined using USEPA Method OIA 1677.
5. Human health standard is 0.012 μg/L. The human health standard must be met on an annual average basis, 35 Ill Adm. Code 302.208 c, f.
6. Human health standard is 310 μg/L. The human health standard must be met on an annual average basis, 35 Ill Adm. Code 302.208 c, f.
7. For Total Ammonia Nitrogen, the 30-day average concentration of total ammonia nitrogen (in mg/L) must not exceed the chronic standard (CS) by an average of at least four samples collected at weekly intervals or at other sampling intervals that statistically represent a 30-day sampling period. The 4-day average concentration of total ammonia nitrogen (in mg/L) must not exceed the subchronic standard by averaging daily sample results collected over a period of four consecutive days within the 30-day averaging period.
8. The Early Life Stage Present period occurs from March through October. In addition, during any other period when early life stages are present, and where the water quality standard does not provide adequate protection for these organisms, the water body must meet the Early Life Stage Present water quality standard. All other periods are subject to the Early Life Stage Absent period.

Table B-4. Lake Michigan Basin Water Quality Standards.

Parameter	Unit	*Aquatic Life* Use (1)			Human Health Standard (5)	Water Quality or HHS(6) Standard for "Open Waters" only(6)	Water Quality Standard for other uses(7)	Wildlife Standard (8)
		AS (2)	CS (3)	Other (4)				
Arsenic (trivalent, dissolved)	µg/L	340	148	NA(9)	NA	NA	NA	NA
Arsenic (total)	µg/L	NA	NA	NA	NA	50.0	NA	NA
Cadmium (dissolved)	µg/L	exp[A+Bln(H)]X{1.138672–[(lnH)X(0.041838)]}, where A = -3.6867 B = 1.128	exp[A+Bln(H)]X{1.138672–[(lnH)X(0.041838)]}, where A = -2.715 B = 0.7852	NA	NA	NA	NA	NA
Chromium (hexavalent, total)	µg/L	16	11	NA	NA	NA	NA	NA
Chromium (trivalent, dissolved)	µg/L	exp[A+Bln(H)] X 0.316, where A = 3.7256 B = 0.819	exp[A+Bln(H)] X 0.860, where A = 0.6848 B = 0.819	NA	NA	NA	NA	NA
Copper (dissolved)	µg/L	exp[A+Bln(H)] X 0.960, where A = -1.700 B = 0.9422	exp[A+Bln(H)] X 0.960, where A = -1.702 B = 0.8545	NA	NA	NA	NA	NA
Cyanide (weak acid dissociable)	µg/L	22	5.2	NA	NA	NA	NA	NA
Lead (dissolved)	µg/L	exp[A+Bln(H)] X {1.46203-[(lnH)(0.145712)]}, where A = -1.055 B = 1.273	exp[A+Bln(H)] X {1.46203-[(lnH)(0.145712)]}, where A = -4.003 B = 1.273	NA	NA	NA	NA	NA
Lead (total)	µg/L	NA	NA	NA	NA	50.0	NA	NA
Nickel (dissolved)	µg/L	exp[A+Bln(H)] X 0.998, where A = 2.255 B = 0.846	exp[A+Bln(H)] X 0.997, where A = 0.0584 B = 0.846	NA	NA	NA	NA	NA
Selenium (dissolved)	µg/L	NA	5.0	NA	NA	NA	NA	NA
Selenium (total)	µg/L	NA	NA	NA	NA	10.0	NA	NA
Total Residual Chlorine	µg/l	19	11	NA	NA	NA	NA	NA
Zinc (dissolved)	µg/L	exp[A+Bln(H)] X 0.978, where A = 0.884 B = 0.8473	exp[A+B ln(H)] X 0.986, where A = 0.884 B = 0.8473	NA	NA	NA	NA	NA
Benzene	µg/L	3900	800	NA	310	HHS: 12.0	NA	NA
Chlorobenzene	mg/L	NA	NA	NA	3.2	HHS: 0.470	NA	NA
2,4 – Dinitrophenol	mg/L	NA	NA	NA	2.8	HHS: 0.0550	NA	NA
Endrin	µg/L	0.086	0.036	NA	NA	NA	NA	NA
Hexachloroethane	µg/L	NA	NA	NA	6.7	HHS: 5.30	NA	NA
Methylene Chloride	mg/L	NA	NA	NA	2.6	HHS: 0.0470	NA	NA
Parathion	µg/L	0.065	0.013	NA	NA	NA	NA	NA
Pentachlorophenol	µg/L	exp B([pH] + A), where A = -4.869 B = 1.005	exp B([pH] + A), where A = -5.134 B = 1.005	NA	NA	NA	NA	NA
Ethylbenzene	µg/L	150	14	NA	NA	NA	NA	NA
Toluene	mg/L	2000	610	NA	51.0	HHS: 5.60	NA	NA

Parameter	Unit	*Aquatic Life* Use (1)			Human Health Standard (5)	Water Quality or HHS(6) Standard for "Open Waters" only(6)	Water Quality Standard for other uses(7)	Wildlife Standard (8)
		AS (2)	CS (3)	Other (4)				
Xylene(s) (total)	µg/l	1200	490	NA	NA	NA	NA	NA
Trichloroethylene	µg/L	NA	NA	NA	370	HHS: 29.0	NA	NA
Barium (total)	mg/L	NA	NA	5.0	NA	1.0	NA	NA
Boron (total)	mg/L	NA	NA	NA	NA	NA	1.0	NA
Chloride	mg/L	NA	NA	500	NA	12.0	NA	NA
Fluoride	mg/L	NA	NA	NA	NA	NA	1.4	NA
Iron (dissolved)	mg/L	NA	NA	1.0	NA	0.30	NA	NA
Manganese (total)	mg/L	NA	NA	1.0	NA	0.15	NA	NA
Phenols	µg/l	NA	NA	NA	NA	1.0	100	NA
Sulfate	mg/L	NA	NA	NA	NA	24.0	500	NA
Total Dissolved Solids	mg/L	NA	NA	1000	NA	180.0	NA	NA
Nitrate-Nitrogen	mg/L	NA	NA	NA	NA	10.0	NA	NA
Phosphorus	µg/L	NA	NA	NA	NA	7.0	NA	NA
Lindane	µg/L	0.95	NA	NA	0.5	HHS: 0.47	NA	NA
Un-ionized ammonia:								
April-October	mg/L	0.33 (10)	0.057 (10)	NA	NA	NA	NA	NA
November-March	mg/L	0.14 (10)	0.025 (10)	NA	NA	NA	NA	NA
Total Ammonia-Nitrogen	mg/L	NA	NA	15	NA	0.02	NA	NA
Fecal coliform bacteria	#/100 ml	NA	NA	NA	NA	20(11)	200/400(12)	NA
pH minimum	SU	NA	NA	6.5	NA	7.0	NA	NA
pH maximum	SU	NA	NA	9.0	NA	9.0	NA	NA
Dissolved Oxygen	mg/L	NA	NA	– (13)	NA	NA	NA	NA
Mercury (total)	ng/L	1700	910	NA	3.1	NA	NA	1.3
Chlordane	ng/L	NA	NA	NA	0.25	NA	NA	NA
DDT and metabolites	pg/L	NA	NA	NA	150	NA	NA	11.0
Dieldrin	ng/L	240	56	NA	0.0065	NA	NA	NA
Hexachlorobenzene	ng/L	NA	NA	NA	0.45	NA	NA	NA
PCBs (class)	pg/L	NA	NA	NA	26	NA	NA	120
2,3,7,8-TCDD	fg/L	NA	NA	NA	8.6	NA	NA	3.1
Toxaphene	pg/L	NA	NA	NA	68	NA	NA	NA
2,4-Dimethylphenol	mg/L	NA	NA	NA	8.7	HHS: 0.450	NA	NA
Oil (hexane solubles or equivalent)	mg/L	NA	NA	NA	NA	0.10	NA	NA
Temperature	(Refer to 35 Ill. Adm. Code 302.506, 302.507, 302.508, 302.509)							

Where:

mg/L = milligrams per liter (10^{-3} grams per liter)
µg/L = micrograms per liter (10^{-6} grams per liter)
ng/L = nanograms per liter (10^{-9} grams per liter)
pg/L = picograms per liter (10^{-12} grams per liter)

NA = Criterion currently not available or not applicable
Exp (x) = base of natural logarithms raised to the x-power
ln(H) = natural logarithm of Hardness
fg/L – femtograms per liter (10^{-15} grams per liter)

Footnotes for Table B-4

1 35 Ill. Adm. Code 302
2 Acute standard – not to be exceeded at any time (35 Ill. Adm. Code 302.504 a, e). These criteria apply in all waters of the Lake Michigan Basin.
3 Chronic standard – not to be exceeded by the arithmetic average of at least four consecutive samples over a period of at least four days (35 Ill. Adm. Code 302.504 a, e). These criteria apply in all waters of the Lake Michigan Basin.
4 Other water quality standards applicable to *aquatic life* use (35 Ill. Adm. Code 302.502, 302.503, 302.504 b). These criteria apply in all waters of the Lake Michigan Basin unless an open waters water quality standard is specified. In these cases, the criterion in the *aquatic life* use column applies to all waters of the Lake Michigan Basin other than the open waters.
5 Human health standard – not to be exceeded by the arithmetic average of at least four consecutive samples over a period of at least four days (35 Ill. Adm. Code 302.504 a, d, e). For each parameter, the criterion applies in all waters of the Lake Michigan Basin unless an open waters human health standard is specified. In these cases, the standard in the "Human Health Standards" column applies to all waters of the Lake Michigan Basin other than the open waters.
6 Water quality standards or human health standards, specified as "HHS," apply only in the open waters of the Lake Michigan Basin (35 Ill. Adm. Code 302.504 c, d; 302.502; 302.503; 302.505; 302.535).
7 Water quality standards applicable to uses other than *aquatic life* use. These do not include Public and Food Processing Water Supply Standards applicable at some locations in the waters of the Lake Michigan Basin; for these standards see Table B-2.
8 Wildlife standard – not to be exceeded by the arithmetic average of at least four consecutive samples over a period of at least four days (35 Ill. Adm. Code 302.504 e). These criteria apply in all waters of the Lake Michigan Basin.
9 "NA" means that a numeric criterion currently is not available, but may be derived in the future as per 35 Ill. Adm. Code 302.540.
10 Acute standard and chronic standard for un-ionized ammonia computed as per 35 Ill. Adm. Code 302.535 c.
11 Based on a minimum of five samples taken over not more than a 30-day period.
12 For Lake Michigan-basin waters other than open waters, fecal coliform bacteria must not exceed a geometric mean of 200 per 100 ml, nor shall more than 10% of the samples during any 30-day period exceed 400 per 100 ml, based on a minimum of five samples taken over not more than a 30-day period.
13 Dissolved oxygen must not be less than 90% of saturation, except due to natural causes, in the open waters of the Lake Michigan Basin (as defined at 35 Ill. Adm. Code 302.501). The other waters of the Lake Michigan Basin (i.e., tributaries, harbors and areas within breakwaters of Lake Michigan) must not be less than 6.0 mg/L during at least 16 hours of any 24 hour period, nor less than 5.0 mg/L at any time.

Table B-5. Illinois Designated Uses and Applicable Water Quality Standards.

Illinois EPA Designated Uses Assessed in 2008	Illinois Waters in which the Designated Use and Standards Apply(1)	Applicable Illinois Water Quality Standards
Aquatic Life	Streams, Inland Lakes	General Use Standards
	Lake Michigan-basin waters	Lake Michigan Basin Standards
Aesthetic Quality	Inland Lakes	General Use Standards
	Lake Michigan-basin waters	Lake Michigan Basin Standards
Indigenous Aquatic Life	Specific Chicago Area Waters (Figure B-1)	Secondary Contact and Indigenous Aquatic Life Standards
Primary Contact (Swimming)	Streams, Inland Lakes	General Use Standards
	Lake Michigan-basin waters	Lake Michigan Basin Standards
Secondary Contact	Streams, Inland Lakes	General Use Standards
	Lake Michigan-basin waters	Lake Michigan Basin Standards
	Specific Chicago Area Waters (Figure B-1)	Secondary Contact and Indigenous Aquatic Life Standards
Public and Food Processing Water Supply	Streams, Inland Lakes, Lake Michigan-basin waters	Public and Food Processing Water Supply Standards
Fish Consumption	Streams, Inland Lakes	General Use Standards (Human Health)
	Lake Michigan-basin waters	Lake Michigan Basin Standards (Human Health)
	Specific Chicago Area Waters (Figure B-1)	Secondary Contact and Indigenous Aquatic Life Standards

1. As defined in 35 Ill. Adm. Code 302.201 and 303.

Narrative Standards and Antidegradation Regulations

Water quality standards generally consist of three components: designated uses, a set of numeric and narrative criteria to protect those uses, and an antidegradation statement. In Illinois, the antidegradation statement (35 Ill. Adm. Code 302.105) is separate and covers all designated uses. This component of Illinois' water quality standards describes regulations which protect "*existing uses of all waters of the State of Illinois, maintain the quality of waters with quality that is better than water quality standards, and prevent unnecessary deterioration of waters of the State*."

While the majority of Illinois' water quality standards are in the form of numeric criteria as shown in Tables B-2, B-3, and B-4, several aspects of the standards have narrative elements. The standard for water temperature in both the General Use Standards (35 Ill. Adm. Code 302.211) and the Lake Michigan Basin Standards (35 Ill. Adm. Code 302.507) has a narrative element which prohibits "*abnormal temperature changes that may affect aquatic life*" and any disruptions in the "*normal daily and seasonal temperature fluctuations that existed before the addition of heat*." Narrative language in the General Use and Lake Michigan Basin standards (35 Ill. Adm. Code 302.210, 302.540) also protects waters from any toxic substances "*harmful to human health, or to animal, plant or aquatic life*." In addition, the Public and Food Processing Water Supply Standards also contain narrative elements (35 Ill. Adm. Code 302.303, 302.305) that prohibit concentrations of contaminants hazardous to human health in waters used for human consumption. Furthermore, "*Offensive Conditions*" such as "*sludge or bottom deposits, floating debris, visible oil, odor, plant or algal growth, color or turbidity of other than natural origin*" are prohibited in all waters of the state (35 Ill. Adm. Code 302.203, 302.403, 302.515).

Derived Water Quality Criteria

The narrative standards in Title 35 of the Illinois Administrative Code, Section 302.210 and in Subpart F for General Use Waters and at 302.540 and elsewhere in Subpart E allow the Illinois EPA to derive numeric water quality criteria values for any substance that does not already have a numeric standard in the Illinois Pollution Control Board regulations. These criteria serve to protect aquatic life, human health or wildlife, although wildlife based criteria have not yet been derived. Illinois EPA derived criteria can be found at following the web site: http://www.epa.state.il.us/water/water-quality-standards/water-quality-criteria.html.

Revisions to Illinois General Use Water Quality Standards

Several important revisions to the General Use standards have been adopted by the Illinois Pollution Control Board since the publication of the 2006 Integrated Report and have been incorporated into the 2008 Integrated Report.

Dissolved Oxygen. On April 19, 2004, the Illinois Association of Wastewater Agencies (IAWA) filed its rulemaking proposal to amend Illinois' general use water quality standard for dissolved oxygen. The IPCB issued an order on May 6, 2004, accepting the IAWA proposal for hearing. The Illinois Department of Natural Resources and Illinois EPA filed their jointly recommended revisions to the dissolved oxygen standard on April 4, 2006. Hearings concluded in November 2006 and public comments were filed through June 2007. On August 3rd, 2007, the first notice was published in the *Illinois Register*, stating the Illinois Pollution Control Board's intention to adopt proposed amendments to Illinois' General Use Water Quality Standard for dissolved oxygen. The amended standards were approved on January 24, 2008. The complete wording of the new dissolved oxygen standard is found in 35 Ill Adm. Code 302.206. A summary of the new standard is found in Table B-2

Sulfate/Total Dissolved Solids: In October of 2006 the Illinois EPA submitted to the Illinois Pollution Control Board proposed revisions to Illinois' General Use Water Quality Standards for sulfate and total dissolved solids. The standard for total dissolved solids is proposed to be eliminated and a new aquatic-life-based standard for sulfate is proposed to be added. This proposal also includes revisions to mixing zone regulations and mining activities. Hearings were completed in April 2007. On October 5, 2007 the first notice was published in the *Illinois Register*, stating the Illinois Pollution Control Board's intention to adopt proposed amendments to Illinois' General Use Water Quality Standard for sulfate and TDS. The amended standards are expected to be approved in July 2008. The complete wording of new sulfate standard is found in 35 Ill Adm. Code 302.208. A summary of the new standard is found in Table B-2

Proposed Revisions to the Secondary Contact and Indigenous Aquatic Life Standards

These standards currently apply to portions of the Chicago, Calumet and Lower Des Plaines River drainages which were altered, in various stages during the mid 1800s into the mid 1900s, to promote commercial navigation and to eliminate untreated sewage from flowing into Lake Michigan. These waters were greatly impacted by hydromodification, alteration in flow, and storm water and waste water discharges from the urban development of the Chicago metropolitan area. At the time of standards development it was believed these waters could not meet the interim goal of the Clean Water Act. The Secondary Contact and Indigenous Aquatic Life Standards were intended to provide some level of protection for these highly modified waters which were not suited for General Use activities.

Since the implementation of the standards in the 1970s water quality improved and questions arose as to the potential of these waters and what level of protection they should receive. Two separate Use Attainability Analyses (UAA) were conducted; one on the lower Des Plaines River (AquaNova International, Ltd. and Hey & Associates, Inc., 2003), and one on the Chicago Area Waterway System (Camp, Dresser and McKee, 2007). The main purpose of the UAAs was to determine if the Secondary Contact and Indigenous Aquatic Life Use waters could meet the aquatic life and recreational goals of the Clean Water Act or, if these goals could not be met, what beneficial uses could be attained in those waters.

Illinois EPA used the two UAAs to form a single rulemaking proposal and on October 26, 2007 filed a rulemaking notice with the Illinois Pollution Control Board. The result is an exhaustive and detailed rulemaking proposal which includes changes in definitions, use designations and the subdivision of the segments of the UAA waters into the new Use Designation Categories. The proposal also includes changes to Part 302, Subparts A and D which replace the existing narrative and numerical water quality standards necessary to protect the Secondary Contact and Indigenous Aquatic Life Uses with new standards designed to protect newly defined uses.

Finally, changes are proposed to Part 304 that address effluent limitations for bacteria discharges. The complete proposal can be found on the Illinois Pollution Control Board website at http://www.ipcb.state.il.us/documents/dsweb/Get/Document-59147/.

Water Pollution Control Programs for Surface Water

The Illinois Environmental Protection Act of 1970 established a statewide program for environmental protection and assigned authority to implement purposes of the Act to three entities. The Illinois Pollution Control Board was assigned the responsibility of establishing the basic regulations and standards necessary for the preservation of the environment. The Act also created and established the Illinois EPA as the principal state agency for implementation of environmental programs. This includes activities such as monitoring, watershed planning, permitting, financial assistance administration, compliance assurance, and program management conducted to prevent, control and abate water pollution in Illinois. The Illinois EPA is responsible for the maintenance and updating of the state Water Quality Management Plan that identifies the state's goals and objectives pertaining to water quality activities.

The Act further established the Illinois Institute for Environmental Quality as the research and education arm of the state's environmental protection apparatus. These responsibilities were subsequently assumed by the Illinois Department of Energy and Natural Resources that, in July 1995, became part of the Illinois Department of Natural Resources.

Water resource management activities involving interstate waters are also coordinated with various interstate committees and commissions. The Illinois EPA participates in water-resource management activities of the Association of State and Interstate Water Pollution Control Administrators, International Joint Commission of the Great Lakes Water Quality Board, Ohio River Valley Water Sanitation Commission, Upper Mississippi River Conservation Committee, Upper Mississippi River Basin Association, Council of Great Lakes Governors, and other interstate committees and commissions.

Point Source Pollution Control

Discharges that enter surface waters through a pipe, ditch or other well-defined point of discharge are broadly referred to as "point sources." Common point source discharges include wastewater treatment facilities serving municipalities, industries, residential developments, retail and commercial complexes, schools, mobile home parks, military installations, state parks, resorts/campgrounds, prisons, and individual residences. Other wastewater point source discharges can come from municipal combined sewer overflows (CSOs), concentrated animal feeding operations, mines, groundwater remediation projects, and water treatment plants.

The most significant contaminants of concern from domestic point sources (non-industrial) and CSOs include nutrients, deoxygenating wastes and dissolved solids. Bacterial contamination can also be a concern from CSOs. Contaminants from industrial dischargers vary by source.

The National Pollutant Discharge Elimination System (NPDES) was established by the Clean Water Act in 1972 and has been administered by the Illinois EPA since 1973. The program requires permits for the discharge of treated municipal effluent, treated industrial effluent, storm water and other dischargers. The permits establish the conditions under which the discharge may occur and establish monitoring and reporting requirements.

In all areas except pretreatment, the state of Illinois has been delegated NPDES permitting authority pursuant to Sections 402 and 303(e) of the CWA, and has the responsibility for issuance, reissuance, modification and enforcement of NPDES Permits. The procedures for the issuance of permits are established by a memorandum of agreement with the USEPA, the regulations under 40 Code of Federal Regulations 122, 123, 124 and 125, and the Illinois Administrative Code, Title 35, Environmental Protection. The priorities for permit issuance are established based on the economic needs of the state, guidance from USEPA, and the needs of the Illinois EPA in implementing the construction grants/loans program.

The Clean Water Act Amendments of 1987 established the NPDES storm water program. Municipalities located in urban areas as defined by the Census Bureau are required to obtain NPDES permit coverage for discharges from their municipal separate storm sewer systems. Construction sites that disturb one acre or more are required to have coverage under the NPDES general permit for storm water discharges from construction site activities.

Nonpoint Source Pollution Control

Precipitation moving over and through the ground picks up pollutants from farms, cities, mined lands, and other landscapes and carries these pollutants into rivers, lakes, wetlands, and groundwater. This is type of pollution is called nonpoint source pollution (NPS), and major sources in Illinois include agriculture, construction erosion, urban runoff, hydrologic modifications, and resource extraction activities. Under Section 319(h) of the Clean Water Act, the Illinois EPA receives federal funds to implement nonpoint source pollution control projects in cooperation with local units of government and other organizations. The program emphasizes funding for implementing corrective and preventative best management practices (BMPs) on a watershed scale; demonstration of new and innovative BMPs on a nonwatershed scale; and the development of information/education NPS pollution control programs.

303(d)/Total Maximum Daily Load Program

As stated earlier, section 303(d) of the federal Clean Water Act requires states to identify waters that do not meet applicable water quality standards or do not fully support their designated uses. States are required to submit a prioritized list of impaired waters, known as the 303(d) List, to the USEPA for review and approval (Appendix A).

The CWA also requires that a Total Maximum Daily Load (TMDL) be developed for each pollutant of an impaired water body. The establishment of a TMDL sets the pollutant reduction goal necessary to improve impaired waters. It determines the load (i.e., quantity) of any given pollutant that can be allowed in a particular water body. A TMDL must consider all potential sources of pollutants, whether point or nonpoint. It also takes into account a margin of safety, which reflects scientific uncertainty, as well as the effects of seasonal variation.

After the reduced pollutant loads have been determined, an implementation plan is developed for the watershed spelling out the actions necessary to achieve the goals. The plan specifies limits for point source discharges and recommends best management practices for nonpoint sources. It also estimates associated costs and lays out a schedule for implementation. Commitment to the implementation plan by the citizens who live and work in the watershed is essential to success in reducing the pollutant loads and improving water quality. The status of all TMDLs in the state is discussed in Section C-3.

Watershed Management Program

The Illinois EPA Bureau of Water implements a Watershed Management Program to protect and restore natural resources. This initiative incorporates common sense approaches that emphasize involvement from citizens and the regulated community. In recent years, there has been an increased awareness among natural resource managers regarding the interdependence of natural systems. As a result, a more comprehensive approach to natural resource management has emerged, using watersheds as the basic management unit. Water quality standards define the water quality goals for all water bodies in a watershed and are the driving force behind this initiative. The Watershed Management Program looks holistically at the range of problems that affect a given watershed, taking into account that most watersheds are not experiencing a single problem, but are faced with an array of interrelated concerns.

The objective of the Watershed Management Program is to develop an integrated, holistic process to effectively and efficiently protect, enhance and restore the physical, chemical, and biological integrity of our water resources within a defined hydrologic area. This comprehensive approach focuses on the total spectrum of water resource issues, including the following:

1. Integration of water pollution control and drinking-water issues. The environmental goals of this program were chosen to reflect statewide progress in areas of water quality, safety of drinking water provided to Illinois citizens, and overall reduction in water related pollutant loading. The interrelationship of water pollution control and drinking water provides an opportunity to address requirements of both the Clean Water Act and the Safe Drinking Water Act in a holistic manner.

2. Integration of regulatory and nonregulatory programs. Regulatory programs are currently in place to deal with point sources of pollution. These regulatory programs have been very effective in improving water quality conditions nation wide. However, to address the challenges we now face in controlling nonpoint sources of pollution, the key to success lies in a combination of voluntary approaches (regarding issues for which we currently have no regulatory authority), while maintaining strong and effective regulatory controls through both compliance assistance and enforcement when necessary.

3. Addressing surface and groundwater-resource issues. Where surface and groundwater issues are linked within a watershed, program approaches compliment the resolution of both concerns in a manner that improves or protects both resources. This is accomplished through such activities as targeting of noncompliance discharges within a watershed, and expansion of wellhead and recharge zone protection areas.

Illinois Groundwater Quality Standards

Since the inception of the Illinois Environmental Protection Act (Act) (415 ILCS 5) in 1970, it has been the policy of the State of Illinois to restore, protect, and enhance the groundwater of the State as a natural and public resource. Groundwater has an essential and pervasive role in the social and economic well-being of Illinois, and it is vitally important to general health, safety, and welfare. Groundwater resources should be utilized for beneficial and legitimate purposes; waste and degradation of the resource should be prevented; and the underground water resource should be managed to allow for maximum benefit of the State. Groundwater used as drinking water is one of the highest beneficial uses of the groundwater resource. The Illinois Groundwater Protection Act (IGPA) (415 ILCS 55) defines "resource groundwater" as groundwater that is presently being or in the future capable of being put to beneficial use by reason of being of suitable quality (415 ILCS 55/3(j)).

The Act included Sections 11 and 12(a). Section 11 describes part of the purpose of Title III, as follows:

> "…assure that no contaminants are discharged into waters without being given the degree of treatment or control necessary to prevent pollution."

Section 11(b) of the 2005 Act includes the same purpose statement. Water pollution was defined in Section 3(a) of the 1970 version of the Act the same as it is to this day. Moreover, Section 12(a) of the 1970 version of the Act includes the following:

> "<u>No person shall: (a) cause, threaten or allow the discharge of contaminants into the environment in any State so as to cause or tend to cause water pollution</u> in Illinois, either alone or in combination with matter from other sources, or so as to violate regulations or standards adopted by the Pollution Control Board under this Act." (Emphasis added)

The term "threat" in Section 12(a) of the Act established Illinois' original narrative nondegradation standard. The Board's final order and opinion, for 35 Ill. Adm. Code: Subtitle C, indicated that:

> "…Standards are <u>applicable to groundwaters that are a present or are a potential source of water for potable use or for food processing, except where deviation is due to natural causes</u>. It is significant to note that these standards <u>apply in situ; that is they are ambient water quality standards.</u> <u>They also apply irrespective of whether they are used by a public water supplier, a private water supplier, or have the potential for being so used.</u> (Emphasis added).

Additionally, the Board's opinion, in regard to *Water Quality Standards Revisions* (#R71-14), and *Water Quality Standards for Intrastate Waters* (SWB-14) (#R71-20) indicated the following:

> "203 General Standards. Today's revision is based upon the principle that <u>all waters should be protected against nuisances and against health hazards to those near them;</u> that all waters naturally capable of supporting aquatic life, with the exception of a few highly industrialized streams consisting primarily of effluents in the Chicago area, should be protected to support such life; <u>and that waters that</u>

> are used for public water supply should be clean enough that ordinary treatment processes will assure their potability..."
>
> "...Since general criteria apply to all waters designated for public water supply, the present regulation omits separate requirements for those parameters whose general standards are tight enough to protect public water supplies: boron, chromium, copper, fluoride, mercury, silver and zinc. The remaining standards are based largely upon Public Health Service standards, as amplified by the Green Book and by McKee and Wolf. While the PHS explicitly states that its standards are intended to prescribe the quality of finished rather than of raw water, it is clear from the evidence that many of the metals and other contaminants here listed are not substantially affected by ordinary water supply treatment, and therefore, as the Green Book recommends, the raw water must itself meet the standard to assure satisfactory finished water." (Emphasis added)

The phrase "ordinary treatment processes," emphasized in the Board's opinion above, is one of the keys to understanding Illinois' nondegradation requirements for groundwater. First, it is important to note that there is a significant difference between what is considered ordinary treatment processes for surface water versus groundwater sources of drinking water. All CWS using surface water apply coagulation, sedimentation, filtration, disinfection, and treatment for taste and odor. Private drinking water systems do not use surface water as a source of drinking water, due to the inherent vulnerability of surface water resources to contamination and the associated cost for treating such water. A private drinking water system is defined as a system that serves an owner occupied single family dwelling (415 ILCS 55/9(a)). Secondly, there is a significant difference between what is considered ordinary treatment processes for a small CWS using groundwater versus a private drinking water system well. The small CWS using groundwater has more treatment infrastructure resources available than the owner of a private well. Lastly, a private well owner typically only has to chlorinate his or her well to use the groundwater for potable uses.

Thus, this defines the lowest common denominator of what ordinary treatment processes means to the protection of Class I: Potable Resource Groundwater. In other words, the Act and Board regulations prohibit a person from causing, threatening or allowing contamination of potable resource groundwater above what is not removed by ordinary treatment processes in a private drinking water system well. For example, a plume of tritium at a concentration above background or naturally occurring levels, moving toward a private drinking water system well, is considered a threat to diminishing the existing Class I groundwater resource, since tritium cannot be removed by advanced treatment processes let alone ordinary treatment processes. This diminishment of resource groundwater (415 ILCS 55/3(j)) may lead to preclusion of the use of the well if the private well owner chooses not to use it (e.g., suitability) due to the contamination.

The Illinois Supreme Court also determined the following in *Central Illinois Public Service Company v. Pollution Control Board*, 116 Ill.2d 397:

> The Board, at the outset, disagrees with CIPS' interpretation of the definition of water pollution in the Act. The Board argues that the Act treats water as a resource, and that pollution occurs whenever contamination is likely to render

> water unusable. Under the Board's interpretation there is no need to show that harm *will* occur, only that harm *would* occur if the contaminated water were to be used. Since the Board is charged with administering the Environmental Protection Act, its interpretation of the statute is entitled to deference. (*Massa v. Department of Registration & Education* (1987), 116 Ill.2d 376, 107 Ill. Dec. 661, 507 N.E.2d 814; *Illinois Consolidated Telephone Co. v. Illinois Commerce Com.* (1983), 95 Ill.2d 142, 152, 69 Ill. Dec. 78, 447 N.E.2d 295.) Under the Board's view any contamination which prevents the State's water resources from being usable would constitute pollution, thus allowing the Board to protect those resources from necessary diminishment. CIPS' interpretation, on the other hand would mean that water rendered unusable would not be polluted so long as use of the water ceased subsequent to contamination. We find the Board's interpretation preferable to CIPS' interpretation, especially considering the deference we must accord to the Board. (Emphasis added)

Public Act 85-863 (effective on September 24, 1987) created the IGPA and also amended portions of the Act. The IGPA required the Illinois EPA to develop and the Board to adopt comprehensive groundwater-quality standards. These groundwater quality standards (35 Ill. Adm. Code 620) became effective in 1991, and replaced the groundwater quality standards of 35 Ill. Adm. Code 302.208 and 35 Ill. Adm. Code 302.303 Under, 35 Ill. Adm. Code 620 the Board classified groundwater into one of the four following classes:

- Class I: Potable Resource Groundwater (saturated geologic materials with a hydraulic conductivity of greater than or equal to 10^{-4} centimeters per second (cm/sec)) includes current and future uses of drinking water (35 Ill. Adm. Code 620.210), and includes domestic, industrial, agricultural and other legitimate and beneficial uses (Board Final Opinion and Order R89-14(b), 1991);
- Class II: General Resource Groundwaters (saturated geologic materials with a hydraulic conductivity of less than 10^{-4} cm/sec) are quality-limited, quantity-limited, or both. It is necessary that the standards that apply to these waters reflect this range of possible attributes;
- Class III: Special Resource Groundwaters are demonstrably unique (e.g., irreplaceable sources of groundwater) that are vital for a particularly sensitive ecological system or groundwater that contributes to a dedicated nature preserve that are suitable for application of a water quality standard more stringent than the otherwise applicable water quality standard; and
- Class IV: Other Groundwater is within a zone of attenuation as provided in 35 Ill. Adm. Code 811 and 814, within a point of compliance as provided in 35 Ill. Adm. Code 724, that naturally contain more than 10,000 mg/L of total dissolved solids; which has been designated by the Board as an exempt aquifer pursuant to 35 Ill. Adm. Code 730.104; or which underlies a potential primary or secondary source, in which contaminants may be present from a release, if the owner or operator of such source notifies the Agency in writing.

For further detail on groundwater quality standards see: http://www.ipcb.state.il.us/.

Narrative Nondegradation Standard

The Board's GWQS include the following narrative nondegradation standard that applies in Class I and III resource groundwater:

> Section 620.301 General Prohibition Against Use Impairment of Resource Groundwater
>
> a) No person shall cause, threaten or allow the release of **any contaminant** to a resource groundwater such that:
>
> 1) Treatment or additional treatment is necessary to continue an existing use or to assure a potential use of such groundwater; or
>
> 2) An existing or potential use of such groundwater is precluded. (Emphasis added)

Groundwater must meet the standards (except due to natural causes) appropriate to the groundwater's class as listed below and the nondegradation provisions enforceable under Section 12(a) of the Act:

Groundwater Quality Standards for Class I: Potable Resource Groundwater

Inorganic Chemical Constituents

Constituent	Units	Standard
Antimony	mg/L	0.006
Arsenic	mg/L	0.05
Barium	mg/L	2.0
Beryllium	mg/L	0.004
Boron	mg/L	2.0
Cadmium	mg/L	0.005
Chloride	mg/L	200.0
Chromium	mg/L	0.1
Cobalt	mg/L	1.0
Copper	mg/L	0.65
Cyanide	mg/L	0.2
Fluoride	mg/L	4.0
Iron	mg/L	5.0
Lead	mg/L	0.0075
Manganese	mg/L	0.15
Mercury	mg/L	0.002
Nickel	mg/L	0.1
Nitrate as N	mg/L	10.0

Radium-226	pCi/l	20.0
Radium-228	pCi/l	20.0
Selenium	mg/L	0.05
Silver	mg/L	0.05
Sulfate	mg/L	400.0
Thallium	mg/L	0.002
Total Dissolved Solids (TDS)	mg/L	1,200
Zinc	mg/L	5.0

Organic Chemical Constituents

Constituent	Standard (mg/L)
Alachlor*	0.002
Aldicarb	0.003
Atrazine	0.003
Benzene*	0.005
Benzo(a)pyrene*	0.0002
Carbofuran	0.04
Carbon Tetrachloride*	0.005
Chlordane*	0.002
Dalapon	0.2
Dichloromethane*	0.005
Di(2-ethylhexyl)phthalate*	0.006
Dinoseb	0.007
Endothall	0.1
Endrin	0.002
Ethylene Dibromide*	0.00005
Heptachlor*	0.0004
Heptachlor Epoxide*	0.0002
Hexachlorocyclopentadiene	0.05
Lindane (Gamma-Hexachlorocyclohexane)	0.0002
2,4-D	0.07
ortho-Dichlorobenzene	0.6
para-Dichlorobenzene	0.075
1,2-Dibromo-3-Chloropropane*	0.0002
1,2-Dichloroethane*	0.005
1,1-Dichloroethylene	0.007
cis-1,2-Dichloroethylene	0.07
trans-1,2-Dichloroethylene	0.1
1,2-Dichloropropane*	0.005
Ethylbenzene	0.7
Methoxychlor	0.04
Methyl Tertiary-Butyl Ether	0.07

Monochlorobenzene	0.1
Pentachlorophenol*	0.001
Phenols	0.1
Picloram	0.5
Polychlorinated Biphenyls(PCBs)(as decachloro-biphenyl)*	0.0005
Simazine	0.004
Styrene	0.1
2,4,5-TP (Silvex)	0.05
Tetrachloroethylene*	0.005
Toluene	1.0
Toxaphene*	0.003
1,1,1-Trichloroethane	0.2
1,1,2-Trichloroethane	0.005
1,2,4-Trichlorobenzene	0.07
Trichloroethylene*	0.005
Vinyl Chloride*	0.002
Xylenes	10.0

*Denotes a carcinogen.

Complex Organic Chemical Mixtures (constituents of gasoline, diesel fuel, or heating fuel must not be exceeded in Class I groundwater**)**

Constituent	Standard (mg/L)
Benzene*	0.005
BETX	11.705

*Denotes a carcinogen.

pH

Except due to natural causes, a pH range of 6.5 - 9.0 units must not be exceeded in Class I groundwater.

Beta Particle and Photon Radioactivity

1) Except due to natural causes, the average annual concentration of beta particle and photon radioactivity from man-made radionuclides shall not exceed a dose equivalent to the total body organ greater than 4 mrem/year in Class I groundwater. If two or more radionuclides are present, the sum of their dose equivalent to the total body or to any internal organ shall not exceed 4 mrem/year in Class I groundwater except due to natural causes.

2) Except for the radionuclides listed below, the concentration of man-made radionuclides causing 4 mrem total body or organ dose equivalent must be calculated on the basis of a 2 liter per day drinking water intake using the 168-hour data in accordance with the procedure set forth in NCRP Report Number 22.

3) Except due to natural causes, the average annual concentration assumed to produce a total body or organ dose of 4 mrem/year of the following chemical constituents shall not be exceeded in Class I groundwater:

Constituent	Critical Organ	Standard (pCi/L)
Tritium	Total body	20,000.0
Strontium-90	Bone marrow	8.0

Groundwater Management Zone

Within any class of groundwater, a groundwater management zone may be established as a three dimensional region containing groundwater being managed to mitigate impairment caused by the release of contaminants from a site: That is subject to a corrective action process approved by the Agency; or for which the owner or operator undertakes an adequate corrective action in a timely and appropriate manner.

Groundwater Protection

For a full description of Illinois' groundwater protection programs see the Illinois Groundwater Protection Act Biennial Report at: http://www.epa.state.il.us/water/groundwater/groundwater-protection/index.html or contact the Groundwater Section at 217/ 785-4787 to obtain a hard copy.

B-3. Cost/Benefit Assessment

Section 305(b) requires the state to report on the economic and social costs and benefits necessary to achieve Clean Water Act objectives. Information on costs associated with water quality improvements is complex, and not readily available for developing a complete cost/benefit assessment. The individual program costs of pollution control activities in Illinois, the general surface water quality improvements made, and the average groundwater protection program costs follow.

Cost of Pollution Control and Groundwater/Source Water Protection Activities

The Illinois EPA Bureau of Water distributed a total of $137.4 million in loans during 2006 for construction of municipal wastewater treatment facilities. Other Water Pollution Control program and Groundwater/Source Water Protection costs for Bureau of Water activities conducted in 2006 are summarized in Table B-6.

Table B-6. Water Pollution Control Program Costs for the Illinois Environmental Protection Agency's Bureau of Water, 2006.

Activity	Total
Monitoring	$6,325,000
Planning	$1,374,400
Point Source Control Programs	$12,151,500
Nonpoint Source Control Programs	$8,396,100
Groundwater/Source-Water Protection	$1,926,000
Total	$30,173,000

General Surface Water Quality Improvements

Economic benefits of water quality improvements, while difficult to quantify, include increased opportunities for water-based recreational activities, enhanced commercial and sport fisheries, recovery of damaged aquatic environments, and reduced costs of water treatment to various municipal and industrial users. While assessment methods have improved over time making comparisons with previous years' assessments difficult to interpret, the summary of attainment of *aquatic life* use in streams and inland lakes indicates improvement in these waters. The number of assessed stream miles reported in good condition has improved from 34.7 percent in 1972 to 61 percent in 2008, while during that same period, the miles reported in poor condition declined from 11.3 percent to 4.1 percent. The lake acreage assessed in good condition has also improved from 17.8 percent in 1972 to 69.4 percent in 2008. During the same time period, the lake acreage assessed in poor condition has declined from 27.8% in 1972 to 0.0 percent in 2008.

Groundwater Improvements

Protecting and managing groundwater are critical. Groundwater is an important natural resource that not only provides Illinois' citizens water for drinking and household uses, but also supports industrial, agricultural, and commercial activities throughout the state.

Unfortunately, industrial, agricultural and commercial activities can often produce volatile organic compounds. They are usually produced in large volumes and are associated with products such as plastics, adhesives, paints, gasoline, fumigants, refrigerants, and dry-cleaning fluids. They can reach groundwater through many sources and routes, including leaking storage tanks, landfills, infiltration of urban runoff and wastewater, septic systems, and injection through wells. Volatile organic compounds are an important group of environmental contaminants to monitor and manage in groundwater because of their widespread and long-term use, as well as their ability to persist and migrate in groundwater.

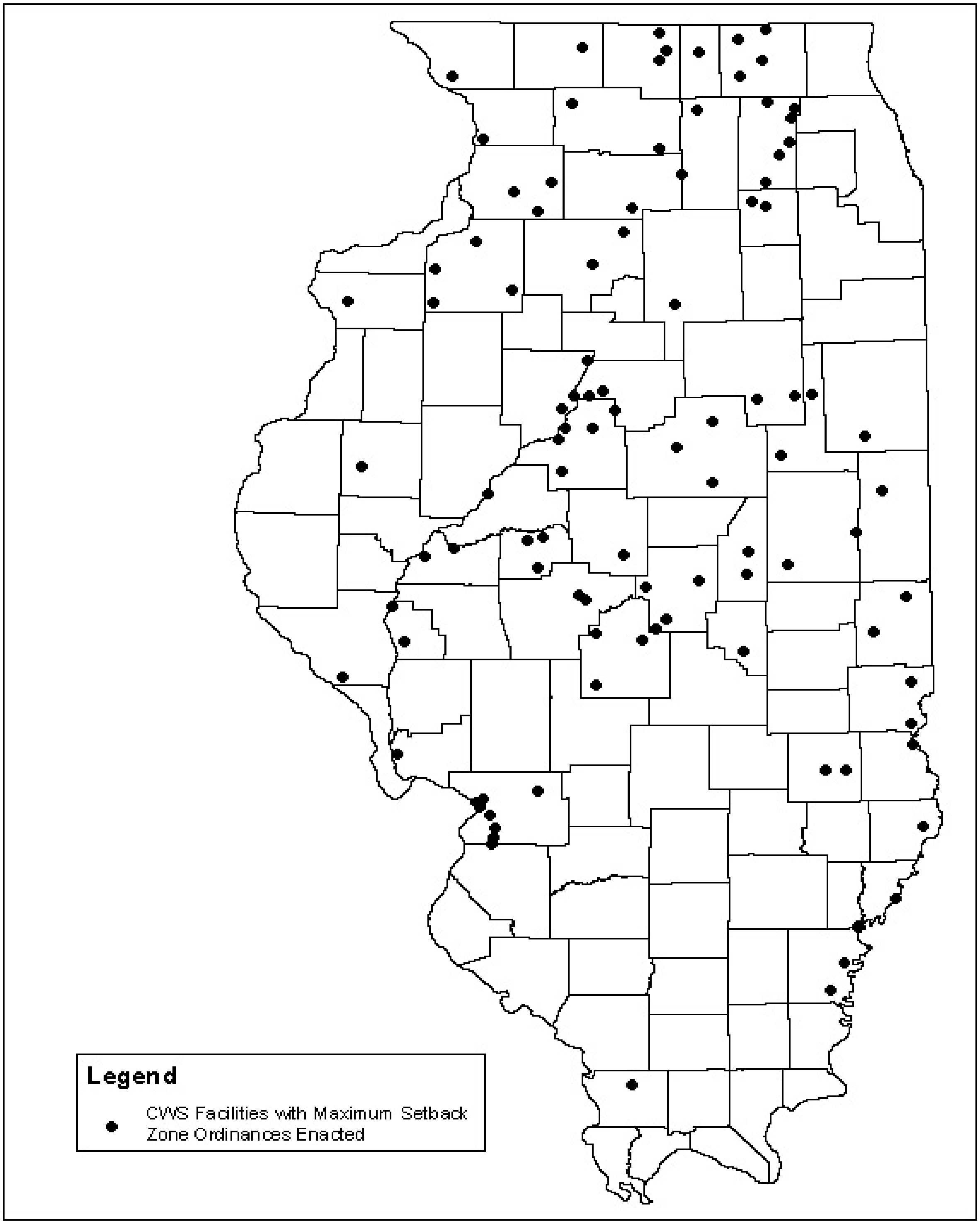
CWSs such as Illinois American Water Company-Pekin and Pleasant Valley Public Water District have adopted a comprehensive overlay Wellhead Protection Area (WHPA) ordinance or requested that Illinois EPA propose a regulated recharge area. Additionally, in past years CWSs have adopted maximum setback zones as shown in Figure B-2. Maximum setback zones are one of the tools used to expand protection in a WHPA. During the past two years, the communities of Normal, Hebron, and Dawson have pursued adopting maximum setback zones for seven CWS wells. These results, combined with the increasing trend of VOC contamination, indicate that the voluntary wellhead protection management approaches have reached a steady-state condition.

Illinois EPA's Web site, *http://www.epa.state.il.us/water/groundwater/index.html* , was enhanced to provide additional Interagency Coordinating Committee on Groundwater (ICCG) information, including nine previously published IGPA biennial reports, ICCG educational materials, and a "Who to Call for Help" directory.

The Illinois State Water Survey (ISWS) Web site now includes pages devoted to water supply planning. These pages were developed to provide current information concerning ongoing statewide and regional water supply planning efforts under the auspices of Executive Order #1-2006. In addition to new material developed specifically for this Web site, there are links to a wide variety of documents and Web resources. Also included are all presentations made by the surveys to the two regional water supply planning committees as well as ISWS presentations to other public interest groups. Material is routinely being added to these pages and may be found at *http://www.sws.uiuc.edu/wsp/*.

The ISWS Center for Groundwater Science also added a page devoted to domestic wells. Links are provided to a number of publications and Web resources, including Illinois EPA, Illinois Department of Public Health (IDPH), and Illinois Association of Groundwater Professionals (IAGP) private well information sites. Domestic well information may be found at *http://www.sws.uiuc.edu/gws/domesticwell.asp* .

Figure B-2. Community water supply facilities with adopted maximum setback zone ordinances.



The regional groundwater protection process has resulted in successful local coordination and outreach efforts that have benefited both private citizens and businesses in these high priority areas of the state (e.g., pollution prevention interns, Groundwater Protection Field Days, well sealing demonstrations). Cooperative efforts with entities such as the Groundwater Guardian program will assist the regional groundwater protection process by providing national attention and recognition to CWS developing groundwater protection programs. Illinois EPA continues to promote the Groundwater Foundation's Groundwater Guardian Affiliate program. Illinois EPA encourages each of the four priority groundwater protection planning regions to become Groundwater Guardian affiliates and to commit to a series of result-oriented services. These result-oriented services include working with communities within their respective regions to implement local source water protection programs and become Groundwater Guardian communities.

McHenry County officials have made significant progress in their efforts to implement key components of a Groundwater Resources Management Plan. The county has hired a water resource manager to help unify and encourage municipalities to develop sensibly in an effort to minimize potential water shortages predicted in the 2006 report. The water resource manager has created a task force to evaluate county water issues, and a final report is expected by 2009. McHenry County will start planning for future water needs.

The Kane County Water Resources Study was initiated in 2002 by using the services and expertise of the ISWS and the ISGS. The planned five-year study consists of the development of a conceptual model of the geology and hydrogeology of Kane County, the compilation of a comprehensive database of digital geologic and hydrogeologic information, design of a three-dimensional numerical model of the aquifers below the county, and the creation of detailed geologic maps and cross-sections of the subsurface geology of the county. This information will be used for planning and management purposes upon the completion of the study in late 2007 and early 2008. Significant progress has been achieved in understanding the complex nature of the groundwater resources of the county. Community representatives of Kane County participate in the study by providing input and updates on water supply planning, development, and management activities in the county to the researchers for inclusion in the study.

"Executive Order #1-2006 requires the Development of State and Regional Water Supply Plans." The Executive Order encourages the creation of locally-based regional water supply planning committees. Two locally-based regional water supply planning committees were established under the direction of the Chicago Metropolitan Agency for Planning and the Mahomet Aquifer Consortium. The plans developed will consider how to meet water demands through the year 2050. Challenges from the regional planning aspect include: understanding of water resource development, meeting needs of growth, agreement on the problem, managing large single-purpose users such as industry and livestock, and domestic well impacts. Once these reports are developed, the GAC will be given an opportunity to provide input.

Protecting the source of drinking water is one of the top priority environmental programs and is essential for establishing a multi-barrier layer of protection for drinking water. This is especially relevant today with the ever increasing emergence of new contaminants that may not be able to be removed with treatment, let alone protecting the investment in existing water supply infrastructure.

PART C: SURFACE WATER MONITORING AND ASSESSMENT

C-1. Monitoring Program

Illinois EPA's "Surface Water Monitoring Strategy" (Illinois EPA 2007) provides a detailed discussion of all agency monitoring programs. Field, laboratory, and data-management procedures are explained in the Illinois EPA Bureau of Water's "Quality Assurance Project Plan" (Illinois EPA 1994). Specific programs that contribute data to the assessment process are briefly described below.

Streams

Ambient Water Quality Monitoring Network

The Ambient Water Quality Monitoring Network (AWQMN) consists of 214 fixed stations. At each station water samples are collected once every six-weeks and analyzed for a minimum of 55 universal parameters including field pH, temperature, specific conductance, dissolved oxygen, suspended solids, nutrients, fecal coliform bacteria, and total and dissolved metals. Additional parameters specific to the station, watershed, or subnetwork within the ambient network are also analyzed.

Pesticide Monitoring Subnetwork

Since October 1985, Illinois EPA has operated a Pesticide Monitoring Subnetwork to expand screening for toxic organic substances. Several common herbicides and organophosphate insecticides currently used in agricultural production are analyzed in water samples. The list of stations sampled under this program has varied over the years as program design and goals have evolved. In 2004 and 2005 there were approximately 30 AWQMN stations adjusted annually and sampled in conjunction with the Intensive Basin Survey program. At these stations, one pre-application (of pesticides) water sample was collected during March to mid-April and two post-application samples are collected during mid-April to July. Post-application sampling was coordinated with farming activities occurring locally near the station. In addition, beginning in 2002, collection of pesticide samples were incorporated into the routine six-week sampling cycle at six AWMQN stations: Bear Creek (KI-02), Des Plaines River (G-15), Little Wabash River (C-19), Lusk Creek (AK-02), Illinois River (D-30) and the Sangamon River (E-18). In 2006, the Intensive Basin Program coverage was dropped. However, an additional 12 AWQMN stations near public water supply intakes were included in the network and sampled during the routine six-week sampling cycle: Salt Fork Vermilion River (BPJ-03), Skillet Fork (CA-05), Vermilion River (DS-06), Sangamon River (E-06), Kankakee River (F-16), Mississippi River (J-98, K-22), Kaskaskia River (O-07, O-08, O-30), Shoal Creek (OI-08) and North Fork Kaskaskia River (OKA-01).

Facility-Related Stream Surveys

Illinois EPA conducts Facility-Related Stream Surveys that collect macroinvertebrate, water chemistry, stream flow, and habitat data upstream and incrementally downstream of discharges from municipal and industrial wastewater treatment facilities. Information is used to evaluate water quality impacts and the need for additional wastewater treatment controls. Data are also used to characterize the existing and potential resource quality of the receiving stream, to determine biological impacts on the receiving stream, and to support the Bureau of Water's National Pollutant Discharge Elimination System permitting activities.

Intensive Basin Surveys

Illinois EPA conducts Intensive Basin Surveys in cooperation with the Illinois Department of Natural Resources. These surveys are a major source of information for assessments of ***aquatic life*** use. Sampling is organized by drainage basin on a five-year schedule (Figure C-1): in any single year, a subset of basins is sampled so that statewide coverage is achieved once every five years. Sampling locations are selected based on where data are currently lacking or historical data needs updating. Water chemistry and biological information (fish and macroinvertebrate assemblages) plus qualitative and quantitative instream-habitat information (including stream discharge) are collected to characterize stream segments, to identify resource conditions, and to assess attainment of ***aquatic life*** use. Samples of fish tissue (see below) and sediment are also collected to screen for the accumulation of toxic substances.

Fish Contaminant Monitoring Program

The Illinois Fish Contaminant Monitoring Program (FCMP) is responsible for determining the levels of contaminants in Illinois sport fish and issuing consumption advisories for species found to be contaminated above specified levels. The FCMP operates under a Memorandum of Agreement (MOA), last renewed in 1989, that spells out many details of the responsibilities of the participating agencies (Depts. of Agriculture, Natural Resources, Nuclear Safety, Public Health and Environmental Protection Agency). However, certain procedures and criteria for the determination and issuance of consumption advisories are now outdated or not specified in the MOA, leaving these elements to the discretion of the agencies. To address this, the FCMP now closely follows the procedures recommended in the *Protocol for a Uniform Great Lakes Sport Fish Consumption Advisory* (Anderson et al. 1993), and has adopted as policy over the years certain other procedures that replace outdated procedures in the MOA, or are not specifically addressed by the MOA for the determination of advisories. Key elements of the procedures and policies for issuing the advisories include:

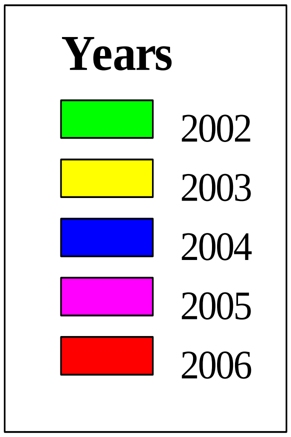
- The MOA lays out various tasks for the member agencies that allow the FCMP to collect, process, analyze, and preserve for possible future analysis sufficient numbers and sizes of sport fish samples from across the state to evaluate levels of contaminants in most bodies of water accessible to anglers. The goal of the FCMP is to sample most accessible waters every five to ten years, except for waters already under an advisory. In these cases, more frequent sampling is used to assess whether changes in the advisory are needed.

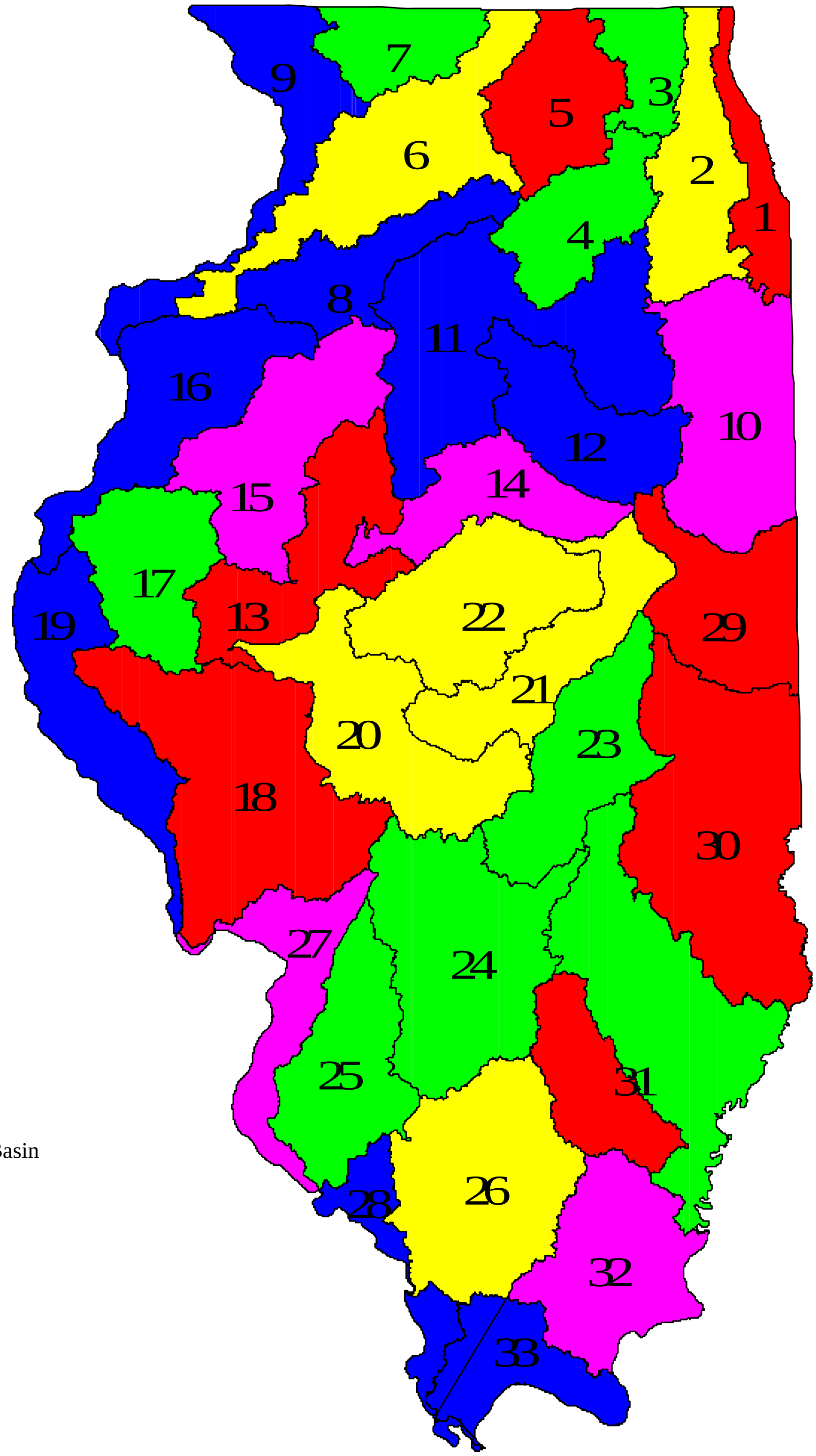
- The MOA specifies the collection of filet and whole fish samples from a network of 73 permanent stations for annual or biennial monitoring of trends in contaminant levels over time, plus additional samples from across the state to evaluate important sport-fishing waters. However, the funding source for trend-monitoring has since been lost, and the existing funding at this time is dedicated to the analysis of filet samples for advisory purposes. Therefore, since 1993 only filet samples are analyzed and the permanent monitoring stations are sampled at the same frequency as similar stations across the state.

- The MOA specifies collection of a core set of samples from each body of water to be evaluated. These samples are to be composites of filets from three to five fish of similar size, and are to include two different sizes of bottom feeders (preferably carp), one sample of an omnivorous species (preferably channel catfish), and one sample of a predatory species (preferably largemouth or smallmouth bass). These samples are analyzed for a suite of 14 bioaccumulative organic chemicals and mercury. If a sample is found to contain one or more of the analytes above a criterion, the FCMP has adopted a policy of requiring a second set of samples from the water, which should include two bottom feeders, two omnivores, two predators, and one or more additional species of local importance to confirm the original findings and provide sufficient data for the issuance of advisories if needed.

- The Protocol stresses the benefits of fish consumption. Language relaying this message is included with all consumption advisories issued.

Figure C-1. IEPA/IDNR Intensive Basin Schedule, 2002-2006.





1 Great Lakes/Calumet River Basin
2 Des Plaines River Basin
3 Upper Fox River Basin
4 Lower Fox River Basin
5 Kishwaukee River Basin
6 Rock River Basin
7 Pecatonica River Basin
8 Green River Basin
9 Mississippi River North Basin
10 Kankakee/Iroquois River Basin
11 Upper Illinois/Mazon River Basin
12 Vermilion (Illinois) River Basin
13 Middle Illinois River Basin
14 Mackinaw River Basin
15 Spoon River Basin
16 Mississippi River North Central Basin
17 La Moine River Basin
18 Lower Illinois/Macoupin River Basin
19 Mississippi River Central Basin
20 Lower Sangamon River Basin
21 Upper Sangamon River Basin
22 Salt Creek-Sangamon River Basin
23 Upper Kaskaskia River Basin
24 Shoal Creek/Middle Kaskaskia River Basin
25 Lower Kaskaskia River Basin
26 Big Muddy River Basin
27 Mississippi River South Central Basin
28 Mississippi River South Basin
29 Vermilion (Wabash) River Basin
30 Embarras/Middle Wabash River Basin
31 Little Wabash/Skillet Fork River Basin
32 Saline River/Bay Creek Basin
33 Cache River Basin

Inland Lakes

The Illinois EPA conducts and supports several inland-lake-monitoring programs. Collectively, chemical, physical or biological data have been collected from nearly 2,000 lake stations since 1977. Lake monitoring programs are described briefly below.

Ambient Lake Monitoring Program

Illinois EPA conducts an Ambient Lake Monitoring Program (ALMP) at approximately 50 inland lakes annually. Lakes are selected on a rotating basis so that all significant publicly-owned lakes are monitored at least once every five years. Furthermore, approximately one-half of the 50 inland lakes sampled each year are monitored on a three-year rotating schedule to enhance Illinois EPA's ability to assess lake trends. There are 78 inland lakes included in this trends monitoring program. These lakes are known as the Ambient "Core" Lakes. Data collected through the ALMP are primarily used for assessment of *aquatic life*, *aesthetic quality*, and *public and food processing water supply* uses and to identify potential causes of use impairment. However, data are also used to encourage development of management plans and to evaluate the effectiveness of programs implemented.

The Ambient Lake Monitoring Program involves the collection of physical data (e.g. temperature/dissolved oxygen profiles, Secchi Disk transparency, and water color), water and sediment chemical data, and field observations, including weather conditions and the presence of algae and macrophytes. Lakes in the ALMP are sampled five times during the year: once during the spring runoff and turnover period (April or May), three times during the summer (June, July, and August), and once during fall turnover (October). Data are routinely collected from three distinct lake sites, with water samples collected from one foot below the surface at all sites, and two feet above the bottom (and at intake depth for lakes with a public water supply intake) at the deepest site. Chemical analyses include: total ammonia, nitrate-nitrite nitrogen, total and dissolved phosphorus, total Kjeldahl nitrogen, and total and volatile suspended solids. Integrated water samples are also collected for analysis of chlorophyll *a*, chlorophyll b, chlorophyll c, and pheophytin. Additional parameters specific to public and food processing water supply use are also analyzed.

Clean Lakes Program Intensives

The Illinois Clean Lakes Program is a two-part program consisting of Phase 1 diagnostic-feasibility studies and Phase 2 implementation projects. Intensive lake-specific monitoring is conducted under both phases of the Illinois Clean Lakes Program and includes water sampling twice per month from April-October and monthly from November-March for a one-year period. Water quality samples are collected from one foot below the surface, intake-depth (for lakes with a public water supply intake), and two feet above the bottom at the deepest site. Surface samples (one foot below the surface) are also typically collected at two other lake sites. Physical (dissolved oxygen, temperature, pH, and Secchi transparency depth), chemical (alkalinity, total ammonia, nitrate-nitrite nitrogen, total and dissolved phosphorus, total Kjeldahl nitrogen, and total and volatile suspended solids), and biological (phytoplankton, fish, macrophytes) information is collected. In addition, for Phase 1 studies only, flow and chemical data are collected at major inflows and outflows for development of hydrologic, nutrient and sediment budgets. Additional Phase I activities include: bathymetric mapping; sedimentation surveys, fish contaminant monitoring conducted pursuant to the Fish Contaminant Monitoring Program; and analysis of sediment samples.

Volunteer Lake Monitoring Program

The Volunteer Lake Monitoring Program (VLMP) has been administered by the Illinois EPA since 1981 and relies on the time and talents of citizen volunteers. The VLMP is an educational program for Illinois citizens to learn about lake ecosystems, as well as a cost-effective method of gathering fundamental information about inland lakes.

The VLMP Basic Program includes training volunteers to measure water clarity (transparency) using a Secchi disk. Secchi-transparency measurements are useful for tracking changes in lake water transparency within a single year and for tracking trends over many years. Monitoring is conducted twice a month from May-October, typically at three sites per lake. The basic program also emphasizes education and monitoring of aquatic invasive species. Aquatic invasive species, also known as exotic species, include zebra mussels, eurasian water-milfoil, bighead and silver carp, rusty crayfish, and others. The main focus of this program is to establish a network of individuals at the local level that can assist Illinois EPA in their effort to control the spread of exotic species. Volunteers are educated on how to identify exotic species through the use of Illinois-Indiana Sea Grant "Watch ID Cards," signs, and other educational materials. With their help, Illinois EPA can be notified of new infestations shortly after they are discovered.

The VLMP Advanced Program includes Basic Program monitoring plus the collection of water samples from one foot below the water's surface at one to three lake sites. Water samples are shipped to an accredited laboratory for analysis of the following parameters: total ammonia, nitrate-nitrite nitrogen, total phosphorus, total Kjeldahl nitrogen, and total and volatile suspended solids. Integrated water samples are also collected for analysis of chlorophyll pigments. These samples are collected at a depth equal to twice the Secchi transparency depth, then filtered and sent to a laboratory for analysis of chlorophyll *a*, chlorophyll b, chlorophyll c and pheophytin. Chlorophyll *a*, Secchi transparency depth, and total phosphorus data are used to calculate the lake's trophic state index which is used for determining the lake's resource quality.

The primary purpose of the VLMP is to promote education on lake issues and evaluate lake resource quality as good, fair and poor. While the VLMP is conducted according to an approved QAPP and does meet the QA/QC requirements for these purposes, the data do not have the degree of reliability that Illinois EPA deems necessary for placing a water on the 303(d) List. Volunteer Lake Monitoring Program data are considered insufficient for making use-support determinations and 303(d) listings.

Lake Michigan

Lake Michigan water quality is monitored through a cooperative agreement between Illinois EPA and the city of Chicago (updated August 1, 2001). The Lake Michigan Monitoring Program is conducted by the city of Chicago's Water Quality Surveillance Section and consists of 77 sites assessed in five monitoring surveys: 14 on the Lake Michigan Open Water Survey, eight on the North Shore Survey, 10 on the South Shore Survey, 23 on the Jardine Water Purification Plant Radial Lake Survey, and 22 on the South Water Purification Plant Radial Lake Survey. Water surveys are conducted from January through December each year providing there are no weather-related problems. The city's Water Purification Division Laboratory performs general water chemistry analyses with additional analyses performed by Illinois EPA laboratories.

Chemical and fecal coliform bacteria data are collected to characterize overall water quality conditions and evaluate designated uses. Fish contaminant sampling is conducted in cooperation with the Illinois Department of Natural Resources to screen for the accumulation of toxic substances. The fish contaminant data provide essential information to the general public relative to contaminant concentrations in fish tissue, species affected, and risks associated with fish consumption. Fecal coliform and *Escherichia coli* bacteria data provide the basis for protecting *primary contact* use (swimming). Chemical parameters, including arsenic, cadmium, chromium, copper, cyanide, lead, mercury and others are used to assess *aquatic life* use.

C-2. Assessment Methodology

This section explains how Illinois EPA uses various criteria (including, but not limited to, Illinois water quality standards) to assess the level of support (attainment) of each applicable designated use in the waters of the state. Designated uses assessed in Illinois waters include *aquatic life*, *indigenous aquatic life*, *fish consumption*, *primary contact*, *secondary contact*, *public and food processing water supply* and *aesthetic quality*. Assessments of designated uses are based on water-body-specific monitoring data believed to accurately represent existing resource conditions. The methodology for the assessment of use attainment and causes of impairment is explained below for each use and each water body type. At the end of Section C-2, we explain guidelines for identifying potential sources of impairment.

Water Body Segments

Illinois EPA uses the National Hydrography Dataset (1:100,000 scale) as the basis for mapping and calculating the length of streams. Mapping and area calculations of inland lakes and Lake Michigan are based on Illinois data (see Table B-1). While assessments of designated uses are based on data from individual monitoring stations, the data are extrapolated to represent larger water body segments (i.e., a stream segment, an inland lake, an open water area in Lake Michigan), also called assessment units. Assessment units delineated for *aquatic life* use are typically used as the basis for all other assessed uses.

For streams, monitoring data are extrapolated to linear segments depending on the size of the stream (USEPA, 1997). Assessments of *aquatic life* use typically apply approximately 10 miles upstream and downstream from the sampling site for wadable streams, about 25 miles upstream and downstream for unwadable streams (i.e., generally ≥7th order, ≥ 3.5 ft. average depth and fish sampled with an electrofishing boat) and approximately 50 miles upstream and downstream for large rivers, i.e., Illinois, Ohio, and Wabash rivers. However, the final extent of any particular segment is determined by considering significant influences such as point or nonpoint source inputs; changes in watershed characteristics such as land use; changes in riparian vegetation, stream banks, slope or channel morphology; stream confluence or diversions; or hydrologic modifications such as channelization or dams. This process can result in segments that are either longer or shorter than the general numeric guidelines above. On the Mississippi River, the segments mostly reflect a September 2003 interstate memorandum of understanding between five states (Illinois, Iowa, Minnesota, Missouri and Wisconsin) designed to improve the assessment process on the Mississippi River (UMRBA 2003).

In the case of lakes, monitoring data are typically used to assign an assessment to the entire lake acreage as a single assessment unit.

Assessments of *fish consumption* use are generally extrapolated to include the entire named water body.

Changes to some 2006 assessment units were made and some new assessment units were added for the 2008 cycle. These are described in Appendix D.

Levels of Use Attainment

The Illinois EPA determines the resource quality of each assessment unit by determining the level of support (i.e., attainment) of each applicable designated use. For each assessment unit and for each designated use applicable to that assessment unit, an Illinois EPA assessment concludes one of two possible use-support levels: "Fully Supporting" or "Not Supporting." Fully Supporting means that the designated use is attained; Not Supporting means the use is not attained. To facilitate communicating these results, Illinois EPA also refers to Fully Supporting status (for a use) as Good resource quality; Not Supporting status is called Fair or Poor resource quality, depending on the degree to which the use is not attained. Uses determined to be Not Supporting are called "impaired," and waters that have at least one use assessed as Not Supporting are also called impaired. For each impaired use in each assessment unit, Illinois EPA attempts to identify potential causes and sources of the impairment as explained below.

Aquatic Life - Streams

Aquatic life use assessments in streams are typically based on the interpretation of biological information, physicochemical water data and physical-habitat information from the Intensive Basin Survey, Ambient Water Quality Monitoring Network or Facility-Related Stream Survey programs as described previously. The primary biological measures used are the fish Index of Biotic Integrity (fIBI; Karr et al. 1986; Smogor 2000, 2005), the new macroinvertebrate Index of Biotic Integrity (mIBI; Tetra Tech, 2004) and the Macroinvertebrate Biotic Index (MBI; Illinois EPA 1994). Physical-habitat information used in assessments includes quantitative or qualitative measures of stream-bottom composition and qualitative descriptors of channel and riparian conditions. Physicochemical water data used include measures of "conventional" parameters (e.g., dissolved oxygen, pH, temperature), priority pollutants, non-priority pollutants, and other pollutants (USEPA 2002 and www.epa.gov/waterscience/criteria/wqcriteria.html). In a minority of streams for which biological information is unavailable, *aquatic life* use assessments are based primarily on physicochemical water data. Physicochemical data (from water and sediment) and habitat information play primary roles in identifying potential causes and sources of *aquatic life* use impairment.

A major improvement in the assessment of *aquatic life* use in this 2008 cycle involves the incorporation of the new mIBI. The new macroinvertebrate index is a multi-metric index based on a more quantitative sample collection procedure than was originally used for the calculation of the MBI. Although an MBI score is one of the components of the new mIBI, the mIBI incorporates several other aspects of the macroinvertebrate sample to provide a more comprehensive assessment of the health of the macroinvertebrate community than the MBI alone. Therefore, when a macroinvertebrate sample is available which allows for the calculation of an mIBI score, the MBI score is not independently used in the assessment process.

Table C-1 shows a decision matrix which illustrates how biological data (fIBI, mIBI, and MBI), physicochemical water data (i.e., water chemistry), and physical-habitat information are integrated and interpreted to guide the assessment of *aquatic life* use.

All biological indices are divided into three ranges: 1. a range which indicates no impairment; 2. a range which indicates moderate impairment, and, 3. a range which indicates severe impairment. (Table C-2). Water-chemistry data are also evaluated to determine whether the potential for impairment of *aquatic life* use is indicated (Table C-3). Finally, several conditions of physical habitat are also used to indicate the potential for impairment of aquatic life use (Table C-4).

When all available data indicate no impairment, the stream segment is considered fully supporting *aquatic life* use. In general, when both fish and macroinvertebrate indicators are available for a site and each indicator shows a similar level of impairment, the attainment decision is based primarily on this concordant information. If either biological indicator shows severe impairment, the attainment decision is based primarily on a worst case emphasis.

For assessing attainment of *aquatic life* use in streams, direct reliance on information-rich biological indicators over indirect and sometimes simplistic comparisons of physicochemical water quality criteria is a useful and widely recommended approach (Karr and Dudley 1981; Yoder and Rankin 1995; Karr 1991; Yoder and Rankin 1998; Hall and Giddings 2000; National Research Council 2001). Much more than physicochemical water data, biological indicators--such as a fish Index of Biotic Integrity--provide direct, reliable measures of aquatic-community health and facilitate detection of cumulative impacts on aquatic life from multiple stressors (e.g., Norton et al. 2000). By relying more on biological indicators than on less-reliable surrogates (e.g., water chemistry), our assessments of *aquatic life* use achieve their primary purpose: to determine the degree to which a water body provides for the protection and propagation of fish, shellfish, and wildlife (i.e., the Clean Water Act's interim aquatic life goal). In these terms, an

Illinois EPA assessment conclusion of Full Support for *aquatic life* use indicates conditions that meet the Clean Water Act's interim aquatic life goal.

Water chemistry and habitat data are used to help determine the attainment status: 1) where only one biological assemblage is available, 2) where two biological assemblages may indicate different levels of impairment, or 3) occasionally, when no biological data are available. Water-chemistry data (Table C-3) and habitat data (Table C-4) are used as corroborating evidence when one biological assemblage indicates fully supporting but another indicates moderate impairment. When only one biological assemblage (mIBI or fIBI) is available which indicates full support, an indication of severe water chemistry impairment overrides this single biological indicator. A limited amount of water chemistry data which indicates the potential for impairment may be used to determine non support of *aquatic life* use, but when biological data is unavailable, a conclusion of full support requires an amount of water chemistry data which represents a long period of time and a large suite of parameters. The dataset collected at the typical Ambient Water Quality Monitoring Network station is considered adequate for concluding full support.

When interpreting water chemistry data for assessing attainment of *aquatic life* use, we do not consider a single exceedance of a water quality criterion as indicative of impairment. Such an event does not account for at least two other aspects critical for determining how physicochemical conditions in water affect aquatic life: the frequency and duration of the exceedances (Barnett and O'Hagan 1997; National Research Council 2001). Illinois EPA uses "frequency of exceedance" guidelines (Table C-3) that better represent the true risk of impairment to aquatic life than do single-exceedance guidelines. Further research is needed to determine how to better incorporate the frequency and duration aspects of physicochemical conditions into assessments of *aquatic life* use.

Illinois EPA's approach for assessing attainment of *aquatic life* use achieves a reasonable balance in minimizing the two possible types of assessment mistakes: incorrectly concluding that a use is being fully supported or incorrectly concluding that it is not. Inherent uncertainty exists in using water-monitoring information to assess the condition of water resources (Ward et al. 1990). Designing an assessment protocol exclusively to minimize the potential for making one of these mistakes necessarily results in a counteractive, increased vulnerability to the other type of mistake. Therefore, short of incorporating an in-depth analysis of the relative costs and benefits of decision mistakes—some of which are very difficult to quantify—the most reasonable and practical assessment approach is one that results in an acceptably low and equal number of each type of mistake. In assessing attainment of *aquatic life* use, Illinois EPA tries to achieve this balance by recognizing and accommodating the greater information value of biological indicators over less informative, surrogate water-chemistry data or habitat data. Illinois EPA interprets water-chemistry data and habitat data as indicators of the potential for aquatic-life impairment, not as direct evidence of such. Consistent with this approach, we typically conclude *Fully Supporting* for situations in which two biological indicators indicate lack of impairment, despite any contraindication from surrogate data (see cells 1A and 4A in Table C-1).

However, Illinois EPA does recognize and accommodate uncertainty in our biological indicators by allowing for situations in which the potential for impairment, as indicated by water-chemistry or habitat data, is sufficient to conclude *Not Supporting* despite contraindication from a biological indicator. Specifically, if one biological indicator indicates *Fully Supporting* and the other indicates *Not Supporting*, the potential for impairment, as indicated by water-chemistry or habitat data, typically results in a decision of *Not Supporting* (see cells 1B, 2A, and 5A in Table C-1). In such situations, we judge that the combined information value of one biological indicator indicating impairment, plus corroborating water-chemistry or habitat data, provides sufficient evidence of actual impairment.

For situations in which one biological indicator indicates *Fully Supporting*, but no other biological indicator is available (see cells 1D, 4D, and 7A in Table C-1), we typically conclude *Fully Supporting*, unless sufficient contraindication is provided by surrogate data. In such situations, although our decision of *Fully Supporting* is based on less information than those in which we have two biological indicators, it nonetheless relies primarily on the superior information value of the single biological indicator relative to the surrogate data. Specifically, if a fish or macroinvertebrate IBI is the only available biological indicator and it indicates *Fully Supporting*, then typically we diverge from this conclusion only if water-chemistry data indicate a potential for severe impairment. If an MBI is the only available biological indicator and it indicates lack of impairment, we diverge from this conclusion if water-chemistry data indicate at least a potential for moderate impairment. We incorporate this distinction because, unlike an IBI score, an MBI score is designed to be sensitive only to a specific type of water-chemistry impact: organic pollution.

The last stage of the assessment process is a final review of the assessment conclusion (Table C-1, cell 8). In this review, Illinois EPA biologists carefully examine all available biological, water-chemistry and habitat data and also use their site-specific knowledge and other information about the environmental setting of the stream segment. This additional information includes field notes and observations, knowledge of the nature of the stream and its biological potential, the existence of potential sources of pollution, and riparian or watershed information. Based on this review, the biologist may modify the use-attainment decision indicated in any cell in Table C-1. For example, conflicting biological information may require case-specific interpretation, including analysis of possible error or ambiguity in an IBI score, especially when scores are near the threshold values in Table C-2. Also, physicochemical, physical-habitat and other information are examined for corroborating or refuting evidence of *aquatic life* use attainment. In some cases, after careful review, it may be determined that the current data are not adequate to make a new assessment. In these cases, the previous assessment status remains unchanged. Illinois EPA believes that this final review helps improve the accuracy of our *aquatic life* use assessments.

Table C-1. Decision Table for Assessing Attainment of Aquatic Life Use in Streams. Each table cell shows the preliminary assessment conclusions based primarily on biological data: fish Index of Biotic Integrity (fIBI), macroinvertebrate Index of Biotic Integrity (mIBI), and Macroinvertebrate Biotic Index (MBI). See Table C-2 for how to interpret these biological indicators. See Tables C-3 and C-4 for how to interpret surrogate water-chemistry data or habitat data. The final review in table cell 8 applies to every preliminary assessment conclusion.

Biological Indicator Indicates:	**A. fIBI Indicates No Impairment fIBI ≥ 41**	**B. fIBI Indicates Moderate Impairment fIBI < 41 and > 20**	**C. fIBI Indicates Severe Impairment fIBI ≤ 20**	**D. fIBI is Unavailable**
1. mIBI Indicates No Impairment mIBI ≥ 41.8	*Fully Supporting (Good)* (Water chemistry and other data are considered during final review) (See cell 8 below.)	If water-chemistry data or habitat data indicate a potential for impairment, then *Not Supporting (Fair)*. Otherwise, *Fully Supporting (Good)*.	*Not Supporting (Poor)*	If water-chemistry data indicate a potential for severe impairment, then *Not Supporting (Fair)* Otherwise, *Fully Supporting (Good)*.
2. mIBI Indicates Moderate Impairment mIBI < 41.8 and > 20.9	If water-chemistry data or habitat data indicate a potential for impairment, then *Not Supporting (Fair)* Otherwise, *Fully Supporting (Good)*.	*Not Supporting (Fair)*	*Not Supporting (Poor)*	*Not Supporting (Fair)*
3. mIBI Indicates Severe Impairment mIBI ≤ 20.9	*Not Supporting (Poor)*	*Not Supporting (Poor)*	*Not Supporting (Poor)*	*Not Supporting (Poor)*
4. mIBI is Unavailable and MBI Indicates No Impairment MBI ≤ 5.9	*Fully Supporting (Good)*	*Not Supporting (Fair)*	*Not Supporting (Poor)*	If water-chemistry data indicate a potential for moderate impairment, then *Not Supporting (Fair)*. If water-chemistry data and sufficient habitat data [1] indicate no impairment, then *Fully Supporting (Good)*. Otherwise, no assessment is made [2].

Biological Indicator Indicates:	A. fIBI Indicates No Impairment fIBI $\geq$ 41	B. fIBI Indicates Moderate Impairment fIBI < 41 and > 20	C. fIBI Indicates Severe Impairment fIBI $\leq$ 20	D. fIBI is Unavailable
5. mIBI is Unavailable and MBI Indicates Moderate Impairment MBI > 5.9 and $\leq$ 8.9	If water-chemistry data or habitat data indicate a potential for impairment, then *Not Supporting (Fair)*. Otherwise, *Fully Supporting (Good)*.	*Not Supporting (Fair)*	*Not Supporting (Poor)*	*Not Supporting (Fair)*
6. mIBI is Unavailable and MBI Indicates Severe Impairment MBI > 8.9	*Not Supporting (Poor)*	*Not Supporting (Poor)*	*Not Supporting (Poor)*	*Not Supporting (Poor)*
7. mIBI and MBI are Unavailable	If water-chemistry data indicate a potential for severe impairment, then *Not Supporting (Fair)* Otherwise, *Fully Supporting (Good)*.	*Not Supporting (Fair)*	*Not Supporting (Poor)*	If water-chemistry data indicate a potential for moderate impairment, then *Not Supporting (Fair)*. If water-chemistry data indicate a potential for severe impairment, then *Not Supporting (Poor)*. If sufficient water-chemistry data [3] and sufficient habitat data [1] indicate no impairment, then *Fully Supporting (Good)*. Otherwise, no assessment is made[2].
8. Final review using site-specific knowledge and considering all available biological, water-chemistry, habitat and other information. This review considers factors such as the extent to which biological-indicator scores exceed or fall short of impairment thresholds, the type and degree of water quality standard exceedances, the type and degree of habitat degradation, and the presence or absence of pollution sources. Based on this review, the biologist may modify the preliminary use-attainment decision. In some cases, after careful review, it may be determined that current data are not adequate to make a new assessment. In these cases the previous assessment status remains unchanged.				

1. "*Sufficient habitat data*" means a dataset at least as representative of physical-habitat conditions as the dataset that is typically available from an Intensive Basin Survey. For a relatively few waters, assessments of *aquatic life* use as *Fully Supporting* may not include consideration of habitat data because appropriate physical-habitat indicators have not yet been fully developed or conditions prevented comprehensive habitat measurements or observations. Typically, these are large-stream locations.
2. If a previous assessment exists, it remains unchanged.
3. "*Sufficient water chemistry data*" means a dataset at least as representative of water-chemistry conditions as the three-year dataset that is typically available from an Ambient Water Quality Monitoring Network station.

Table C-2. Guidelines for Using Biological Information in Table C-1 to Assess *Aquatic Life* Use Attainment in Streams.

	No Impairment	**Moderate Impairment**	**Severe Impairment**
Biological Indicator	**Fully Supporting *Aquatic Life* Use (Good Resource Quality)**	**Not Supporting *Aquatic Life* Use (Fair Resource Quality)**	**Not Supporting *Aquatic Life* Use (Poor Resource Quality)**
Fish Index of Biotic Integrity (fIBI,)	fIBI ≥ 41	fIBI < 41 and > 20	fIBI ≤ 20
Macroinvertebrate Index of Biotic Integrity (mIBI)	mIBI ≥ 41.8	mIBI < 41.8 and > 20.9	mIBI ≤ 20.9
Macroinvertebrate Biotic Index[1] (MBI)	MBI ≤ 5.9	MBI > 5.9 and ≤ 8.9	MBI > 8.9

1. When the mIBI is available, the MBI is not used independently to assess attainment of *aquatic life* use.

Table C-3. Guidelines for Using Water-Chemistry Data in Table C-1 to Indicate the Potential for Impairment of Aquatic Life Use in Streams.

Number of Observa-tions [1]	Type of Parameter	Type of Water Quality Standard	Water Chemistry Condition Indicating Potential for Moderate Impairment of ***Aquatic Life*** Use [2]	Water Chemistry Condition Indicating Potential for Severe Impairment of ***Aquatic Life*** Use [2]
Ten or more observa-tions are available for the applicable water-chemistry parameter	Toxic [3]	Acute	For any single parameter, two observations exceed the applicable standard [4].	For any single parameter, three or more observations exceed the applicable standard.
		Chronic	For any single parameter, there is one exceedances of the applicable standard [5].	For any single parameter, there are two or more independent exceedances of the applicable standard [5].
	Nontoxic [6]	Other	For any single parameter, more than 10% but no more than 25% of observations exceed the applicable standard; or, there is one exceedance of any standard that requires multiple observations to apply.	For any single parameter, more than 25% of observations exceed the applicable standard; or, there are two or more exceedances of any standard that requires multiple observations to apply.
Fewer than 10 observa-tions are available for the applicable water-chemistry parameter	Toxic [3]	Acute	Among all parameters, one observation exceeds an applicable standard.	Among all parameters, two or more observations exceed an applicable standard.
		Chronic	Among all parameters, there is one exceedance of an applicable standard [5].	Among all parameters, there are two or more independent exceedances of an applicable standard [5].
	Nontoxic [6]	Other	Among all parameters, two observations exceed an applicable standard.	Among all parameters, three or more observations exceed an applicable standard.

1. The most recent consecutive three years of data are used. It is not necessary that observations be available for every parameter of each type; the assessment is based on available data. As used in Table C-1, "*sufficient water chemistry data*" means a dataset at least as representative of water-chemistry conditions as the three-year dataset that is typically available from an Ambient Water Quality Monitoring Network station.
2. If conditions in at least one table cell apply, then the potential for impairment is indicated.
3. Includes 2, 4-D, alachlor, atrazine, ammonia, arsenic, barium, benzene, cadmium, chloride, chlorine, chromium (hexavalent and trivalent), copper, cyanazine, cyanide, dicamba, endrin, ethylbenzene, fluoride, iron, lead, manganese, mercury, metolachlor, metribuzin, nickel, selenium, silver, sulfate, terbufos, toluene, xylenes, and zinc or any parameter with an acute or chronic aquatic life criteria derived under 35 IAC 302.210. If no specific chronic water quality standard applies, the standard is interpreted as an acute one.
4. Hereafter in this table, "*applicable standard*" refers to an Illinois General Use Water Quality Standard (see tables B-2 and B-3, 35 IAC 302.208, 302.212 and 303.444and 35 IAC 303.311 through 303.445) or an aquatic life criterion derived according to 35 IAC 302.210 (www.epa.state.il.us/water/water-quality-standards/water-quality-criteria.html.).
5. Chronic standards are applied consistent with 35 IAC 302.208, 302.210, 302.212, and 303.444 as follows. If the chronic standard is exceeded for one or more combinations of four consecutive observations, then the water chemistry condition indicates the potential for impairment of *aquatic life* use. If the chronic standard is exceeded for more than one *independent* set of four consecutive observations, then the water chemistry condition indicates the potential for severe impairment of *aquatic life* use. An *independent* set of four consecutive observations is one that does not share any observations with any other set of four consecutive observations.
6. Includes: water temperature, pH, and dissolved oxygen.

Table C-4. Guidelines for Using Habitat Information in Table C-1[(1)] to Assess Attainment of *Aquatic Life* Use in Streams.

Information Sources	Habitat Conditions Indicating the Potential for Impairment of *Aquatic Life* Use [(2)]
Illinois EPA field observations and notes	Moderate to severe habitat alteration by channelization and dredging activities, removal of riparian vegetation, bank failure or bank erosion, heavy sediment deposition, alteration of flow regime, fish passage barriers, alteration/reduction of hydrologic diversity, alteration/reduction of instream cover, alteration of wetland habitats, or excessive algae or plant growth (USEPA 1997).
Stream Habitat Assessment Procedure (Illinois EPA 1994) Metrics 2, 4, 8, 9, 10, 12 and 15:	Metric 2, score 1-3: Mud, silt or sand in braided or nonbraided channels with pools almost absent due to deposition; or, Metric 4, score 1-3: lack of habitat is obvious; or, Metric 8, score 1-3: lack of canopy, full sunlight reaching water surface (due to anthropogenic causes); or, Metric 9, score 1-4: <50% of the stream bank surfaces covered by vegetation or bare rock; or, Metric 10, score 1-2: little of immediate watershed is undisturbed; or, Metric 12, score 1-2: extensive recent or regularly maintained channelization; or, Metric 15, score 1-3: essentially a straight stream with poor habitat and uniform velocity.
Qualitative Habitat Evaluation Index (Rankin 1989) Metrics: Substrate, Instream Cover, Channel Morphology, Riparian Zone and Bank Erosion	Metric 1: "Silt heavy" is indicated, or Metric 2: instream cover is indicated as "nearly absent" (due to anthropogenic causes), or Metric 3: "recent channelization/no recovery," is indicated, or Metric 4: riparian width is indicated as "none" or bank erosion is indicated as "heavy/severe."
Illinois EPA Stream Assessment Form (Illinois EPA 1994)	Filamentous algae or macrophytes are abundant New channelization documented >50% of riparian vegetation denuded Documented site-specific knowledge of sludge, excessive siltation or unnatural bottom deposits.
Illinois EPA habitat-transect data or visual evaluation of substrate	≥75% silt/mud bottom substrate[(3)]

1. As used in Table C-1 "s*ufficient habitat data*" means a dataset at least as representative of physical-habitat conditions as the dataset that is typically available from an Intensive Basin Survey.
2. If any of the conditions exist, the potential for impairment is indicated.
3. Based on an 98th percentile value calculated from statewide data from sites having at least three habitat transects.

After a stream is assessed and determined to be impaired for a designated use, potential causes of impairment are identified. The next two paragraphs describe, in general, how Illinois EPA identifies potential causes of impairment of *aquatic life* use in streams.

When a stream segment is determined to be Not Supporting *aquatic life* use, generally, one exceedance of an applicable Illinois water quality standard (related to the protection of aquatic life) results in identifying the parameter as a potential cause of impairment (Table C-5). Additional guidelines used to determine potential causes of impairment include site-specific standards (35 Ill. Adm. Code 303, Subpart C), adjusted standards (published in the Illinois Pollution Control Board's *Environmental Register* at http://www.ipcb.state.il.us/Archive/dscgi/ds.py/View/Collection-11), or narrative standards (35 Ill. Adm. Code 302.203) intended to protect waters from "*…sludge or bottom deposits, floating debris, visible oil, odor, plant or algal growth, color or turbidity of other than natural origin.*"

Changes have occurred related to three parameters for which standards have recently been revised (See Section B-2). Total dissolved solids (TDS) has been eliminated as a numeric standard for general use waters as part of a revised standard for sulfates. Therefore, we no longer assess TDS as a cause of *aquatic life* use impairment. Because the revised standard for sulfates in general use waters is based on protecting *aquatic life* use (unlike the old standard which was intended to protect livestock watering), we use the new sulfate standard for identifying a cause of impairment. Likewise, the revised standard for dissolved oxygen in general use waters is now the basis for identifying dissolved oxygen impairment of *aquatic life* use. These changes are discussed in detail in Section B-2, *Revisions to Illinois General Use Water Quality Standards.*

For parameters that have no numeric water quality standards (e.g., nutrients, suspended solids, siltation, various features of stream habitat), a statistically derived numeric value or a field observation may be used to identify potential causes of *aquatic life* use impairment. For example, for total phosphorus and suspended solids, a numeric threshold based on an 85^{th}-percentile value is used as a cause guideline (Table C-5); this threshold value is derived from all available data from water years 1978 through 1996, at Ambient Water Quality Monitoring Network sites. Similarly, for siltation, a 98^{th}-percentile threshold is based on stream-bottom composition data from Intensive Basin Survey sites sampled from 1982 through 1997. Measures of sediment chemistry are also used to identify potential causes of *aquatic life* use impairment. In general, sediment parameters found at highly elevated levels (Short 1997) are identified as potential causes. Examples of less-quantitative cause guidelines include scores for selected Stream Habitat Assessment Procedure (Illinois EPA 1994) and Qualitative Habitat Evaluation Index (Rankin 1989) metrics that reflect channel alteration, riparian zone disturbance, heavy siltation or streambank instability, as well as other related field observations.

In some cases, biological data may indicate that *aquatic life* use in streams is impaired but only nonpollutant causes, such as low dissolved oxygen, alteration in streamside or littoral vegetative covers, fish passage barriers, low flow alterations, or other flow regime alterations are identified. If only nonpollutant causes of impairment are identified, the assessor must determine if the segment should be placed in category 4C (see Section C-3, Five-Part Categorization of Surface Waters). The assessor will examine carefully all of the information related to the segment, including the amount of water chemistry data available, the nature of the stream, the degree of impairment, the existence of potential pollution sources, whether the elimination of riparian vegetation may also be increasing turbidity and sedimentation and other relevant watershed information. After reviewing this information, if the assessor thinks that the *aquatic life* use impairment is occurring because of nonpollutant causes then that water body segment may be placed in category 4C depending on the results of other use attainment assessments. If the assessor believes that an unidentified pollutant may also be contributing to the impairment, Cause Unknown will be listed as an additional cause and the segment will be placed in Category 5 (the 303(d) List).

Table C-5. Guidelines for Identifying Potential Causes of Impairment of *Aquatic Life* Use in Illinois Streams.

	Basis for Identifying Causes[1] [7]				
	Criteria based on Water Quality Standards [2]			Non-Standards-based Criteria[3]	
Potential Cause	**Acute Criteria**	**Chronic Criteria**	**Narrative Criteria**	**Sediment Criteria**	**Other Criteria**
Pesticides and other Organic Pollutants					
Alachlor	1100 μg/L[4]	---	Toxic effects[9]	---	---
Aldrin	---	---	Toxic effects[9]	1.0 μg/kg	---
alpha-BHC	31 μg/L[4]	2.5 μg/L[4]	Toxic effects[9]	1.0 μg/kg	---
Atrazine	82 μg/L[4]	9 μg/L[4]	Toxic effects[9]	---	---
Benzene	4200 μg/L	860 μg/L	---	---	---
Chlordane	---	---	Toxic effects[9]	23 μg/kg	---
Cyanazine	370 μg/L[4]	30 μg/L[4]	Toxic effects[9]	---	---
DDT	---	---	Toxic effects[9]	34 μg/kg	---
Dicambra	1500 μg/L[4]	150 μg/L[4]	Toxic effects[9]	---	
Dieldrin	---	---	Toxic effects[9]	15 μg/kg	---
Endrin	160 μg/L[4]	33 μg/L[4]	Toxic effects[9]	1.0 μg/kg	---
Ethylbenzene	150 μg/L	14 μg/L	---	---	---
Heptachlor	---	---	Toxic effects[9]	1.0 μg/kg	---
Heptachlor epoxide	---	---	Toxic effects[9]	3.8 μg/kg	---
Hexachlorobenzene	---	---	Toxic effects[9]	1.0 μg/kg	---
Lindane (gamma BHC)	---	---	Toxic effects[9]	1.0 μg/kg	---
Methoxychlor	---	---	Toxic effects[9]	5.0 μg/kg	---
Metolachlor	380 μg/L [4]	30.4 μg/L [4]	Toxic effects[9]	---	---
Metribuzin	8.4 mg/L[4]	---	Toxic effects[9]	---	---
Polychlorinated biphenyls (PCBs)	---	---	Toxic effects[9]	180 μg/kg	---
Terbufos	0.024 μg/L[4]	---	Toxic effects[9]	---	---
Toluene	2000 μg/L	600 μg/L	---	---	---
Trifluralin	26 μg/L[4]	1.1 μg/L[4]	Toxic effects[9]	---	---
Xylenes (total mixed)	920 μg/L	360 μg/L	---	---	---
Metal Pollutants					
Arsenic	360 μg/L (dissolved)	190 μg/L (dissolved)	---	18 mg/kg	---
Barium	5000 μg/L	---	---	230 mg/kg	---
Cadmium	Table B-3[5]	Table B-3[5]	---	9.3 mg/kg	---
Copper	Table B-3[5]	Table B-3[5]	---	170 mg/kg	---
Chromium, hexavalent	16 μg/L	11 μg/L	---	---	---
Chromium, trivalent	Table B-3[5]	Table B-3[5]	---	---	---
Chromium (total)	---	---	Toxic effects[9]	110 mg/kg	---
Iron	1000 μg/L (dissolved)	---	---	53,000 mg/kg	---
Lead	Table B-3[5]	Table B-3[5]	---	245 mg/kg	---
Manganese	1000 μg/L	---	---	2300 mg/kg	---

Table C-5 (continued). Guidelines for Identifying Potential Causes of Impairment of *Aquatic Life* Use in Illinois Streams.

	Basis for Identifying Causes(1) (7)				
	Criteria based on Water Quality Standards (2)			Non-Standards-based Criteria(3)	
Potential Cause	**Acute Criteria**	**Chronic Criteria**	**Narrative Criteria**	**Sediment Criteria**	**Other Criteria**
Metals (cont.)					
Mercury	2.2 µg/L (dissolved)	1.1 µg/L (dissolved)	---	1.40 mg/kg	---
Nickel	Table B-3(5)	Table B-3(5)	---	45 mg/kg	---
Selenium	1000 µg/L	---	---	---	---
Silver	5 µg/L	---	---	5 mg/kg	---
Zinc	Table B-3(5)	Table B-3(5)	---	760 mg/kg	---
Other Pollutants					
(any pollutant with aquatic life criteria derived under 35 IAC 302.210)	<criterion>(4)	<criterion>(4)	---	---	---
Ammonia (Total)	Table B-3(5)	Table B-3(5)	---	---	---
Cause Unknown	(13).	(13).	---	---	(13).
Chlorides	500 mg/L	---	---	---	---
Chlorine(5)	19 µg/L	11 µg/L	---	---	---
Cyanide(5)	22 µg/L	5.2 µg/L	---	---	---
Fluoride	1.4 mg/L	---	---	---	---
Oil and Grease	---	---	unnatural sources(10)	---	Observed degradation from oil and grease (8)
pH	<6.5 or >9.0	---	---	---	---
Phosphorus (Total)	---	---	---	2800 mg/kg	0.61 mg/L
Sedimentation/Siltation (Bottom Deposits)	---	---	unnatural sources(10)	---	$\geq$ 75% silt/mud substrate, or Observed degradation from siltation/sedimentation (6) (8)
Sludge	---	---	unnatural sources(10)	---	Observed degradation from sludge (6) (8)
Sulfate(12)	(12)	(12)	---	---	---
Temperature, Water(5) *(used only for thermal point sources)*	2.8°C maximum rise in water temperature(5)	(5)	unnatural temperature changes(11)	---	Observed degradation from unnatural temperature changes (8)
Total Suspended Solids	---	---	---	---	116 mg/L
Turbidity	---	---	unnatural sources(10)	---	Observed degradation from turbidity (8)

Table C-5 (continued). Guidelines for Identifying Potential Causes of Impairment of *Aquatic Life* Use in Illinois Streams.

	Basis for Identifying Causes[1] [7]				
	Criteria based on Water Quality Standards [2]			Non-Standards-based Criteria[3]	
Potential Cause	**Acute Criteria**	**Chronic Criteria**	**Narrative Criteria**	**Sediment Criteria**	**Other Criteria**
Nonpollutant Causes					
Alteration in stream-side or littoral vegetative covers[6]	---	---	---	---	Observed degradation from alteration in stream-side or littoral vegetative covers [6] [8]
Alteration in wetland habitats	---	---	---	---	Observed degradation from alteration in wetland habitats [8]
Aquatic Algae[6]	---	---	unnatural sources[10]	---	Observed degradation from aquatic algae [6] [8]
Aquatic Plants (Macrophytes)[6]	---	---	unnatural sources[10]	---	Observed degradation from aquatic plants [6] [8]
Changes in stream depth and velocity patterns					Observed degradation from alteration/reduction of hydrologic diversity [6] [8]
Fish Kills	---	---	Toxic effects[9]	---	Documented fish kill; IDNR or Ill. EPA Records[8]
Fish-Passage Barrier	---	---	---	---	Observed degradation from fish-passage barrier [8]
Loss of instream cover					Observed degradation from reductions in instream cover[6] [8]
Low flow alterations[6]	---	---	---	---	Observed degradation from low flow alterations [6] [8]
Non-Native Aquatic Plants	---	---	unnatural sources[10]	---	Observed degradation from non-native aquatic plants[6] [8]
Non-Native Fish, Shellfish, or Zooplankton[6]	---	---	---	---	Observed degradation from non-native fish, shellfish or zooplankton [6] [8]
Other flow alterations[6]	---	---	---	---	Observed degradation from other flow alterations [8]
Oxygen, Dissolved	[12]	[12]	---	---	---

1. Unless otherwise indicated, for numeric criteria serving as guidelines, a single exceedance indicates that the substance is a potential cause of impairment. For applying these guidelines, Illinois EPA typically uses data from our three primary stream-monitoring programs: Ambient Water Quality Monitoring Network (most recent three years), Intensive Basin Survey (most recent survey), Facility-Related Stream Survey (most recent survey).
2. General Use Water Quality Standards at 35 Ill. Adm. Code 302, Subpart B.
3. Non-standards based numeric criteria for substances in water are based on 85th-percentile values determined from a statewide set of observations from the Ambient Water Quality Monitoring Network, for water years 1978-1996. Criteria for substances in sediment represent the minimum threshold of "highly elevated" levels (Short 1997).
4. Criterion derived according to 35 Ill. Adm. Code 302.210. Derived water quality criteria are available at www.epa.state.il.us/water/water-quality-standards/water-quality-criteria.html. Any single value above the chronic criteria indicates a potential cause of impairment.
5. Numeric criteria used as cause guidelines are available in Tables B-2 and B-3 with further explanation.
6. Physical-habitat criteria are available in Table C-4 with further explanation.
7. All table entries of "---" indicate that a cause guideline is not applicable or is unavailable.
8. Site-specific observation, information, or knowledge.
9. 35 Ill. Adm. Code 302.210.

10. 35 Ill. Adm. Code 302.203.
11. 35 Ill. Adm. Code 302.211b & c.
12. See Table B-2 and Section B-2 *Revisions to Illinois General Use Water Quality Standards*.
13. Cause Unknown is used if any of the following conditions apply:
    a. If Aquatic Algae or Aquatic Plants (Macrophytes) is identified as a cause of impairment but total phosphorus is not identified;
    b) If Fish Kills is identified as a cause of impairment, but the pollutant which caused the fish kill is not;
    c) If Non-Native Fish, Shellfish, or Zooplankton is identified as a cause of impairment, and those non-native species are contributing to an increase in the level of some pollutant, but that pollutant is not identified;
    d) If only nonpollutant causes are identified such as dissolved oxygen or habitat related causes, and there is reason to suspect that a pollutant impairment is likely, but the quantity and timing of water sampling is insufficient to detect it;
    e) If dissolved oxygen is identified as a cause and a pollutant is suspected of contributing to low DO, but that pollutant is not identified.
    f) If no causes of any type are identified.

Aquatic Life – Inland Lakes

The *Aquatic Life* Use Index (ALI) is the primary tool used for assessing *aquatic life* use in lakes (Tables C-6 and C-7). The Trophic State Index (TSI; Carlson 1977), the percent surface area macrophyte coverage during the peak growing season (June through August), and the median concentration of nonvolatile suspended solids (NVSS) are used to calculate the ALI score. Higher ALI scores indicate increased impairment.

Assessments of *aquatic life* use are based primarily on physical and chemical water quality data collected via the Ambient Lake Monitoring Program, the Illinois Clean Lakes Program, or by non-Illinois EPA persons under an approved quality assurance project plan. The physical and chemical data used for *aquatic life* use assessments include: Secchi-disk transparency, chlorophyll *a*, total phosphorus (epilimnetic samples only), nonvolatile suspended solids (epilimnetic samples only), and percent surface area macrophyte coverage. Data are collected a minimum of five times per year (April through October) from one or more established lake sites. Data are considered usable for assessments if meeting the following minimum requirements (Figure C-2): 1) at least four out of seven months (April through October) of data are available; 2) at least two of these months occur during the peak growing season of June through August (this requirement does not apply to NVSS); and 3) usable data are available from at least half of all lake sites within any given lake each month. As outlined in Figure C-2, a whole-lake TSI value is calculated for the median Secchi-disk transparency, median total phosphorus (epilemnetic sample depths only), and median chlorophyll *a* values. A minimum of two parameter-specific TSI values are required to calculate parameter-specific use support determinations. An assessment is then made based on the parameter-specific use support determinations. The 0.05 mg/L Illinois General Use Water Quality Standard for total phosphorus in lakes (35 Ill. Adm. Code 302.205) has been incorporated into the weighting criteria used to assign point values for the ALI.

Table C-6. Aquatic Life Use Index.

Evaluation Factor	Parameter	Weighting Criteria	Points
1. Trophic State Index (TSI)	For data collected April-October: Whole-lake TSI value calculated from median total phosphorus (epilimnetic sample only), median chlorophyll *a*, and median Secchi-disk transparency values	a. <60 b. ≥60<85 c. ≥85<90 d. ≥90	a. 40 b. 50 c. 60 d. 70
2. Macrophyte Coverage	Average percentage of lake surface area covered by macrophytes during peak growing season (June through August). Determined by: a. Macrophyte survey conducted during same water year as the chemical data used in the assessment; <u>or</u> b. Average value reported on the VLMP Secchi Monitoring Data form.	a. ≥15<40 b. ≥10<15, ≥40<50; c. ≥5<10, ≥50<70 d. <5, ≥70	a. 0 b. 5 c. 10 d. 15
3. Nonvolatile Suspended Solids (NVSS) Concentration	For data collected April-October: Median epilimnetic sample NVSS concentration (mg/L).	a. <12 b. ≥12<15 c. ≥15<20 d. ≥20	a. 0 b. 5 c. 10 d. 15

Figure C-2. Flow Chart for Assessing Attainment of *Aquatic Life* Use in Lakes.

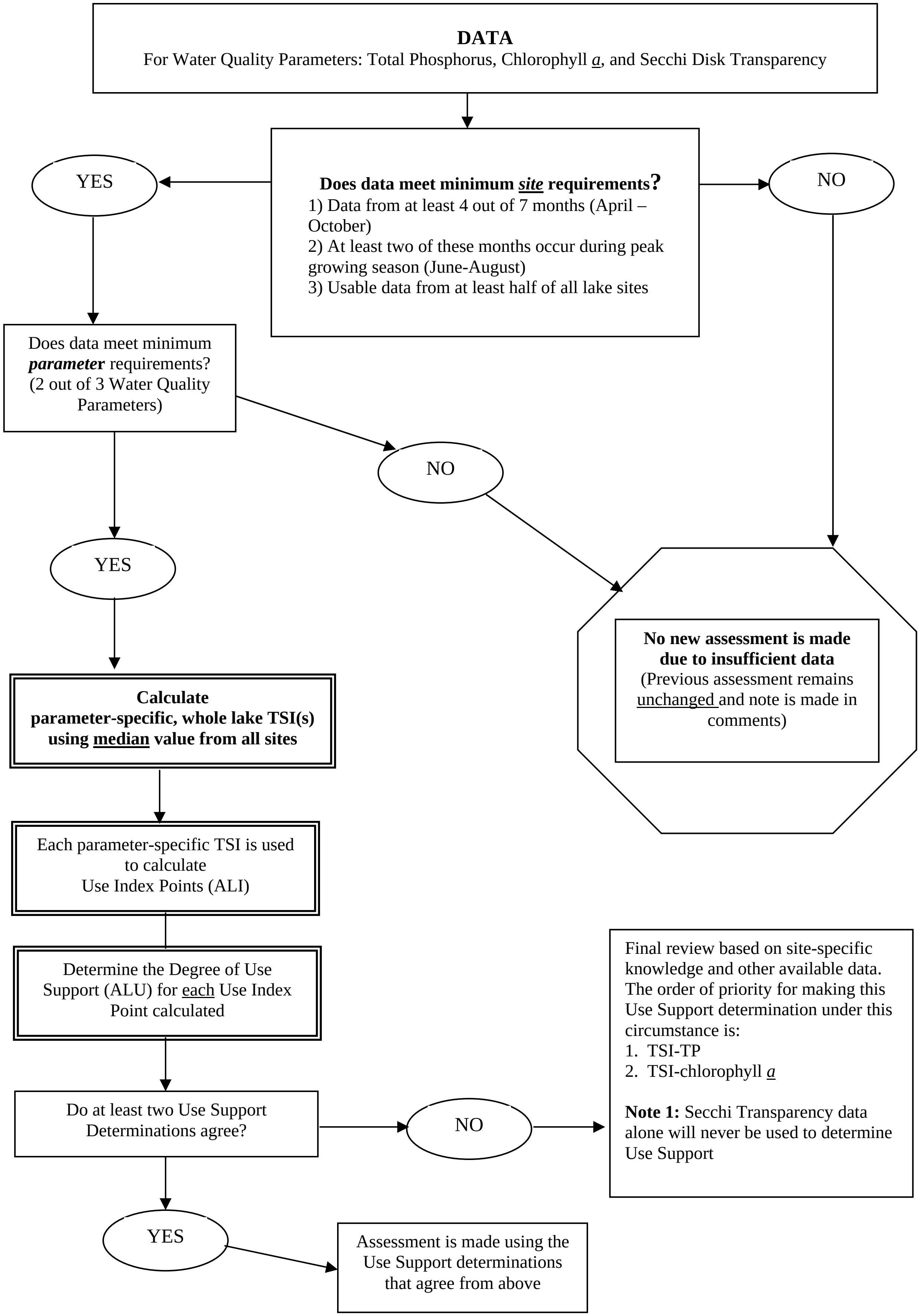


Table C-7. Guidelines for Assessing *Aquatic Life* Use in Illinois Inland Lakes.

Degree of Use Support	**Guidelines**
Fully Supporting (Good)	Total ALI points are <75
Not Supporting (Fair)	Total ALI points are ≥75<95
Not Supporting (Poor)	Total ALI points are ≥95

When an *aquatic life* use is found to be Not Supporting in a particular lake, potential causes of impairments are identified. Specific guidelines used to determine potential causes of impairment of *aquatic life* use in inland lakes are listed in Table C-8. Generally, one exceedance of an applicable Illinois water quality standard results in identifying the parameter as a potential cause of impairment. Additional guidelines used to determine potential causes of impairment include site-specific standards (35 Ill. Adm. Code 303.Subpart C), adjusted standards (published in the Illinois Pollution Control Board's *Environmental Register* at http://www.ipcb.state.il.us/Archive/dscgi/ds.py/View/Collection-11), or narrative standards (35 Ill. Adm. Code 302.203) intended to protect waters from "…sludge or bottom deposits, floating debris, visible oil, odor, plant or algal growth, color or turbidity of other than natural origin."

For parameters that have no numeric water quality standard (e.g., total suspended solids), a statistically-derived numeric value or a qualitative field observation may be used to identify potential causes of use impairment. For example, for total suspended solids, a numeric threshold based on an 85th-percentile value is used as a cause guideline (Table C-8); this threshold value is derived from all available data from water years 1978 through 1998, at Ambient Lake Monitoring Program or Illinois Clean Lakes Program sites. Measures of sediment chemistry are also used to identify potential causes of use impairment. In general, sediment parameters found at highly elevated levels (Mitzelfelt 1996) are identified as potential causes of impairment.

Table C-8. Guidelines for Identifying Potential Causes of Impairment of *Aquatic Life* Use in Illinois Inland Lakes.

	Basis for Identifying Causes[1] [7]				
	Criteria based on Water Quality Standards [2]			Non-Standards-based Criteria[3]	
Potential Cause	**Acute Criteria**	**Chronic Criteria**	**Narrative Criteria**	**Sediment Criteria**	**Other Criteria**
Pesticides and other Organic Pollutants					
Alachlor	1100 µg/L[4]	---	Toxic effects[9]	---	---
Aldrin	---	---	Toxic effects[9]	1.2 µg/kg	---
alpha-BHC	31 µg/L[4]	2.5 µg/L[4]	Toxic effects[9]	1.0 µg/kg	---
Atrazine	82 µg/L[4]	9 µg/L[4]	Toxic effects[9]	---	---
Benzene	4200 µg/L	860 µg/L	---	---	---
Chlordane	---	---	Toxic effects[9]	12 µg/kg	---
Cyanazine	370 µg/L[4]	30 µg/L[4]	Toxic effects[9]	---	---
DDT	---	---	Toxic effects[9]	180 µg/kg	---
Dicambra	1500 µg/L[4]	150 µg/L[4]			
Dieldrin	---	---	Toxic effects[9]	15 µg/kg	---
Endrin	160 µg/L[4]	33 µg/L[4]	Toxic effects[9]	1.0 µg/kg	---
Ethylbenzene	150 µg/L	14 µg/L	---	---	---
Heptachlor	---	---	Toxic effects[9]	1.0 µg/kg	---
Heptachlor epoxide	---	---	Toxic effects[9]	1.6 µg/kg	---
Hexachlorobenzene	---	---	Toxic effects[9]	1.0 µg/kg	---
Lindane (gamma BHC)	---	---	Toxic effects[9]	1.0 µg/kg	---
Methoxychlor	---	---	Toxic effects[9]	5.0 µg/kg	---
Metolachlor	380 µg/L [4]	30.4 µg/L [4]	Toxic effects[9]	---	---
Metribuzin	8.4 mg/L[4]	---	Toxic effects[9]	---	---
Polychlorinated biphenyls (PCBs)	---	---	Toxic effects[9]	89 µg/kg	---
Terbufos	0.024 µg/L[4]	---	Toxic effects[9]	---	---
Toluene	2000 µg/L	600 µg/L	---	---	---
Trifluralin	26 µg/L[4]	1.1 µg/L[4]	Toxic effects[9]	---	---
Xylenes (total mixed)	920 µg/L	360 µg/L	---	---	---
Metal Pollutants					
Arsenic	360 µg/L (dissolved)	190 µg/L (dissolved)	---	95.5 mg/kg	---
Barium	5000 µg/L	---	---	397 mg/kg	---
Cadmium	Table B-3[5]	Table B-3[5]	---	14 mg/kg	---
Copper	Table B-3[5]	Table B-3[5]	---	590 mg/kg	---
Chromium, hexavalent	16 µg/L	11 µg/L	---	---	---
Chromium, trivalent	Table B-3[5]	Table B-3[5]	---	---	---
Chromium (total)	---	---	Toxic effects[9]	49 mg/kg	---
Iron	1000 µg/L (dissolved)	---	---	56,000 mg/kg	---
Lead	Table B-3[5]	Table B-3[5]	---	339 mg/kg	---
Manganese	1000 µg/L	---	---	5500 mg/kg	---

Table C-8 (continued). Guidelines for Identifying Potential Causes of Impairment of *Aquatic Life* Use in Illinois Inland Lakes.

	Basis for Identifying Causes[1] [7]				
	Criteria based on Water Quality Standards [2]			Non-Standards-based Criteria[3]	
Potential Cause	**Acute Criteria**	**Chronic Criteria**	**Narrative Criteria**	**Sediment Criteria**	**Other Criteria**
Metals (cont.)					
Mercury	2.2 µg/L (dissolved)	1.1 µg/L (dissolved)	---	0.701 mg/kg	---
Nickel	Table B-3[5]	Table B-3[5]	---	43 mg/kg	---
Selenium	1000 µg/L	---	---	---	---
Silver	5 µg/L	---	---	1.0 mg/kg	---
Zinc	Table B-3[5]	Table B-3[5]	---	1100 mg/kg	---
Other Pollutants					
(any pollutant with aquatic life criteria derived under 35 IAC 302.210)	<criterion>[4]	<criterion>[4]	---	---	---
Ammonia (Total)	Table B-3[5]	Table B-3[5]	---	---	---
Cause Unknown	[13].	[13].	---	---	[13].
Chlorides	500 mg/L	---	---	---	---
Chlorine[5]	19 µg/L	11 µg/L	---	---	---
Cyanide[5]	22 µg/L	5.2 µg/L	---	---	---
Fluoride	1.4 mg/L	---	---	---	---
Oil and Grease	---	---	unnatural sources[10]	---	Observed degradation from oil and grease [8]
pH	$\geq$6.5 & $\leq$9.0	---	---	---	---
Phosphorus (Total)	0.05 mg/L[6]			2179 mg/kg	0.05 mg/L[6]
Sedimentation/Siltation (Bottom Deposits)	---	---	unnatural sources[10]		Annual storage loss > 0.25%
Sulfate					(See proposed standard in Section B-2)
Sludge			unnatural sources[10]		Observed degradation from sludge [8]
Temperature, Water[5] *(used only for thermal point sources)*	2.8°C maximum rise in water temperature[5]	[5]	unnatural temperature changes[11]	---	Observed degradation from unnatural temperature changes [8]
Total Suspended Solids	---	---	---		Median Surface NVSS > 12 mg/L
Turbidity	---	---	unnatural sources[10]	---	Observed degradation from turbidity [8]

Table C-8 (continued). Guidelines for Identifying Potential Causes of Impairment of *Aquatic Life* Use in Illinois Inland Lakes.

	Basis for Identifying Causes[1] [7]				
	Criteria based on Water Quality Standards [2]			Non-Standards-based Criteria[3]	
Potential Cause	**Acute Criteria**	**Chronic Criteria**	**Narrative Criteria**	**Sediment Criteria**	**Other Criteria**
Nonpollutant Causes					
Alteration in stream-side or littoral vegetative covers	---	---	---	---	Observed degradation from alteration in stream-side or littoral vegetative covers [8]
Alteration in wetland habitats	---	---	---	---	Observed degradation from alteration in wetland habitats [8]
Aquatic Algae	---	---	unnatural sources[10]	---	Median chlorophyll a (corrected) > 20 µg/L [7]
Aquatic Plants (Macrophytes)	---	---	unnatural sources[10]	---	> 40% peak coverage (June-Aug.)
Fish Kills	---	---	Toxic effects[9]	---	Documented fish kill; IDNR or Ill. EPA Records[8]
Non-Native Aquatic Plants	---	---	unnatural sources[10]	---	Observed degradation from non-native aquatic plants [8]
Non-Native Fish, Shellfish, or Zooplankton	---	---	---	---	Observed degradation from non-native fish, shellfish or zooplankton [8]
Oxygen, Dissolved	[12]	[12]	---	---	---

1. In general, a single exceedance of the criteria results in listing the parameter as a potential cause of impairment. Determination of causes is normally based on the most recent year of data from the Ambient Lake Monitoring Program, Illinois Clean Lakes Program or Source Water Assessment Program.
2. General Use Water Quality Standards at 35 Ill. Adm. Code 302, Subpart B.
3. Non-standards based numeric criteria for substances in water are based on 85th-percentile values of statewide Ambient Lake Monitoring Program and Illinois Clean Lakes Program data for water years 1978-1998. Criteria for substances in sediment represent the minimum threshold of "highly elevated" levels (Mitzelfelt 1996).
4. Criterion derived according to 35 Ill. Adm. Code 302.210. Derived water quality criteria are available at www.epa.state.il.us/water/water-quality-standards/water-quality-criteria.html. Any single value above the chronic criteria indicates a potential cause of impairment.
5. Numeric criteria used as cause guidelines are available in Tables B-2 and B-3 with further explanation.
6. The total phosphorus standard applies to lakes of 20 acres or larger. However, an observation of total phosphorus greater than 0.05 mg/L in lakes under 20 acres in size is also used to indicate a cause of impairment.
7. All table entries of "---" indicate that a cause guideline is not applicable or is unavailable.
8. Site-specific observation, information, or knowledge.
9. 35 Ill. Adm. Code 302.210.
10. 35 Ill. Adm. Code 302.203.
11. 35 Ill. Adm. Code 302.211b & c.
12. See Table B-2 and Section B-2 *Revisions to Illinois General Use Water Quality Standards*.
13. Cause Unknown is used if any of the following conditions apply:
    a) if either Aquatic Algae or Aquatic Plants (Macrophytes) is identified as a cause of impairment, but total phosphorus is not identified;
    b) if fish kills is identified as a cause of impairment, but the pollutant which caused the fish kill is not;
    c) if Non-Native Fish, Shellfish, or Zooplankton is identified as a cause of impairment and those non-native species are contributing to an increase in the level of some pollutant, but that pollutant is not identified;

d) if only nonpollutant causes are identified such as dissolved oxygen or habitat related causes, and there is reason to suspect that a pollutant impairment is likely, but the quantity and timing of water sampling is insufficient to detect it;
e) if dissolved oxygen is identified as a cause and a pollutant is suspected of contributing to low DO, but that pollutant is not identified.
f) if no causes of any type are identified.

Aquatic Life – Lake Michigan

Aquatic life use assessments are based on the applicable Lake Michigan Basin Water Quality Standards (Table B-4). The most-current three years of water quality data are used. Table C-9 provides the guidelines used to assess *aquatic life* use in Lake Michigan-basin waters.

Table C-9. Guidelines for Assessing *Aquatic Life* Use in Lake Michigan Basin Waters.

Water Chemistry: Lake Michigan Basin Water Quality Standards exceedances for any one parameter over three-year period. [1]	Fully Supporting (Good)	Not Supporting (Fair)	Not Supporting (Poor)
Conventionals [2] and other pollutants [3] Percent of samples	≤10%	>10≤25%	>25%
Toxics (priority pollutants, including chlorine, metals and un-ionized ammonia) [4] Acute (number of exceedances)	<2	2	>2
Toxics (priority pollutants, including chlorine, metals and un-ionized ammonia) [4] Chronic (percent of samples and mean)	≤10% and mean ≤standard	>10% and mean ≤standard	>10% and mean >standard

1. based on the most current three years of data from Lake Michigan Monitoring Program (LMMP) sampled six times per year
2. 35 Ill. Adm. Code, 302.502, 302.503, 302.507 including dissolved oxygen, pH, and water temperature
3. 35 Ill. Adm. Code 302.504 (b) including barium, chloride, iron, manganese, and total dissolved solids
4. 35 Ill. Adm. Code 302.504 (a, e), 302.535 (a, b) and 302.540 including ammonia nitrogen/un-ionized ammonia, arsenic, benzene, bis (2-ethylhexyl) phthalate, cadmium, chlorine (total residual), chromium, copper, cyanide, dieldrin, endrin, ethylbenzene, lead, lindane, ,mercury, nickel, parathion, pentachlorophenol, toluene, xylenes (total) and zinc

After a segment of Lake Michigan is assessed as Not Supporting *aquatic life* use, potential causes of impairments are identified. The primary methods for identifying and listing potential causes of specific use impairments for *aquatic life* use are described below and in Table C-10.

- Whenever possible, these guidelines are based on Lake Michigan Basin Water Quality Standards. In general, at least one exceedance of a numeric standard within the most-current three-year period serves as a guideline for identifying a potential cause of impairment. Also used are exceedances of the narrative portion of the Lake Michigan Basin Water Quality Standards which states that waters "...must be free from sludge or bottom deposits, floating debris, visible oil, odor, plant or algal growth, color or turbidity of other than natural origin." (35 Ill. Adm. Code, Section 302).

- For several potential causes, there are no applicable standards; however, quantitative data are available for assessments. In these cases, statistical methods were used. All available Lake Michigan surface data from 1978 through 1996 were evaluated and a value equal to the 85^{th}-percentile was used as the guideline for listing a potential cause of impairment.

- Sediment data are also used for listing potential causes. In general, whenever a sediment parameter was found at heavily polluted levels (USEPA 1977), it was listed as a potential cause of impairment.

Table C-10. Guidelines for Identifying Potential Causes of Impairment of *Aquatic Life* Use in Lake Michigan.

	Basis for Identifying Causes[1] [6]				
	Criteria based on Water Quality Standards[2]			Non-Standards-based Criteria[3]	
Potential Cause	**Acute Criteria**	**Chronic Criteria**	**Narrative Criteria**	**Sediment Criteria**	**Other Criteria**
Pesticides and other Organic Pollutants					
Benzene	3900 µg/L	800 µg/L	---	---	---
bis (2-ethylhexyl) phthalate	76 µg/L[4]	17 µg/L[4]	---	---	---
Dieldrin	240 ng/L	56 ng/L	---	---	---
Endrin	0.086 µg/L	0.036 µg/L	---	---	---
Ethylbenzene	150 µg/L	14 µg/L	---	---	---
Lindane (gamma BHC)	0.95 µg/L	---	---	---	---
Parathion	0.065 µg/L	0.013 µg/L	---	---	---
Pentachlorophenol (PCP)	Table B-4[5]	Table B-4[5]	---		
Polychlorinated biphenyls (PCBs)	---	---	Toxic effects[8]	10,000 µg/kg	---
Toluene	2000 µg/L	610 µg/L	---	---	---
Xylenes (total mixed)	1200 µg/L	490 µg/L	---	---	---
Metal Pollutants					
Arsenic	340 µg/L (dissolved)	1148 µg/L (dissolved)	---	8 mg/kg	---
Barium	5 mg/L	---	---	60 mg/kg	---
Cadmium	Table B-4[5]	Table B-4[5]	---	14 mg/kg	---
Copper	Table B-4[5]	Table B-4[5]	---	590 mg/kg	---
Chromium, hexavalent	16 µg/L	11 µg/L	---	---	---
Chromium, trivalent	Table B-4[5]	Table B-4[5]	---	---	---
Chromium (total)	---	---	Toxic effects[8]	75 mg/kg	---
Iron	1 mg/L (dissolved)	---	---	25,000 mg/kg	---
Lead	Table B-4[5]	Table B-4[5]	---	60 mg/kg	---
Manganese	1 mg/L	---	---	500 mg/kg	---
Mercury	1700 ng/L (dissolved)	910 ng/L (dissolved)	---	1.0 mg/kg	---
Nickel	Table B-4[5]	Table B-4[5]	---	50 mg/kg	---
Selenium	---	5.0 µg/L (dissolved)	---	---	---
Zinc	Table B-4[5]	Table B-4[5]	---	200 mg/kg	---

Table C-10 (continued). Guidelines for Identifying Potential Causes of Impairment of *Aquatic Life* Use in Lake Michigan.

	Basis for Identifying Causes[1] [6]				
	Criteria based on Water Quality Standards[2]			Non-Standards-based Criteria[3]	
Potential Cause	**Acute Criteria**	**Chronic Criteria**	**Narrative Criteria**	**Sediment Criteria**	**Other Criteria**
Other Pollutants					
Ammonia (Total)	15 mg/L[5]	---	---	---	---
Ammonia (Un-ionized)	Table B-4[5]	Table B-4[5]	---	---	---
Chlorides	500 mg/L	---	---	---	---
Chlorine[5]	19 μg/L	11 μg/L	---	---	---
Cyanide[5]	22 μg/L	5.2 μg/L	---	---	---
Fluoride	1.4 mg/L	---	---	---	---
Oil and Grease	---	---	unnatural sources[9]	---	Observed degradation from oil and grease [7]
pH[5]	>7.0 & <9 in open waters >6.5 & <9.0 in remainder of basin	---	---	---	---
Phosphorus (Total)	---	---	---	650 mg/kg	0.01 mg/L
Sedimentation/Siltation (Bottom Deposits)	---	---	unnatural sources[9]	---	---
Temperature, Water[5] *(used only for thermal point sources)*	1.7°C maximum rise in water temperature[5]	[5]	unnatural temperature changes[4]	---	Observed degradation from unnatural temperature changes [7]
Total Dissolved Solids	1000 mg/L or Conductivity > 1667 umho/cm	---	---	---	---
Total Suspended Solids	---	---	---	---	6.0 mg/L
Turbidity	---	---	unnatural sources[9]	---	Observed degradation from turbidity [7]
Nonpollutant Causes					
Alteration in stream-side or littoral vegetative covers	---	---	---	---	Observed degradation from alteration in stream-side or littoral vegetative covers [7]
Aquatic Algae	---	---	unnatural sources[9]	---	chlorophyll a (corrected) > 6 μg/L or algal cells > 1900/ml
Aquatic Plants (Macrophytes)	---	---	unnatural sources[9]	---	Observed degradation from aquatic plants [7]
Non-Native Aquatic Plants	---	---	unnatural sources[9]	---	Observed degradation from non-native aquatic plants [7]
Non-Native Fish, Shellfish, or Zooplankton	---	---	---	---	Observed degradation from non-native fish, shellfish or zooplankton [7]
Oxygen, Dissolved [5]	≥90% saturation in open waters 5.0 mg/L in remainder of basin[10]	---	---	---	---

1. Unless otherwise indicated, for numeric criteria serving as guidelines, a single exceedance indicates that the substance is a potential cause of impairment. For applying these guidelines, Illinois EPA typically uses data from the Lake Michigan Monitoring Program (LMMP) (most recent three years).
2. Illinois Lake Michigan Basin Water Quality Standards, 35 Ill. Adm. Code, Subpart E
3. Non-standards based numeric criteria for substances in water are based on 85th-percentile values from a set of observations from the Lake Michigan Monitoring Program for years 1978-1996. Criteria for substances in sediment are based on levels considered heavily polluted in *Guidelines for Classification of Great Lakes harbor sediments*, USEPA, 1977.
4. The criterion was derived according to 35 Ill. Adm. Code 302.540. Derived water quality criteria are available at www.epa.state.il.us/water/water-quality-standards/water-quality-criteria.html. Any single value above the chronic criteria indicates a potential cause of impairment.
5. Numeric criteria used as cause guidelines are available in Table B-4 with further explanation.
6. All table entries of "---" indicate that a cause guideline is not applicable or is unavailable.
7. site-specific observation, information, or knowledge
8. 35 Ill. Adm. Code 302.540
9. 35 Ill. Adm. Code 302.515
10. Dissolved oxygen must not be less than 90% of saturation, except due to natural causes, in the open waters of Lake Michigan. The other waters of the Lake Michigan Basin must not be less than 6.0 mg/L during at least 16 hours of any 24 hour period, nor less than 5.0 mg/L at any time.

Indigenous Aquatic Life

Illinois' Secondary Contact and Indigenous Aquatic Life Standards (35 Ill. Adm. Code, 302, Subpart D) apply to about 86 miles of canals, channels and modified streams and Lake Calumet, in northeastern Illinois (35 Ill. Adm. Code 303.441). The standards are intended to protect *indigenous aquatic life* limited only by the physical configuration of the body of water, characteristics, and origin of the water and the presence of contaminants in amounts that do not exceed these water quality standards.

On October 26, 2007, Illinois EPA filed a comprehensive rulemaking notice with the Illinois Pollution Control Board to change use definitions, use designations, and associated water-quality standards for the waters currently co-designated for *secondary contact* use and for *indigenous aquatic life* use. This rulemaking process also includes the following three General Use waters: the North Shore Channel (IL_HCCA-02); Chicago River (IL_HCB-01); and the Calumet River (IL_HAA-01). The proposal is available on the Illinois Pollution Control Board website at http://www.ipcb.state.il.us/documents/dsweb/Get/Document-59147/. Because of these proposed comprehensive changes, (see Section B-2) no new assessments of *indigenous aquatic life* use have been made in this cycle. All previous assessments of *indigenous aquatic life* use (and *aquatic life* use for the three general use waters listed above) which were approved in the 2006 cycle have been carried forward to 2008 without change. Those assessments of *indigenous aquatic life* use were based on the methodology described below.

Fully Supporting status of *indigenous aquatic life* use is intended to represent aquatic-life conditions consistent with conditions judged as reasonably attainable in these highly modified waters. Unlike most assessments of *aquatic life* use, assessment of *indigenous aquatic life* use is not based primarily on direct measures of aquatic life; rather, it is based primarily on surrogate water chemistry data. All available water chemistry data are compared to the appropriate Secondary Contact and Indigenous Aquatic Life standards (Table B-2). Assessments of *indigenous aquatic life* use rely on frequency of exceedance guidelines to better represent the true risk of impairment to aquatic life than would a single exceedance of a water quality criterion. Table C-11 provides the guidelines used to assess *indigenous aquatic life* use in applicable streams and in Lake Calumet. Table C-12 provides the guidelines for identifying potential causes of indigenous aquatic life impairment.

Table C-11. Guidelines for Assessing *Indigenous Aquatic Life* Use in Illinois Streams.

Degree of Use Support	Guidelines
Fully Supporting (Good)	For every available pollutant or stressor, $\leq$ 10% of observations exceed an applicable standard.
Not Supporting (Fair)	For any one pollutant or stressor, > 10% but $\leq$ 25% of observations exceed an applicable standard.
Not Supporting (Poor)	For any one pollutant or stressor, > 25% of observations exceed an applicable standard.

Table C-12. Guidelines for Identifying Potential Causes of Impairment of *Indigenous Aquatic Life* Use in Illinois Streams and Lake Calumet.

	Basis for Identifying Causes[1] [6]			
	Criteria based on Water Quality Standards[2]		Non-Standards-based Criteria[3]	
Potential Cause	**Acute Criteria**	**Narrative Criteria**	**Sediment Criteria**	**Other Criteria**
Pesticides and other Organic Pollutants				
Aldrin	---	---	1.0/1.2 µg/kg	---
alpha-BHC	---	---	1.0 µg/kg	---
Chlordane	---	---	23/12 µg/kg	---
DDT	---	---	34/180 µg/kg	---
Dieldrin	---	---	15 µg/kg	---
Endrin	---	---	1.0 µg/kg	---
Heptachlor	---	---	1.0 µg/kg	---
Heptachlor epoxide	---	---	3.8/1.6 µg/kg	---
Hexachlorobenzene	---	---	1.0 µg/kg	---
Lindane (Gamma BHC)	---	---	1.0 µg/kg	---
Methoxychlor	---	---	5.0 µg/kg	---
Polychlorinated biphenyls (PCBs)	---	---	180/89 µg/kg	---
Metal Pollutants				
Arsenic	1000 µg/L	---	18/95.5 mg/kg	---
Barium	5000 µg/L	---	230/397 mg/kg	---
Cadmium	150 µg/L	---	9.3/14 mg/kg	---
Copper	1000 µg/L	---	170/590 mg/kg	---
Chromium, hexavalent	300 µg/L	---	---	---
Chromium, trivalent	1000 µg/L	---	---	---
Chromium (total)	---	---	110/49 mg/kg	---
Iron	500 µg/L (dissolved)	---	53,000/56,000 mg/kg	---
Lead	100 µg/L	---	245/339 mg/kg	---
Manganese	1000 µg/L	---	2,300/5,500 mg/kg	---
Mercury	0.5 µg/L	---	1.40/0.701 mg/kg	---
Nickel	1000 µg/L	---	45/43 mg/kg	---
Selenium	1000 µg/L	---	---	---
Silver	100 µg/L	---	5/1 mg/kg	---
Zinc	1000 µg/L	---	760/1,100 mg/kg	---
Other Pollutants				
Ammonia (Un-ionized)[4]	0.1 mg/L[4]	---	---	---

Table C-12 (continued). Guidelines for Identifying Potential Causes of Impairment of *Indigenous Aquatic Life Use* in Illinois Streams and Lake Calumet.

	Basis for Identifying Causes(1) (6)			
	Criteria based on Water Quality Standards(2)		Non-Standards-based Criteria(3)	
Potential Cause	**Acute Criteria**	**Narrative Criteria**	**Sediment Criteria**	**Other Criteria**
Other Pollutants	---	---	---	---
Cyanide(4)	0.1 µg/L	---	---	---
Fluoride	15 mg/L	---	---	---
Oil and Grease	15 mg/L	unnatural sources(8)	---	---
pH	$\geq$6.0 & $\leq$9.0	---	---	---
Phenols	0.3 mg/L	---	---	---
Phosphorus (Total)	---	---	2,800/2,179 mg/kg	0.61 mg/L (streams only)
Sedimentation/Siltation (Bottom Deposits)	---	unnatural sources(8)	---	
Sludge		unnatural sources(8)		
Temperature, Water(4) *(used only for thermal point sources)*	100° F maximum & shall not exceed 93 °F more than 5% of time	---	---	---
Total Dissolved Solids	1500 mg/L (Conductivity >2500 umho/cm)	---	---	---
Total Suspended Solids	---	---	---	116 mg/L (streams only)(7)
Turbidity	---	unnatural sources(8)	---	Observed degradation from turbidity(5)
Nonpollutant Causes				
Aquatic Algae	---	unnatural sources(8)	---	Observed degradation from aquatic algae(5)
Aquatic Plants (Macrophytes)	---	unnatural sources(8)	---	Observed degradation from aquatic plants(5)
Fish Kills	---	---	---	Documented fish kill; IDNR or Ill. EPA Records
Fish-Passage Barrier	---	---	---	Observed degradation from fish passage barrier(5)
Low flow alterations	---	---	---	Observed degradation from low flow alterations(5)
Non-Native Aquatic Plants	---	unnatural sources(8)	---	Observed degradation from non-native aquatic plants(5)
Non-Native Fish, Shellfish, or Zooplankton	---	---	---	Observed degradation from non-native fish, shellfish, or zooplankton(5)
Other flow alterations	---	---	---	Observed degradation from other flow alterations(5)
Oxygen, Dissolved 4)	$\geq$ 4.0 mg/L(4)	---	---	---

Footnotes for Table C-12.

1. Unless otherwise indicated, for numeric criteria serving as guidelines, a single exceedance indicates that the substance is a potential cause of impairment. For applying these guidelines, Illinois EPA typically uses data from our three primary stream-monitoring programs: Ambient Water Quality Monitoring Network (most recent three years), Intensive Basin Survey (most recent survey), Facility-Related Stream Survey (most recent survey).
2. Illinois Secondary Contact and Indigenous Aquatic Life Water Quality Standards, 35 Ill. Adm. Code, 302, Subpart D
3. When two numbers are listed for sediment guidelines the first number applies to streams and the second number applies to Lake Calumet. Criteria for substances in stream sediment represent the minimum threshold of "highly elevated" levels (Short 1997). Criteria for substances in Lake Calumet sediment represent the minimum threshold of "highly elevated" levels (Mitzelfelt 1996). Criteria for substances in stream water are based on 85^{th}-percentile values determined from a statewide set of observations from the Ambient Water Quality Monitoring Network, for water years 1978-1996.
4. Numeric criteria used as cause guidelines are available in Table B-2 with further explanation.
5. site-specific observation, information, or knowledge
6. All table entries of "---" indicate that a cause guideline is not applicable or is unavailable.
7. The criteria for Total Suspended Solids listed in this table is for streams. Criteria for Total Suspended Solids for Lake Calumet are the same as those listed for inland lakes in Table C-8.
8. 35 Ill. Adm. Code 302.403

Fish Consumption – Streams, Inland Lakes and Lake Michigan

Fish consumption use is associated with all water bodies in the state. The assessment of *fish consumption* use is based on water body-specific fish-tissue data and also on fish-consumption advisories issued by the Illinois Fish Contaminant Monitoring Program (FCMP). A list of water bodies having advisories can be found in the Illinois Department of Natural Resources' (IDNR) publication ***2007 Illinois Fishing Information*** (http://dnr.state.il.us/fish/digest/). Fish-consumption advisories are incorporated into the process for assessing *fish consumption* use as explained below.

The FCMP uses the U.S. Food & Drug Administration's (FDA) Action Levels as criteria for determining the need for advisories, except for polychlorinated biphenyls (PCBs), mercury, and chlordane. For these contaminants the FDA criteria have been replaced by a risk-based process developed in the *Protocol for a Uniform Great Lakes Sport Fish Consumption Advisory* (Anderson et al. 1993, herein after referred to as the Protocol). The Protocol requires the determination of a Health Protection Value (HPV) for a contaminant, which is then used with five meal consumption frequencies (eight ounces of uncooked filet): 1) Unlimited (140 meals/year); 2) One meal/week (52 meals/year); 3) One meal/month (12 meals/year); 4) One meal/two months (six meals/year); and 5) Do not eat (0 meals/year). The level of contaminant in fish is then calculated that will not result in exceeding the HPV at each meal consumption frequency. The Protocol also assumes a 50% reduction of contaminant levels for organic chemicals (not used for mercury) when recommended cleaning and cooking methods are used. The HPVs, target populations, critical health effects to be protected by the HPVs, and the criteria for PCBs, mercury and chlordane for the various meal frequencies, are listed in Table C-13 as well as the FDA action levels for other contaminants.

Except in extraordinary circumstances, two or more recent sampling events in a water body in two different sampling years finding fish exceeding a level of concern for one or more contaminants are necessary for issuing or changing an advisory (based on data collected since 1985). Similarly, two or more recent samples finding no fish exceeding criteria are necessary for rescinding an advisory. For any contaminant except mercury, the issuance of a fish-consumption advisory for a specific water body provides the basis for a determination that *fish consumption* use is impaired, with the contaminant of concern listed as a cause of impairment. Currently, fish-consumption advisories are in effect only for PCBs, chlordane and mercury. However, a statewide fish-consumption advisory ("no more than one meal per week of predator fish" for pregnant or nursing women, women of childbearing age, and children less than 15 years of age) has been issued for mercury because fish-tissue data indicated widespread contamination above criteria levels throughout the state. This statewide advisory applies to all waters in Illinois even though not all water bodies were sampled and not all samples exceeded the criteria levels for that advisory.

This last sentence represents a fundamental difference between the purpose and methodology for issuing fish-consumption advisories and assessing attainment of *fish consumption* use. Fish-consumption advisories are, as their name implies, advice to the public on how best to avoid a certain level of exposure to contaminants which **may** be present in fish tissue. The purpose of assessing attainment of *fish consumption* use is to identify those specific waters where *fish* *consumption* use **is** impaired. While statewide or watershed advisories are a justifiable, conservative approach to the protection of human health, they do not identify the specific waters where contaminants are known to occur and may be overprotective in waters where contaminants do not occur.

Because of this, Illinois EPA does not assess *fish consumption* use as Not Supporting in all waters of the state based on the statewide fish-consumption advisory for mercury. Rather, *fish consumption* use is assessed as Not Supporting only for those specific waters where at least one fish-tissue sample is available and where at least one fish species exceeds the 0.06 mg/kg criterion for mercury. Also, because the statewide advisory is for predator species, *fish consumption* use is only assessed as Fully Supporting in those waters where predator fish-tissue data from the most recent two years do not show mercury contamination above criteria levels. Waters where sufficient fish-tissue data are unavailable are considered Not Assessed.

Table C-14 shows the guidelines used for assessing attainment of *fish consumption* use.

The IDNR publication referenced at the beginning of this section notes that there is a statewide one-meal-per-week mercury advisory, but does not list those specific waters where mercury was found in fish-tissue above the 0.06 mg/kg criteria. Only those waters with more restrictive mercury advisories (with greater levels of contamination) were listed. The result is that there appear to be more waters impaired for *fish consumption* use due to mercury on the 2008 303(d) List than listed for a mercury advisory in the IDNR publication.

Table C-15 lists guidelines for identifying potential causes of *fish consumption* use impairment. Although all parameters with FDA action levels are listed in the table, only PCBs, mercury and chlordane have ever been detected in Illinois fish samples at levels that would warrant a fish-consumption advisory.

Table C-13. Health Protection Values (HPVs) and Criteria Levels for Sport-Fish-Consumption Advisories for Polychlorinated Biphenyls, Methyl Mercury, and Chlordane; and FDA Action Levels for Other Contaminants.

CHEMICAL	HPV (ug/kg/d)	TARGET POPULATION[1], EFFECT	MEAL FREQUENCY	CRITERIA LEVELS (mg/kg)
Polychlorinated biphenyls	0.05	All (emphasis on sensitive), Reproductive/ developmental effects	Unlimited	0-0.05
			1 meal/week	0.06-0.22
			1 meal/month	0.23-0.95
			1 meal/2 months	0.96-1.9
			Do not eat	>1.9
Methyl mercury	0.1	Sensitive, Reproductive/ developmental effects	Unlimited	0-0.05
			1 meal/week	0.06-0.22
			1 meal/month	0.23-1.0
			Do not eat	>1.0
Methyl mercury	0.3	Nonsensitive, Nervous system effects	Unlimited	0-0.15
			1 meal/week	0.16-0.65
			1 meal/month	0.66-1.0
			Do not eat	>1.0
Chlordane	0.15	All, Liver effects	Unlimited	0-0.15
			1 meal/week	0.16-0.65
			1 meal/month	0.66-2.8
			1 meal/2months	2.9-5.6
			Do not eat	>5.6

	FDA Action Level (mg/kg)
Aldrin	0.3
DDT (Total)	5.0
Dieldrin	0.3
Endrin	0.3
Heptachlor	0.3
Heptachlor epoxide	0.3
Mirex	0.1
Toxaphene	5.0

1. Sensitive Population includes pregnant or nursing women, women of child-bearing age, and children under 15; Nonsensitive Population includes women beyond child-bearing age and men over 15.

Table C-14. Guidelines for Assessing *Fish Consumption* Use in all Illinois Waters Including Streams, Inland Lakes, and Lake Michigan.

Degree of Use Support	Guidelines[1]
Fully Supporting[6] (Good)	PCBs are less than 0.06 mg/kg and chlordane is less than 0.16 mg/kg in fish tissue in the two most recent years of samples for each species collected since 1985; and, mercury is less than 0.06 mg/kg in fish tissue in the two most recent years of samples for each species collected since 1985 and those samples include at least one predator species[2] of a "large size class[3]" in two different years.
Not Supporting (Fair)	A water body-specific[4], "restricted consumption[5]" fish-consumption advisory is in effect; or, mercury is greater than or equal to 0.06 mg/kg in fish tissue of any species, in at least one of the two most recent years of samples collected in 1985 or later[7].
Not Supporting (Poor)	A "no consumption" (i.e., "Do Not Eat") fish-consumption advisory, for one or more fish species, is in effect for the general human population; or, a commercial fishing ban is in effect.
Not Assessed	None of the guidelines above apply.

1 In general, all data for each named stream or lake are combined to make the assessment. For larger rivers, assessments may be made for partial river segments.

2 "Predatory species" include northern pike, muskellunge, flathead catfish, chinook salmon, coho salmon, lake trout, brown trout, white bass, striped bass, striped-bass hybrids, smallmouth bass, largemouth bass, spotted bass, sauger, walleye, and saugeye.

3 "Large size class" is dependant on the particular species and the water body where the species is collected.

4 Although a general statewide advisory for mercury exists, Illinois EPA assesses *fish consumption* use as "Not Supporting" only for specific waters from which fish tissue has been collected and analyzed for contaminants and mercury contamination is confirmed. Fish-tissue data needed to confirm the advisory are not available from all waters.

5 Restricted consumption is defined as limits on the number of meals or size of meals consumed per unit time, per fish species. In Illinois, restricted-consumption advisories are: 1 meal/week, 1 meal/month, or 1 meal/2 months.

6 An assessment of Fully Supporting *fish consumption* use requires fish-tissue data from two different years (1985 or later). If more than two years of fish-tissue data are available (1985 or later), only the two most recent years of data (per species) are used in the assessment process.

7 Only one sample of fish tissue (1985 or later) exceeding criteria levels is necessary for an assessment of Not Supporting (Fair). If more than two years of fish-tissue data are available (1985 or later), only the two most recent years of data (per species) are used in the assessment process.

Table C-15. Guidelines for Identifying Potential Causes of Impairment of *<u>Fish Consumption</u>* Use in Illinois Streams, Inland Lakes and Lake Michigan.

Potential Cause	Basis For Identifying Cause
Aldrin	Fish-consumption advisory or commercial fishing ban is in effect, attributable to any applicable parameter[1].
Chlordane	
DDT	
Dieldrin	
Endrin	
Heptachlor	
Heptachlor epoxide	
Mirex	
Polychlorinated biphenyls (PCBs)	
Toxaphene	
Mercury	Water body-specific fish-tissue data indicating mercury $\geq$0.06 mg/kg

Primary Contact – Streams and Inland Lakes

According to Illinois water quality standards, "primary contact" means "*...any recreational or other water use in which there is prolonged and intimate contact with the water involving considerable risk of ingesting water in quantities sufficient to pose a significant health hazard, such as swimming and water skiing*" (35 Ill. Adm. Code 301.355). The assessment of *primary contact* use is based on fecal coliform bacteria data. The General Use Water Quality Standard for fecal coliform bacteria specifies that during the months of May through October, based on a minimum of five samples taken over not more than a 30-day period, fecal coliform bacteria counts shall not exceed a geometric mean of 200/100 ml, nor shall more than 10 percent of the samples during any 30-day period exceed 400/100 ml (35 Ill. Adm. Code 302.209). This standard protects *primary contact* use of Illinois waters by humans. Due to limited state resources, fecal coliform bacteria is not normally sampled at a frequency necessary to apply the General Use standard, i.e., at least five times per month during May through October, and very little data available from others are collected at the required frequency. Therefore, assessment guidelines are based on application of the standard when sufficient data is available to determine standard exceedances; but, in most cases, attainment of *primary contact* use is based on a broader methodology intended to assess the likelihood that the General Use standard is being attained.

To assess *primary contact* use, Illinois EPA uses all fecal coliform bacteria from water samples collected in May through October, over the most recent five-year period (i.e., 2002 through 2006 for this report). Based on these water samples, geometric means and individual measurements of fecal coliform bacteria are compared to the concentration thresholds in Tables C-16 and C-17. To apply the guidelines, the geometric mean of fecal coliform bacteria concentration is calculated from the entire set of May through October water samples, across the five years. No more than 10% of all the samples may exceed 400/100 ml for a water body to be considered Fully Supporting.

Some portions of stream segments are exempt from the fecal coliform bacteria water quality standard; *primary contact* use does not apply in these portions (35 Ill. Adm. Code 302.209). Stream miles assessed for *primary contact* use only include those reaches represented by Ambient Water Quality Monitoring Network stations where such exemptions do not apply. Since we typically do not collect fecal coliform bacteria samples in lakes, *primary contact* use assessments are limited to those lakes for which fecal coliform data is available from outside sources, primarily the Lake County Health Department, Lakes Management Unit.

Table C-16. Guidelines for Assessing *Primary Contact* Use in Illinois Streams and Inland Lakes.

Degree of Use Support	Guidelines
Fully Supporting (Good)	No exceedances of the fecal coliform bacteria standard in the last five years and the geometric mean of all fecal coliform bacteria observations ≤200/100 ml, and ≤10% of all observations exceed 400/100 ml.
Not Supporting (Fair)	One exceedance of the fecal coliform bacteria standard in the last five years (when sufficient data is available to assess the standard) or The geometric mean of all fecal coliform bacteria observations in the last five years ≤200/100 ml, and >10% of all observations in the last five years exceed 400/100 ml or The geometric mean of all fecal coliform bacteria observations in the last five years >200/100 ml, and ≤25% of all observations in the last five years exceed 400/100 ml.
Not Supporting (Poor)	More than one exceedance of the fecal coliform bacteria standard in the last five years (when sufficient data is available to assess the standard) or The geometric mean of all fecal coliform bacteria observations in the last five years >200/100 ml, and >25% of all observations in the last five years exceed 400/100 ml

Table C-17. Guidelines for Identifying Potential Causes of Impairment of *Primary Contact* (Swimming) Use in Illinois Streams and Inland Lakes.

Potential Cause	Basis for Identifying Cause - Numeric Standard[1]
Fecal Coliform	Geometric mean of at least five fecal coliform bacteria observations collected over not more than 30 days during May through October >200/100 ml or > 10% of all such fecal coliform bacteria observations exceed 400/100 ml or Geometric mean of all fecal coliform bacteria observations (minimum of five samples) collected during May through October >200/100 ml or > 10% of all fecal coliform bacteria observation exceed 400/100 ml.

1. The applicable fecal coliform standard (35 Ill. Adm. Code, 302, Subpart B, Section 302.209) requires a minimum of five samples in not more than a 30-day period. However, because this number of samples is seldom available in this time frame the criteria are also based on a minimum of five samples over the most recent five-year period.

Primary Contact – Lake Michigan

For Lake Michigan open waters, the assessment of *primary contact* use is based on fecal coliform bacteria. Fecal coliform bacteria data are collected as part of the Lake Michigan Monitoring Program, but insufficient numbers of samples are collected during a 30-day period to appropriately apply the standard (Table B-4). In addition, these samples are collected in the open lake from one to six miles off shore and may not reflect conditions at beaches. At approximately 51 Lake Michigan beaches, local agencies collect daily *Escherichia coli* bacteria samples during the swimming season. Beaches are closed by these agencies if samples exceed 235/100 ml *Escherichia coli* bacteria (77 Ill. Adm. Code 820). *Primary contact* use is assessed by using criteria in Tables C-18 (beaches) and C-19 (open waters). Criteria for identifying causes of impairment for *primary contact* use are shown in Table C-20.

Table C-18. Guidelines for Assessing *Primary Contact* Use at Lake Michigan Beaches (USEPA 1997).

Degree of Use Support	Guidelines [1]
Fully Supporting (Good)	On average, less than one bathing area closure per year of less than one week's duration.
Not Supporting (Fair)	On average, one bathing area closure per year of less than one week's duration.
Not Supporting (Poor)	On average, one bathing area closure per year of greater than one week's duration, or more than one bathing area closure per year.

1. Based on most-current three years of data (if available) from local agencies using Illinois Department of Public Health Bathing Beach Code (77 Ill. Adm. Code 820.400): An *Escherichia coli* count of 235 colonies/100 ml in each of two samples collected on the same day shall require closing the beach. Note: beaches in Lake County and suburban Cook County are closed when one sample exceeds 235/100 ml; beaches in Chicago are closed when two consecutive samples exceed 235/100 ml.

Table C-19. Guidelines for Assessing *Primary Contact* Use in the Open Waters of Lake Michigan.

Degree of Use Support	Guidelines [1, 2]
Fully Supporting (Good)	Geometric mean of all fecal coliform bacteria samples <200/100 ml and ≤10% of samples exceed a count of 400/100 ml.
Not Supporting (Fair)	The geometric mean of all fecal coliform bacteria samples <200/100 ml, and >10% of samples exceed a count of 400/100 ml. or The geometric mean of all fecal coliform bacteria samples >200/100 ml and ≤25% of samples exceed a count of 400/100 ml.
Not Supporting (Poor)	The geometric mean of all fecal coliform bacteria samples >200/100 ml and >25% of samples exceed a count of 400/100 ml.

1. Based on most-current three years of data from Lake Michigan Monitoring Program sampled approximately six times per year.
2. 35 Ill. Adm. Code 302.505 (2002).

Table C-20. Guidelines for Identifying Potential Causes of Impairment of *Primary Contact* (Swimming) Use in Lake Michigan Beaches and Open Waters.

Potential Cause	Basis For Identifying Causes - Numeric Standard[1,2]
Fecal Coliform	Geometric mean of all fecal coliform bacteria observations (minimum of five samples) collected during the most recent three years >200/100 ml
Escherichia coli	On average at least one bathing beach closure per year based on *E. coli* bacteria

1. The applicable fecal coliform standard in 35 Illinois Administrative Code, Part 302, Subpart E, Section 302.505 requires a minimum of 5 samples in not more than a 30-day period. However, because this number of samples is seldom available in this time frame the criteria are based on a minimum of five samples (May through October) over the most recent three year period.
2. Department of Public Health Bathing Beach Code (77 Ill. Adm. Code 820.400): An *Escherichia coli* count of 235 colonies/100 ml in each of two samples collected on the same day shall require closing the beach. Note: beaches in Lake County and suburban Cook County are closed when one sample exceeds 235/100 ml; beaches in Chicago are closed when two consecutive samples exceed 235/100 ml.

Secondary Contact – Streams, Inland Lakes and Lake Michigan

According to Illinois water quality standards, "secondary contact" means "*...any recreational or other water use in which contact with the water is either incidental or accidental and in which the probability of ingesting appreciable quantities of water is minimal, such as fishing, commercial and recreational boating and any limited contact incident to shoreline activity*" (35 Ill. Adm. Code 301.380). Although *secondary contact* use is associated with all waters of the state, no specific assessment guidelines have been developed to assess *secondary contact* use because existing water quality standards have no water quality criterion that specifically address this use. However, consistent with the meanings of these two uses, in any water where *primary contact* use is assessed as Fully Supporting, *secondary contact* use is also assessed as Fully Supporting. In all other circumstances *secondary contact* use is not assessed.

Public and Food Processing Water Supply – Streams, Inland Lakes, and Lake Michigan

Attainment of *public and food processing water supply* use is assessed only in waters in which the use is currently occurring, as evidenced by the presence of an active public-water-supply intake. The assessment of *public and food processing water supply* use is based on conditions in both untreated and treated water (Table C-21). By incorporating data through programs related to both the federal Clean Water Act and the federal Safe Drinking Water Act, Illinois EPA believes that these guidelines provide a comprehensive assessment of *public and food processing water supply* use.

Assessments of *public and food processing water supply* use recognize that characteristics and concentrations of substances in Illinois surface waters can vary and that a single assessment guideline may not protect sufficiently in all situations. Using multiple assessment guidelines helps improve the reliability of these assessments. When applying these assessment guidelines, Illinois EPA also considers the water-quality substance, the level of treatment available for that substance, and the monitoring frequency of that substance in the untreated water.

One of the assessment guidelines for untreated water relies on a frequency-of-exceedance threshold (10%) because this threshold represents the true risk of impairment better than does a single exceedance of a water quality criterion. Assessment guidelines also recognize situations in which water treatment that consists only of "*...coagulation, sedimentation, filtration, storage and chlorination, or other equivalent treatment processes*"(35 Ill. Adm. Code 302.303; hereafter called "conventional treatment") may be insufficient for reducing potentially harmful levels of some substances. To determine if a Maximum Contaminant Level (MCL) violation in treated water would likely occur if treatment additional to conventional treatment were not applied (see 35 Ill. Adm. Code 302.305), the concentration of the potentially harmful substance in untreated water is examined and compared to the MCL threshold concentration. If the concentration in untreated water exceeds an MCL-related threshold concentration, then an MCL violation could reasonably be expected in the absence of additional treatment.

Table C-21 provides the guidelines for assessing attainment of *public and food processing water supply* use in Illinois streams, inland lakes, and Lake Michigan. In general, compliance with an

MCL for treated water is based on a running 4-quarter (i.e., annual) average, calculated quarterly, of samples collected at least once per quarter (Jan.-Mar., Apr.-Jun., Jul.-Sep., and Oct.-Dec.). However, for some untreated-water intake locations, sampling occurs less frequently than once per quarter; therefore, statistics comparable to quarterly averages or running 4-quarter averages cannot be determined.for untreated water. Rather, for substances not known to vary regularly in concentration in Illinois surface waters (untreated) throughout the year, a simple arithmetic average concentration of all available results is used to compare to the MCL threshold. For substances known to vary regularly in concentration in surface waters during a typical year (e.g., atrazine), average concentrations within the relevant sub-annual (e.g., quarterly) periods are used. Table C-22 lists the guidelines for identifying potential causes of *public and food processing water supply* use impairment.

Table C-21. Guidelines for Assessing *Public and Food Processing Water Supply* Use in Illinois Streams, Inland Lakes, and Lake Michigan.

Degree of Use Support	**Guidelines**
Fully Supporting (Good)	For each substance in untreated water [(1)], for the most-recent three years of readily available data or equivalent dataset, a) ≤ 10% of observations exceed an applicable Public and Food Processing Water Supply Standard [(2)]; and b) for which the concentration is not readily reducible by conventional treatment, i) no observation exceeds by at least fourfold the treated-water Maximum Contaminant Level threshold concentration[(3)] for that substance; and ii) no quarterly average concentration exceeds the treated-water Maximum Contaminant Level threshold concentration[(3)] for that substance; and iii) no running annual average concentration exceeds the treated-water Maximum Contaminant Level threshold concentration[(4)] for that substance. And [(4)], For each substance in treated water, no violation of an applicable Maximum Contaminant Level [(3)] occurs during the most recent three years of readily available data.
Not Supporting (Fair)	For any single substance in untreated water, [(1)] for the most-recent three years of readily available data or equivalent dataset, a) > 10% of observations exceed a Public and Food Processing Water Supply Standard [(2)]; or b) for which the concentration is not readily reducible by conventional treatment, i) at least one observation exceeds by at least fourfold the treated-water Maximum Contaminant Level threshold concentration[(3)] for that substance; or ii) the quarterly average concentration exceeds the treated-water Maximum Contaminant Level threshold concentration[(3)] for that substance; or iii) the running annual average concentration exceeds the treated-water Maximum Contaminant Level threshold concentration[(3)] for that substance. Or, For any single substance in treated water, at least one violation of an applicable Maximum Contaminant Level [(3)] occurs during the most recent three years of readily available data.
Not Supporting (Poor)	Closure to use as a drinking-water resource (cannot be treated to allow for use).

1. Includes only the untreated-water results that were available in the primary computer database at the time data were compiled for these assessments.
2. See Table B-2 and 35 Ill. Adm. Code 302.304, 302.306.
3. 35 Ill. Adm. Code 611.300, 611.301, 611.310, 611.311, 611.325.
4. Some waters were assessed as Fully Supporting based on treated-water data only.

Table C-22. Guidelines for Identifying Potential Causes of Impairment of *Public and Food Processing Water Supply* Use in Illinois Streams, Inland Lakes and Lake Michigan.

	Basis For Identifying Cause[1, 4]	
Potential Cause	**Numeric Standard[2]**	**Maximum Contaminant Level[3]**
1,1,1-Trichloroethane	---	0.2 mg/L
1,1,2-Trichloroethane	---	5 μg/L
1,2,4-Trichlorobenzene	---	0.07 mg/L
1,2-Dibromo-3-chloropropane (Dibromochloropropane DBCP)	---	0.2 μg/L
1,2-Dichloroethane	---	5 μg/L
1,2-Dichloropropane	---	5 μg/L
2,3,7,8-Tetrachlorodibenzo-p-dioxin (only)	---	0.03 ng/L
2,4,5-TP (Silvex)	0.01 mg/L	0.05 mg/L
2,4-D	0.1 mg/L	0.01 mg/L
Alachlor	---	2 μg/L
Aldrin	1 μg/L	1 μg/L
Antimony	---	6 μg/L
Arsenic	0.05 mg/L	0.010 mg/L
Asbestos	---	7 MFL[5]
Atrazine	---	3 μg/L
Barium	1.0 mg/L	2 mg/L
Benzene	---	5 μg/L
Benzo[a]pyrene (PAHs)	---	0.2 μg/L
Beryllium	---	4 μg/L
Cadmium	0.010 mg/L	5 μg/L
Carbofuran	---	0.04 mg/L
Carbon tetrachloride	---	5 μg/L
Chlordane	3 μg/L	2 μg/L
Chlorides	250 mg/L	---
Chlorobenzene (mono)	---	0.1 mg/L
Chromium (total)	0.05 mg/L	0.1 mg/L
cis-1,2-Dichloroethylene	---	0.07 mg/L
Cyanide	---	0.2 mg/L
Dalapon	---	0.2 mg/L
DDT	0.05 mg/L	0.05 mg/L
DEHP (di-sec-octyl phthalate) (Di(2-ethylhexyl)phthalate)	---	6 μg/L
Di (2-ethylhexyl) adipate	---	0.4 mg/L
Dichloromethane (methylene chloride)	---	5 μg/L

Table C-22 (cont.). Guidelines for Identifying Potential Causes of Impairment of *Public and Food Processing Water Supply* Use in Streams, Inland Lakes and Lake Michigan.

	Basis For Identifying Cause(1, 4)	
Potential Cause	**Numeric Standard(2)**	**Maximum Contaminant Level(3)**
Dieldrin	1 μg/L	1 μg/L
Dinoseb	---	7 μg/L
Diquat	---	0.02 mg/L
Endothall	---	0.1 mg/L
Endrin	0.2 μg/L	2 μg/L
Ethylbenzene	---	0.7 mg/L
Ethylene dibromide	---	0.05 μg/L
Fecal Coliform	geometric mean of five samples in ≥30 days ≥2000 per 100 ml	---
Fluoride	---	4 mg/L
Glyphosate	---	0.7 mg/L
Heptachlor	0.1 μg/L	0.1 μg/L
Heptachlor epoxide	0.1 μg/L	0.1 μg/L
Hexachlorobenzene	---	1 μg/L
Hexachlorocyclopentadiene	---	0.05 mg/L
Iron	0.3 mg/L (dissolved)	1.0 mg/L (for CWS serving ≥1000 people or ≥300 connections)
Lead	0.05 mg/L	---
Lindane	4 μg/L	0.2 μg/L
Manganese	0.15 mg/L	0.15 mg/L (for CWS serving ≥1000 people or ≥300 connections)
Mercury	---	2 μg/L
Methoxychlor	0.1 mg/L	0.04 mg/L
Nitrate/Nitrite (nitrate + nitrite as N)	---	10 mg/L
Nitrogen, Nitrate	10 mg/L	10 mg/L
Nitrogen, Nitrite	---	1 mg/L
o-Dichlorobenzene	---	0.6 mg/L
Oil and Grease	0.1 mg/L	---
Oxamyl (Vydate)	---	0.2 mg/L
Parathion	0.1 mg/L	---
p-Dichlorobenzene	---	0.075 mg/L
Pentachlorophenol (PCP)	---	1 μg/L
Phenols	1 μg/L	---
Picloram	---	0.5 mg/L
Polychlorinated biphenyls (PCBs)	---	0.5 μg/L
Selenium	0.01 mg/L	0.05 mg/L
Simazine	---	4 μg/L

Table C-22 (cont.). Guidelines for Identifying Potential Causes of Impairment of *Public and Food Processing Water Supply* Use in Streams, Inland Lakes and Lake Michigan.

	Basis For Identifying Cause(1, 4)	
Potential Cause	**Numeric Standard(2)**	**Maximum Contaminant Level(3)**
Styrene	---	0.1 mg/L
Sulfates	250 mg/L	---
Tetrachloroethylene	---	5 µg/L
Thallium	---	2 µg/L
Toluene	---	1 mg/L
Total Dissolved Solids	500 mg/L	---
Toxaphene	5 µg/L	3 µg/L
trans-1,2-Dichloroethylene	---	0.1 mg/L
Trichloroethylene	---	5 µg/L
Vinyl chloride	---	2 µg/L
Vinylidene chloride (1, 1–Dichloroethylene)	---	7 µg/L
Xylene(s) (total) (mixed)	---	10 mg/L
Zinc	---	5 mg/L

1. In general, for untreated water, a cause is identified if:
   a) 10% or more of the observations exceed the applicable numeric standard; or
   b) for any substance for which the concentration is not readily reducible by conventional treatment,
      i) any observation exceeds by at least threefold the treated-water Maximum Contaminant Level threshold concentration for the substance; or
      ii) any quarterly average concentration exceeds the treated-water Maximum Contaminant Level threshold concentration for the substance; or
      iii) any running annual average concentration exceeds the treated-water Maximum Contaminant Level threshold concentration for that substance.

   For treated water, a cause is identifed if there is any violation of the Maximum Contaminant Level for the substance.

   Identification of causes is based primarily on data from these monitoring programs: Ambient Water Quality Monitoring Network, Intensive Basin Surveys, Ambient Lake Monitoring Program, Illinois Clean Lakes Program, Lake Michigan Monitoring Program, Source Water Assessment Program.
2. The numeric standard is based on 35 Ill. Adm. Code 302, Subpart C: Public and Food Processing Water Supply Standards (See Table B-2).
3. Maximum Contaminant Levels are from 35 Ill. Adm. Code 611, Subpart F: Maximum Contaminant Levels (MCLs) and Maximum Residual Disinfectant Levels (MRDLs).
4. All table entries of "---" indicate that a cause guideline is not applicable or is unavailable.
5. MFL – million fibers per liter, for fibers less than 10 microns.

Aesthetic Quality – Inland Lakes

Aesthetic quality use is associated with all water bodies in the state except those Chicago area water bodies where Secondary Contact and Indigenous Aquatic Life Standards apply. However, methods for assessing *aesthetic quality* use have only been developed for inland lakes and *aesthetic quality* use is not assessed in other water body types.

The Aesthetic Quality Index (AQI) (Table C-23) is the primary tool used to assess *aesthetic quality* for inland lakes. The AQI represents the extent to which pleasure boating, canoeing, and aesthetic enjoyment are attained at a lake. The Trophic State Index (TSI; Carlson 1977), the percent-surface-area macrophyte coverage during the peak growing season (June through August), and the median concentration of nonvolatile suspended solids are used to calculate the AQI score. Higher AQI scores indicate increased impairment (Table C-24).

Assessments of *aesthetic quality* use are based primarily on physical and chemical water quality data collected by the Illinois EPA through the Ambient Lake Monitoring Program or the Illinois Clean Lakes Program, or by non-Illinois EPA persons under an approved quality assurance project plan. The physical and chemical data used for *aesthetic quality* use assessments include: Secchi-disk transparency, chlorophyll *a*, total phosphorus (epilimnetic samples only), nonvolatile suspended solids (epilimnetic samples only), and percent surface area macrophyte coverage. Data are collected a minimum of five times per year (April through October) from one or more established lake sites. Data are considered usable for assessments if meeting the following minimum requirements (Figure C-3): 1) At least four out of seven months (April through October) of data are available, 2) At least two of these months occurs during the peak growing season of June through August (this requirement does not apply to NVSS) and 3) Usable data are available from at least half of all lakes sites within any given lake each month. As outlined in Figure C-3, a whole-lake TSI value is calculated for the median Secchi-disk transparency, median total phosphorus (epilimnetic sample depths only), and median chlorophyll *a* values. A minimum of two parameter-specific TSI values are required to calculate a parameter-specific use support determination. An assessment is then made based on the parameter specific use support determinations. The 0.05 mg/L Illinois General Use Water Quality Standard for total phosphorus in lakes (35 Ill. Adm. Code 302.205) has been incorporated into the weighting criteria used to assign point values for the AQI. Table C-25 lists the guidelines for identifying potential causes of *aesthetic quality* use impairment.

Figure C-3. Flow Chart for Assessing Attainment of Aesthetic Quality Use in Lakes.

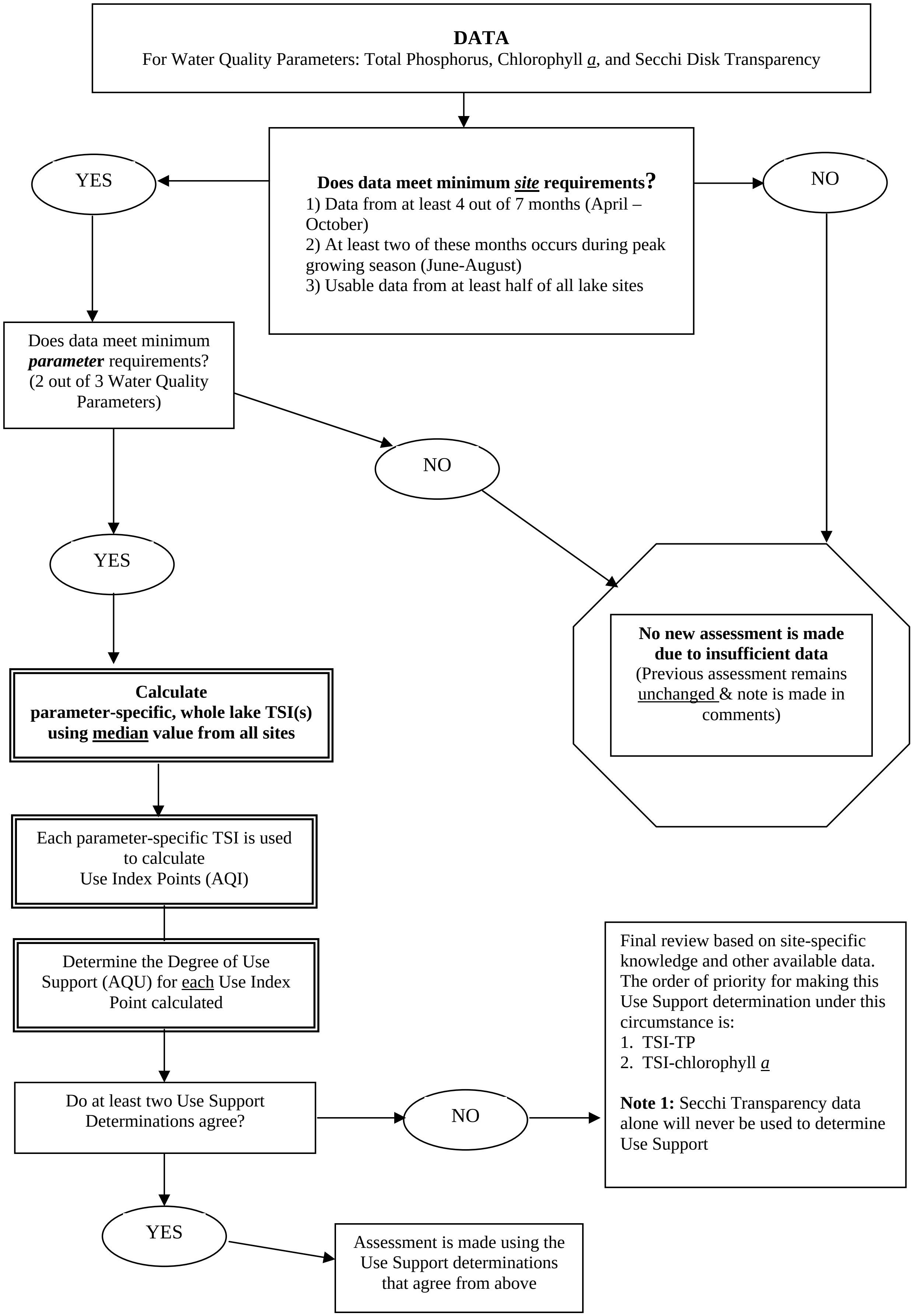


Table C-23. Aesthetic Quality Index.

Evaluation Factor	Parameter	Weighting Criteria	Points
1. Median Trophic State Index (TSI)	For data collected May-October: Median lake TSI value calculated from total phosphorus (samples collected at one foot depth), chlorophyll *a*, and Secchi-disk transparency	Actual Median TSI Value	Actual Median TSI Value
2. Macrophyte Coverage	Average percentage of lake surface area covered by macrophytes during peak growing season (June through August). Determined by: a. Macrophyte survey conducted during same water year as the chemical data used in the assessment; <u>or</u> b. Average value reported on the VLMP Secchi Monitoring Data form.	a. <5 b. ≥5<15 c. ≥15<25 d. ≥25	a. 0 b. 5 c. 10 d. 15
3. Nonvolatile Suspended Solids (NVSS) Concentration	Median lake surface NVSS concentration for samples collected at one foot depth, (reported in mg/L).	a. <3 b. ≥3<7 c. ≥7<15 d. ≥15	a. 0 b. 5 c. 10 d. 15

Table C-24. Guidelines for Assessing *<u>Aesthetic Quality</u>* Use in Illinois Inland Lakes.

Degree of Use Support	Guidelines
Fully Supporting (Good)	Total AQI points are <60
Not Supporting (Fair)	Total AQI points are ≥60<90
Not Supporting (Poor)	Total AQI points are ≥90

Table C-25. Guidelines for Identifying Potential Causes of Impairment of *Aesthetic Quality* Use in Illinois Inland Lakes.

	Basis for Identifying Causes[1]		
Potential Cause	**Numeric Standard[2]**	**Narrative Standard**	**Other Criteria**
Aquatic Algae		Unnatural Algal Growth	Median chlorophyll a (corrected) data >20 µg/L
Aquatic Plants (Macrophytes)		Unnatural Plant Growth	≥5% of lake surface area covered by macrophytes
Phosphorus (Total)	0.05 mg/L[3]		0.05 mg/L[3]
Total Suspended Solids			Median surface nonvolatile suspended solids ≥3 mg/L

1. In general, a single exceedance of the criteria results in listing the parameter as a potential cause of impairment. Determination of causes is normally based on the most recent year of data from the Ambient Lake Monitoring Program (ALMP) or Illinois Clean Lakes Program (CLP).
2. From Illinois General Use Water Quality Standards 35 Illinois Administrative Code, Part 302, Subpart B.
3. The total phosphorus standard applies to lakes of 20 acres or larger. However, an observation of total phosphorus greater than 0.05 mg/L in lakes under 20 acres in size is also used to indicate a cause of impairment.

Assessment Type and Assessment Confidence

Illinois EPA uses USEPA's Assessment Database program version 2.3.0. This program, which stores and organizes assessment information, contains two fields (Assessment Type and Assessment Confidence) which are associated with each assessed use. For each use assessed the assessor must choose at least one assessment type from the following choices: Biological, Habitat, Physical/Chemical, Toxicological, Pathogen Indicators, Other Public Health Indicators and Other Aquatic Life Indicators. After selecting an assessment type, the assessor must assign an assessment confidence from the following choices. Low, Fair, Good or Excellent.

Illinois has defined these fields as follows: **Assessment Type** indicates the primary (or single most important) data type that was used to make a use-attainment determination. **Assessment Confidence** indicates a judgment by Illinois EPA of the relative degree of reliability of a use-attainment assessment based on the quality, quantity, usefulness and acceptability of the specific data set and data type used to make the assessment. Currently, we have not developed comprehensive guidelines for judging the reliability of assessments. In general, Illinois EPA rates all assessments that are based on data meeting Illinois EPA's QA/QC requirements as having Good assessment confidence. Volunteer-lake-monitoring data are considered "Insufficient Data" for use-attainment assessments and 303(d) listings and are therefore listed as having a Low level of confidence. Table C-26 shows the assessment types and assessment confidence levels used in the majority of assessments.

Table C-26. Assessment Type and Assessment Confidence Level for Illinois Assessments. (A small number of exceptions apply).

Water Type	Assessed Use	Assessment Type	Assessment Confidence
Freshwater Lake (VLMP)	None	PHYSICAL/CHEMICAL	LOW
Freshwater Lake (non-VLMP)	Aquatic Life	PHYSICAL/CHEMICAL	GOOD
	Indigenous Aquatic Life	PHYSICAL/CHEMICAL	GOOD
	Aesthetic Quality	PHYSICAL/CHEMICAL	GOOD
	Primary Contact	PATHOGEN INDICATORS	GOOD
	Public & Food Processing Water Supply	PHYSICAL/CHEMICAL	GOOD
	Fish Consumption	PHYSICAL/CHEMICAL	GOOD
	Secondary Contact (only if PCU=Fully Supporting)	PATHOGEN INDICATORS	GOOD
Stream	Aquatic Life	BIOLOGICAL	GOOD
	Indigenous Aquatic Life	PHYSICAL/CHEMICAL	GOOD
	Primary Contact	PATHOGEN INDICATORS	GOOD
	Secondary Contact (only if PCU=Fully Supporting)	PATHOGEN INDICATORS	GOOD
	Public & Food Processing Water Supply	PHYSICAL/CHEMICAL	GOOD
	Fish Consumption	PHYSICAL/CHEMICAL	GOOD
	Aesthetic Quality	(Not applicable because currently not assessed)	
Lake Michigan Open Water	Aquatic Life	PHYSICAL/CHEMICAL	GOOD
	Primary Contact	PATHOGEN INDICATORS	GOOD
	Secondary Contact (only if PCU=Fully Supporting)	PATHOGEN INDICATORS	GOOD
	Public & Food Processing Water Supply	PHYSICAL/CHEMICAL	GOOD
	Fish Consumption	PHYSICAL/CHEMICAL	GOOD
	Aesthetic Quality	(Not applicable because currently not assessed)	
Lake Michigan Shoreline	Aquatic Life Use	(Not applicable because currently not assessed)	
	Primary Contact	PATHOGEN INDICATORS	GOOD
	Secondary Contact (only if PCU=Fully Supporting)	PATHOGEN INDICATORS	GOOD
	Public & Food Processing Water Supply	(Not applicable because not designated)	
	Fish Consumption	(Not applicable because currently not assessed)	
	Aesthetic Quality	(Not applicable because currently not assessed)	
Lake Michigan Bay(s) & Harbor	Aquatic Life	BIOLOGICAL	GOOD
	Primary Contact	(Not applicable because currently not assessed)	
	Secondary Contact	(Not applicable because currently not assessed)	
	Public & Food Processing Water Supply	(Not applicable because not designated)	
	Fish Consumption	PHYSICAL/CHEMICAL	GOOD
	Aesthetic Quality	(Not applicable because currently not assessed)	

PCU = *primary contact* use.

Identifying Potential Sources of Impairment for All Uses and Water Types

Once a use is assessed as impaired (Not Supporting) we attempt to identify the sources related to the impairment. Table C-27 contains guidelines for identifying potential sources of use impairment in Illinois streams, inland lakes, and Lake Michigan-basin waters. Illinois EPA defines potential sources as known or suspected activities, facilities, or conditions that may be contributing to a cause of impairment of a designated use. Each potential source identified is linked to at least one specific cause of impairment. Information used to identify potential sources of impairment include Facility-Related Stream Survey data, ambient-monitoring data, effluent-monitoring data, facility discharge monitoring reports, review of National Pollutant Discharge Elimination System permits and compliance records, land use data, personal observations, and documented site-specific knowledge.

Table C-27. Guidelines for Identifying Potential Sources of Use Impairment in Illinois Streams, Inland Lakes and Lake Michigan-Basin Waters.

Potential Source[3]	Guidelines
Acid Mine Drainage	Low pH and iron deposition due to mine drainage based upon actual observation and/or other existing data.
Agriculture	General agricultural related activities based upon satellite land use, actual observation and/or other existing data.
Animal Feeding Operations (NPS)	Open area feedlots or animal holding buildings and impervious areas based upon satellite land use, actual observation and/or other existing data.
Aquaculture (Not Permitted) or Aquaculture (Permitted)	Fish production facility based upon actual observation and/or other existing data.
Atmospheric Deposition – Acidity, or Atmospheric Deposition – Nitrogen, or Atmospheric Deposition - Toxics	Atmospheric deposition of nutrients, minerals, etc based upon actual observation and/or other existing data.
Channelization	Straightening of stream meanders based upon actual observation and/or other existing data.
Combined Sewer Overflows	Combined sanitary and storm sewer overflow based upon FRSS, Agency effluent monitoring, Discharge Monitoring Reports and/or other existing data.
Contaminated Sediments [1]	High concentrations of metals and organic compounds in sediment based upon actual observation and /or other existing data. For inland lakes see source methodology notes [1] below.
Crop Production (Crop Land or Dry Land)	Nonirrigated crop production based upon satellite land use, actual observation and/or other existing data.
Dam Construction (Other than Upstream Flood Control Projects)	Dam construction activities based upon actual observation and/or other existing data.
Discharges from Biosolids storage, application or disposal	Storage, application or disposal of sludge based upon actual observation and/or other existing data.
Drainage/Filling/Loss of Wetlands	Draining or filling in of wetland areas based upon actual observation and/or other existing data.
Dredge Mining	Underwater mining (e.g., sand and gravel) activities based upon satellite land use, actual observation and/or other existing data.
Dredging (e.g., for Navigation Channels)	Deepening of stream channels based upon actual observation and/or other existing data.
Golf Courses	Golf course runoff directly to lake.

Potential Source[3]	Guidelines
Habitat Modification - other than Hydromodification	General alteration of riparian habitat based upon actual observation and/or other existing data
Highway/Road/Bridge Runoff (Nonconstruction Related)	Salt and pesticide runoff from highways, roads & bridges based upon actual observation and/or other existing data.
Highways, Roads, Bridges, Infrasturcture (New Construction)	Highway/road/bridge construction activities based upon actual observation and/or other existing data.
Impacts from Abandoned Mine Lands (Inactive)	Abandoned mining operation based upon actual observation and/or other existing data.
Impacts from Hydrostructure Flow Regulation/Modification	Alteration of normal flow regimes (e.g., dams, channelization, impervious surfaces, water withdrawal) based upon actual observation and/or other existing data.
Inappropriate Waste Disposal	Illegal waste disposal sites based upon actual observation and/or other existing data.
Industrial Land Treatment	Land application of industrial wastes based upon actual observation and/or other existing data.
Industrial Point Source Discharge	Industrial point source discharge based upon FRSS, Agency effluent, DMR and/or other existing data.
Irrigated Crop Production	Irrigated crop production based upon satellite land use, actual observation and/or other existing data.
Lake Fertilization	Artificial fertilization activities (e.g., addition of triple super-phosphate to create algal blooms for macrophyte control or enhance lake fertility) based upon actual observation and/or other existing data.
Landfills	Leachate and/or runoff from landfills based upon actual observation and/or other existing data.
Leaking Underground Storage Tank Leaks	Leaks from storage tanks based upon actual observation and/or other existing data.
Livestock (Grazing or Feeding Operations	Riparian and/or upland pastureland grazing based upon satellite land use, actual observation and/or other existing data
Loss of Riparian Habitat	Removal of riparian vegetation based upon actual observation and/or other existing data.
Marina Boat Construction, or Marina Boat Maintenance, or Marina Dredging Operations, or Marina Fueling Operations, or Marina-related Shoreline Erosion, or Marina/Boating Pumpout releases, or Marina/Boating Sanitary On-vessel Discharges	In-water and on-land releases based upon actual observation and/or other existing data.
Mill Tailings	Milling operations based upon satellite land use, actual observation and/or other existing data.
Mine Tailings	Mine processing activities (e.g., gob piles) based upon satellite land use, actual observation and/or other existing data.
Municipal Point Source Discharges	Municipal point source discharge based upon FRSS, Agency effluent, DMR and/or other existing data.
Natural Sources [2]	See source methodology notes [2] below.
On-site Treatment Systems (Septic Systems and Similar Decentralized Systems)	Septic system leachate or surface runoff based upon actual observation and/or other existing data.
Other Recreational Pollution Sources	Other recreational impacts based upon actual observation and/or other existing data.
Other Spill Related Impacts	Accidental spills based upon actual observation and/or other existing data.
Permitted Silvicultural Activities	General forest management related runoff based upon satellite land use, actual observation and/or other existing data.
Pesticide Application	Herbicide/algicide applications (e.g., eradication of a beneficial macrophyte community, reduced dissolved oxygen. levels after application) based upon actual observation and/or other existing data.

Potential Source(3)	Guidelines
Petroleum/Natural Gas Activities	Oil and gas production activities based upon satellite land use, actual observation and/or other existing data.
RCRA Hazardous Waste Sites	Hazardous waste leachate or surface runoff based upon actual observation and/or other existing data.
Runoff from Forest/Grassland/Parkland	Watershed related nonpoint source runoff other than from previously specified sources (e.g., lawn or parkland fertilization, leaf litter/forest bed runoff) based upon actual observation and/or other existing data.
Salt Storage Sites	Salt storage for winter highway maintenance based upon actual observation and/or other existing data.
Sanitary Sewer Overflows (Collection System Failures)	Broken sanitary sewer line or overflow based upon FRSS, Agency effluent and/or other existing data.
Septage Disposal	Disposal of septic tank sludge based upon actual observation and/or other existing data.
Site Clearance (Land Development or Redevelopment)	New residential/commercial construction activities based upon actual observation and/or other existing data.
Source Unknown	No identifiable source based upon available information.
Specialty Crop Production	Truck farming, orchards, or horticultural areas based upon satellite land use, actual observation and/or other existing data.
Streambank Modifications/Destabilization or Littoral/Shore Area Modifications (Nonriverine)	Shoreline modification/destabilization activities (e.g., bank erosion, rip rap, loss of habitat) based upon actual observation and/or other existing data.
Subsurface (Hardrock) Mining	Subsurface coal mining activities based upon satellite land use, actual observation and/or other existing data.
Surface Mining	Surface mining (e.g., coal, limestone) activities based upon satellite land use, actual observation and/or other existing data.
Unpermitted Discharge (Domestic Wastes)	Wildcat sewer discharge based upon FRSS, Agency effluent and/or other existing data.
Upstream Impoundments (e.g., Pl-566 NRCS Structures)	Upstream impoundment based upon actual observation and/or other existing data.
Urban Runoff/Storm Sewers	Urban and storm sewer runoff based upon actual observation and/or other existing data
Waterfowl	Nutrient enrichment from waterfowl wastes based upon actual observation and/or other existing data.

1. This primarily refers to sediment and sediment-associated phosphorus deposition in the lake, but also to sediments with highly elevated levels of a metal or priority organic, especially when those substances are associated with a fish advisory.
2. The Natural Sources category is reserved for waters impaired due to naturally occurring conditions (i.e., not caused by or related to past or present human activity) or due to catastrophic conditions. Clearly defined cases include: 1) metals due to naturally occurring deposits, 2) dissolved oxygen or pH associated with poor aeration or natural organic materials, where no human-related sources are present, 3) habitat loss or pollutant loads due to catastrophic floods, which are excluded from water quality standards or other regulations, 4) high temperature, low dissolved oxygen, or high concentrations of pollutants due to catastrophic droughts with flows less than the average minimum seven-day low flow which occurs once every 10 years.
3. Other rare or uncommon sources in addition to those listed here are available in the Assessment Database and may be used when appropriate.

C-3. Assessment Results

This section presents the results of Illinois' surface water assessments, including the five-part categorization of all surface waters, the Section 303(d) List, state level summaries of designated use support and CWA Section 314 (Lakes Program) reporting requirements.

Five-Part Categorization of Surface Waters

USEPA's latest Integrated Report guidance (USEPA 2005) requires all waters of the state to be reported in a five category system as below. Although the guidance allows waters to be placed into more than one category, Illinois EPA treats all categories as mutually exclusive.

Category 1: Segments are placed into Category 1 if all designated uses are supported, and no use is threatened. (Note: Illinois does not assess any waters as threatened)

Category 2: Segments are placed in Category 2 if some, but not all of the designated uses are supported. (All other uses are reported as Not Assessed or Insufficient Information)

Category 3: Segments are placed in Category 3 when there is insufficient available data and/or information to make a use-support determination for any use.

Category 4 contains segments which have at least one impaired use but a TMDL is not required. Category 4 is further subdivided as follows based on the reason a TMDL is not required.

Category 4a: Segments are placed in Category 4a when a TMDL to address a specific segment/pollutant combination has been approved or established by USEPA. Illinois EPA places water bodies in category 4a only if TMDLs have been approved for all pollutant causes of impairment.

Category 4b: Segments are placed in Category 4b if technology-based effluent limitations required by the Act, more stringent effluent limitations required by state, local, or federal authority, or other pollution control requirements (e.g., best management practices) required by local, state or federal authority are stringent enough to implement applicable water quality standards (see 40 CFR 130.7(b)(1)) within a reasonable period of time.

Category 4c: Segments are placed in Category 4c when the state demonstrates that the failure to meet an applicable water quality standard is not caused by a pollutant, but instead is caused by other types of pollution (i.e. only nonpollutant causes of impairment). Water bodies placed in this category are usually those where aquatic life use is impaired by habitat related conditions. (See discussion in Section C-2 Assessment Methodology, Aquatic Life-Streams)

Category 5: Segments are placed in Category 5 if available data and/or information indicate that at least one designated use is not being supported and a TMDL is needed. Water bodies in Category 5 (and their pollutant causes of impairment) constitute the 303(d) List that USEPA will review and approve or disapprove pursuant to 40 CFR 130.7.

Table C-28 shows the results of this categorization for all Illinois surface waters. The category for each individual water body is shown in Appendices B2-B6

Table C-28. Size of Surface Waters Assigned to Reporting Categories[1].

Water Body Type	Category							Total in State	Total Assessed
	1	2	3	4a	4b	4c	5		
Streams: miles	0	6,227	55,825	419	0	500	8,422	71,394	15,569
Inland Lakes: acres	0	5,586	171,116	2,015	0	0	139,760	318,477	147,361
Lake Michigan Bays and Harbors: sq. miles	0	0	0	0	0	0	2.50	2.50	2.50
Lake Michigan Open Waters: sq. miles	0	0	1375	0	0	0	151	1526	151
Lake Michigan Shoreline: miles	0	0	0	0	0	0	63	63	63

1. Categories are mutually exclusive. Illinois does not report water bodies in more than one category.

Section 303(d) List

The Clean Water Act and USEPA regulations require states to submit a list of water-quality-limited waters still requiring TMDLs, pollutants causing the impairment, and a priority ranking for TMDL development (including waters targeted for TMDL development within the next two years. This integrated report combines all of the requirements of sections 305(b), 303(d) and 314 into a single document.

Category 5 waters constitute Illinois' 303(d) List. The complete list is found in Appendix A-1. The development of this list is based on the assessment methodology for determining attainment of designated uses for each water body segment as described previously in Section C-2. Those waters which have at least one Not Supporting designated use and at least one pollutant cause of impairment are included on the 303(d) List unless they fall under the specific exceptions described in categories 4a, 4b or 4c. Waters included on previous lists are also included on the current list unless new information is available to update the assessment or there is other "good cause" for delisting them (see below). A complete list of all water bodies, all use attainment assessments, all identified potential causes of impairment (both pollutant and nonpollutant) and potential sources of impairment is found in Appendix B.

Prioritization of the Illinois Section 303(d) List

USEPA regulations at 40 CFR Part 130.7(b)(4) require establishing a priority ranking of the 303(d) listed waters for the development of TMDLs that accounts for the severity of pollution and the designated uses. For the purposes of the Illinois Section 303(d) List, the prioritization process was done on a watershed basis instead of on individual water body segments. Illinois EPA watershed boundaries are based on USGS ten-digit hydrologic units. Developing prioritization at this watershed scale provides Illinois with the ability to address watershed issues at a manageable level and document improvements to a watershed's health. The Illinois Section 303(d) List was prioritized based on the steps listed below:

Step 1- The first step in the prioritization process is based on use designations, establishing a High, Medium and Low Priority for specific uses.

- High Priority – watersheds containing one or more waters that are Not Supporting *public and food processing water supply* use.
- Medium Priority – watersheds containing one or more waters that are Not Supporting *aquatic life* use, *fish consumption* use, or *primary contact* (swimming) use.
- Low Priority – watersheds containing waters that are Not Supporting *aesthetic quality* use only.

Step 2 - The second step in the prioritization process is based on the overall severity of pollution. For the purposes of this process, severity of pollution is determined by summing the number of potential causes (i.e., atrazine, manganese, etc.) of impairment to a water body segment. The watersheds with more potential causes of impairments were identified and listed as higher priority than those listed with fewer causes within each of the priority groups identified in Step 1.

EXAMPLE: *Watershed A has three water body segments with a total of 15 potential causes identified. Watershed B has four water body segments with a total of 10 potential causes identified. Both* waters *were assessed for public water supply use. Therefore, Watershed A (public water supply use with 15 potential causes) will be ranked above Watershed B (public water supply use with 10 potential causes) for TMDL development within the High Priority Category identified in Step 1.*

Criteria for Higher Prioritization in Scheduling TMDL Development

Once the waters have been prioritized as specified above for the 303(d) List, Illinois EPA may also give consideration to the following criteria to indicate a higher priority within each priority category (High, Medium and Low) when scheduling TMDL development. Those waters meeting the criteria may be selected for TMDL development over those that do not meet the criteria, regardless of priority ranking on the list.

i) A water body's potential for improvement: Best professional judgment for identifying potential improvement will be based, in part, upon the capacity of the data to pinpoint the potential cause-source relationship, and the availability and likelihood of successfully implementing regulatory and voluntary programs to achieve water quality improvement.

ii) The degree of public support and source-water protection (surface water) for improvement: Expressions of public support for an impaired watershed may include but are not limited to: active publicly supported watershed planning groups, ongoing public water quality monitoring programs and other similar efforts.

Criteria for Lower Prioritization in Scheduling TMDL Development

Along with the above factors, Illinois EPA may use the following criteria to indicate a lower priority within each priority category (High, Medium and Low) when scheduling TMDL development. Although these lower priority waters may not be scheduled for TMDL development at this time or may not be appropriate candidates for TMDLs in the future, Illinois EPA will continue ongoing efforts, and support new approaches that will result in these waters meeting full support and being removed from the Section 303(d) List. In that regard, each of the following criteria contains a brief explanation of the actions that Illinois EPA may take to improve or enhance the status of those waters. Those waters meeting the criteria below may be passed over on the list regardless of priority ranking.

i) 303(d) listed waters that are interstate waters—e.g., Mississippi River, Ohio River, Lake Michigan and others. In these waters, the Illinois EPA will continue to work closely with other states and USEPA in addressing issues related to Section 303(d) requirements. USEPA is expected to take a lead role in coordinating the state efforts.

ii) 303(d) listed waters where the potential causes of impairment are pollutants for which there are no numeric water quality standards in Illinois—e.g., phosphorus in streams, and others. Pending development of appropriate numeric water quality standards as may be proposed by the Agency or others and adopted by the Illinois Pollution Control Board, Illinois EPA will continue to work with watershed planning groups and others to identify causes and treat potential sources of impairment.

iii) 303(d) listed waters with legacy issues—e.g., mining, and in-place contaminated sediments. The Illinois EPA will continue to work with watershed planning groups and others to identify causes and treat potential sources of impairment.

iv) 303(d) listed waters with impairment by naturally occurring background levels: The Illinois EPA will continue to work with watershed planning groups and others to identify causes and treat potential sources of impairment.

v) 303(d) listed waters with unknown causes of impairment. In these cases, depending upon available resources, additional data collection and/or site-specific analysis will be instituted to determine causes of impairment and/or the accuracy of the assessment.

The priority ranking for Illinois' 303(d) listed waters is shown in Appendix A-1.

Scheduling of TMDL Development

In accordance with USEPA regulations under 40 CFR Part 130.7(b)(4), "the priority ranking shall specifically include the identification of waters targeted for TMDL development in the next two years." In addition, USEPA guidance encourages states to ensure that the schedule provides that all TMDLs for every pollutant-segment combination listed on previous Section 303(d) Lists be established in a time frame that is no longer than eight to 13 years from the time the pollutant-segment combination is first identified in Category 5.

In Illinois, development of TMDLs will be conducted on a watershed basis (i.e. USGS 10 digit hydrologic units) meaning that impaired waters upstream of a particular segment will have all TMDLs conducted at the same time. Illinois' long-term TMDL schedule (Table C-29) indicates the number of watersheds for which TMDL efforts will be initiated over the next 13 years. Appendix A-3 shows the watersheds, water bodies and pollutants for which TMDLs will be completed in the next two years. The TMDL development schedule provided here replaces all schedules previously submitted by the Illinois EPA to USEPA. The schedule will be reviewed and updated in the future, as needed, to ensure timely development of TMDLs, given available resources.

The Illinois EPA's long-term schedule for TMDL development for all waters on the 2008 Section 303(d) List, projected over a 13-year period, is consistent with other Illinois EPA program cycles which are typically five years, including statewide monitoring programs such as the rotational intensive river basin surveys and issuance of NPDES permits. The long-term TMDL development schedule will be reviewed and revised, as needed, in conjunction with future Section 303(d) Lists submitted to USEPA.

Table C-29. Tentative Long-term TMDL Schedule.

Year	Number of Watersheds Scheduled for TMDLs
2008-2009	25
2009-2010	22
2010-2011	22
2011-2012	22
2012-2013	22
2013-2014	22
2014-2015	22
2015-2016	22
2016-2017	22
2017-2018	22
2018-2019	22
2019-2020	21
2020-2021	20

Removal of Waters Previously Listed on the 2006 Section 303(d) List Prior to TMDL Development

USEPA guidance for the 2006 Integrated Report explains what constitutes good cause for not including in the current submission segments that were previously included on the Section 303(d) List. These include:

1. The assessment and interpretation of more recent or more accurate data in the record demonstrate that the applicable WQS(s) is being met.

2. The results of more sophisticated water quality modeling demonstrate that the applicable WQS(s) is being met.

3. Flaws in the original analysis of data and information led to the segment being incorrectly listed.

4. A demonstration pursuant to 40 CFR 130.7(b)(1)(ii) that there are effluent limitations required by state or local authorities that are more stringent than technology-based effluent limitations, required by the CWA, and that these more stringent effluent limitations will result in the attainment of WQSs for the pollutant causing the impairment.

5. A demonstration pursuant to 40 CFR 130.7(b)(1)(iii) that there are other pollution control requirements required by state, local, or federal authority that will result in attainment of WQSs for a specific pollutant(s) within a reasonable time (i.e., 4b).

6. Documentation that the state included on a previous Section 303(d) List an impaired segment that was not required to be listed by EPA regulations, e.g., segments where there is no pollutant associated with the impairment.

7. Approval or establishment by EPA of a TMDL since the last Section 303(d) List.

8. A state inappropriately listed a segment that is within Indian country, as defined in 18 U.S.C. Section 1151.

9. Other relevant information that supports the decision not to include the segment on the Section 303(d) List.

All waters on Illinois' approved Section 303(d) List from 2006 (Illinois EPA 2006) are included on the 2008 Section 303(d) List except the water bodies under the criteria cited above. Note that the approved 2006 Section 303(d) List contains all impaired segments from the 1992, 1994, 1996, 1998, 2002 and 2004 lists. Illinois EPA delists entire water bodies if all the designated uses are assessed as fully supporting. Listed causes of impairment may change when uses are reassessed even if the water is still considered impaired.

In this cycle Illinois EPA is making two large scale delistings based on changes to how we assess causes of impairment for *aquatic life* use.

The first change involves the listing of total nitrogen as a cause of impairment. We have stopped using total nitrogen, as a cause of impairment for *aquatic life* use. Total nitrogen appeared as nitrogen (total) on previous 303(d) Lists. We currently have no standard for total nitrogen related to aquatic life. In streams, we typically do not have total nitrogen data. While there is some scientific debate over the contribution of nitrogen to excessive plant or algal growth, Illinois has never listed total nitrogen as a cause of impairment based on evidence of excessive plant or algal growth. Furthermore, we believe that these nutrient-related impacts can best be assessed by using criteria for total phosphorus. Total phosphorus data are also more widely available than nitrogen data.

Total nitrogen was listed as a cause of impairment only when biological or other data indicated that *aquatic life* use was impaired. At that point in the assessment process an inappropriate criterion for total nitrogen was used to infer that total nitrogen was a potential cause of the *aquatic life* use impairment. Illinois EPA now believes that the criterion by which it placed total nitrogen on previous 303(d) Lists was not scientifically valid and that no scientifically valid criterion currently exists for determining when total nitrogen is causing an impairment of *aquatic life* use in Illinois. Because Illinois now believes that those previous listings of total nitrogen were based on flaws in the listing methodology (reason #3 above), we have deleted total nitrogen as a cause of impairment for all water bodies.

However, this delisting will not affect the basis upon which these waters were assessed as impaired and will not cause any waters to be changed to an unimpaired status. Illinois has never placed any water body on the 303(d) List solely because of high levels of total nitrogen. The vast majority of water body segments where total nitrogen was listed as a cause remained on the 303(d) List (Category 5) even after this cause was deleted because most of the time there were other pollutant causes listed as well. Even if total nitrogen was the only cause of impairment identified, the water still remained on the 303(d) List after total nitrogen was deleted because when no causes are identified, Cause Unknown is listed which keeps these waters on the 303(d) List. In a few instances where total nitrogen was the only pollutant cause but other nonpollutant causes were identified, there was a potential for an entire water body segment to be moved from Category 5 (the 303d List) to Category 4C. Each of these cases was reviewed carefully to determine whether these segments are impaired only by nonpollutants (pollution) and therefore belong in category 4C.

The second change is related to how we categorize dissolved oxygen as a cause of *aquatic life* use impairment. In previous cycles we have classified (low) dissolved oxygen as a pollutant. However, while low dissolved oxygen may be caused by pollutants, federal regulations in CWA Section 502(6) do not define dissolved oxygen or low dissolved oxygen as a pollutant. Therefore Illinois EPA has changed the classification of dissolved oxygen to a nonpollutant cause of impairment. Since the 303(d) List includes only pollutant causes of impairment, all instances of dissolved oxygen are being delisted.

However, dissolved oxygen is still identified as a nonpollutant cause of impairment where appropriate. Furthermore, Illinois EPA evaluates all water chemistry data in an effort to identify other pollutants, such as total phosphorus, which may be contributing to low dissolved oxygen.

As with total nitrogen, this delisting does not affect the basis upon which any waters were assessed as impaired and does not cause any waters to be changed to an unimpaired status. Illinois still uses violations of the dissolved oxygen standard in its assessment of *aquatic life* use attainment and to identify (low) dissolved oxygen as a potential cause of aquatic life use impairment. The vast majority of water body segments remained on the 303(d) List (Category 5) even after this change because in most cases there were other pollutant causes listed as well. In a few instances where dissolved oxygen was the only pollutant cause listed, there was a potential for an entire water body segment to be moved from Category 5 (the 303d List) to Category 4C. Each of these cases was reviewed carefully to determine whether these segments are impaired only by nonpollutants (pollution) and therefore belong in category 4C.

In general, when any delisting results in a water body segment being moved from Category 5 to Category 4C, a review is conducted to determine whether that segment is impaired by pollutants or pollution.

Appendix A-4 lists all segment/pollutant combinations listed in the 2006 303(d) List but not included with the 2008 submission.

TMDL Development and Implementation Status

In Illinois individual contractors that have been selected through a competitive bidding process develop the TMDLs. Illinois EPA personnel manage the contracts. There are three stages in the TMDL development process.

Stage 1- Watershed Characterization, Data Analysis and Methodology Selection

- Description of the watershed
- Collection/analysis of available data
- Identify methodologies, procedures and models
- Determine if additional data is needed

Stage 2- Data Collection (optional stage)*

- Evaluate Stage 1 and collect additional data as needed
- The Agency or a contractor will collect data

Stage 3- Model calibration, TMDL Scenarios, Implementation Plan

- Develop TMDLs with data from Stages 1 and 2
- Develop and evaluate several scenarios
- Develop an implementation plan

*Stage 2 was added in the 2003 round of TMDLs. If Stage 1 identifies data as lacking, additional data may be collected for a more accurate TMDL.

Appendix A-6 shows the implementation status of all TMDLs for the state of Illinois and includes the TMDL watersheds in progress. We anticipate that TMDL development for each watershed will be completed approximately two years from the initiation date. Stage 1 is scheduled to take a maximum of nine months. Stage 2 is optional and the time frame will depend on the type and quantity of additional data required. Stage 3 has a maximum time frame of 18 months. To date, contractors are doing most of the TMDL development work for Illinois EPA.

The Illinois EPA views TMDLs as a tool for developing water-quality-based solutions that are incorporated into an overall watershed management approach. The TMDL establishes the link between water quality standards attainment and water-quality-based control actions. For these control actions to be successful, they must be developed in conjunction with local involvement, which incorporates regulatory, voluntary and incentive-based approaches with existing applicable laws and programs. The four Illinois programs that have provided funds for implementation of TMDL watersheds include: Illinois EPA's Nonpoint Source Management Program, Illinois Clean Lakes Program (ICLP), and Priority Lake and Watershed Implementation Program (PLWIP), as well as the Illinois Department of Agriculture's Conservation Practices Program (CPP).

The Illinois EPA administers the Illinois Nonpoint Source Management Program, the ICLP and the PLWIP. The Illinois Nonpoint Source Management Program was developed to meet the requirements of Section 319 of the Clean Water Act (CWA). Section 319 projects can include educational programs and nonpoint source pollution control projects such as Best Management Practices (BMPs). The ICLP is a financial assistance grant program that supports lake owners' interest and commitment to long-term, comprehensive lake management and ultimately results in improved water quality and enhanced lake use. The PLWIP supports lake protection/restoration activities at priority lakes where causes and sources of problems are apparent, project sites are highly accessible, project size is relatively small, and local entities are in a position to quickly implement needed treatments. Appendix A-7 shows past and present projects in TMDL watersheds funded under these programs.

Beginning in July of 2002, the Illinois Department of Agriculture began shifting a portion of its CPP funds to Soil and Water Conservation Districts to more directly address water quality concerns within TMDL watersheds. This program gives incentive payments to landowners/operators within that watershed to promote the use of management practices that reduce/control the movement of pollutants causing the water quality impairment.

Statewide Summary of Designated Use Support

Streams

Aquatic life, *fish consumption*, *primary contact (swimming)*, *secondary contact*, *indigenous aquatic life*, and *public and food processing water supply* uses were individually assessed for degree of use support (Table C-30). Of the total 71,394 stream miles in Illinois, 15,569 stream miles (21.8%) were assessed for at least one of these six uses. *Aquatic life* use was Fully Supporting in 61 percent of the stream miles assessed for this use.

Table C-30. Statewide Individual Use-Support Summary for Streams, 2008.

Designated Use	Total Miles	Miles Assessed	Miles Fully Supporting (Good)	Miles Not Supporting (Fair)	Miles Not Supporting (Poor)	Miles Not Assessed
Aquatic Life	71,308	15,314	9,357	5,334	622	55,994
Fish Consumption	71,394	3,827	0	3,516	310	67,567
Indigenous Aquatic Life	85	85	33	47	6	0
Primary Contact	70,777	3,915	740	1,417	1,759	66,862
Public and Food Processing Water Supply	1,108	1,108	100	1,008	0	0
Secondary Contact(1)	71,394	740	740(3)	---	---	70,653
Aesthetic Quality(1)	71,308	---	---	---	---	71,308
Designated Use	**Miles Assessed**	**Percent Assessed**	**Percent Fully Supporting (Good) (2)**	**Percent Not Supporting (Fair) (2)**	**Percent Not Supporting (Poor) (2)**	**Percent Not Assessed**
Aquatic Life	15,314	21.5	61.1	34.8	4.1	78.5
Fish Consumption	3,827	5.4	0.0	91.9	8.1	94.6
Indigenous Aquatic Life	85	100.0	38.2	55.1	6.7	0.0
Primary Contact	3,915	5.5	18.9	36.2	44.9	94.5
Public and Food Processing Water Supply	1,108	100.0	9.0	91.0	0.0	0.0
Secondary Contact(1)	740	1.0	100.0(3)	---	---	99.0
Aesthetic Quality(1)	0	0.0	---	---	---	100.0

Note 1: Illinois EPA did not use the Insufficient Information category for streams in 2008.
Note 2: Numbers and percentages may not add up due to slight rounding errors.

1. Assessment guidelines are not yet fully developed; see Section C-2 Assessment Methodology.
2. Percentages of "Good, Fair and Poor" indicate the percent of miles assessed.
3. By definition, Secondary Contact Use is "Fully Supporting" in all waters in which Primary Contact Use is "Fully Supporting"; otherwise, assessment guidelines are not yet developed for determining the level of use attainment.

Potential causes of impairment for all designated uses in streams are summarized in Table C-31. Potential sources of impairment for all designated uses in streams are summarized in Table C-32. Results of individual use assessments are available in Appendix B-2.

Table C-31. Summary of Potential Causes for All Use Impairments in Streams, 2008.

Potential Cause of Impairment	Stream Miles Impaired
Fecal Coliform	3,175
Oxygen, Dissolved	3,079
Mercury	2,941
Polychlorinated biphenyls	2,821
Alteration in stream-side or littoral vegetative covers	2,261
Sedimentation/Siltation	2,259
Phosphorus (Total)	2,092
Manganese	1,885
Total Suspended Solids (TSS)	1,580
Cause Unknown	1,325
pH	892
Other flow regime alterations	745
Sulfates	445
Aquatic Algae	419
Changes in Stream Depth and Velocity Patterns	351
Chloride	318
Atrazine	287
Loss of Instream Cover	274
Iron	240
DDT	187
Hexachlorobenzene	187
Fish Kills	171
Silver	153
Aquatic Plants (Macrophytes)	139
Dioxin (including 2,3,7,8-TCDD)	130
Cadmium	114
Aldrin	101
Methoxychlor	93
Chlordane	90
Zinc	79
Nitrogen, Nitrate	83
Fish-Passage Barrier	83
Phenols	59
Boron	46
Nickel	45
Ammonia (Total)	41
Barium	35
Copper	34
Endrin	33
Oil and Grease	31
Fluoride	30
Heptachlor	29
Nonnative Fish, Shellfish, or Zooplankton	25
Lindane	21
Dieldrin	20
Chlorine	14
Chromium (total)	10
Arsenic	10
Ammonia (Un-ionized)	9
alpha-BHC	6
Cyanide	4
Temperature, water	3
Lead	3

Table C-32 Statewide Summary of Potential Sources of All Use Impairments in Streams.

Potential Sources of Impairment	Stream Miles
Source Unknown	6,177
Atmospheric Deposition - Toxics	2,908
Crop Production (Crop Land or Dry Land)	2,626
Channelization	1,998
Municipal Point Source Discharges	1,437
Urban Runoff/Storm Sewers	1,176
Surface Mining	684
Impacts from Hydrostructure Flow Regulation/modification	675
Streambank Modifications/destabilization	652
Animal Feeding Operations (NPS)	634
Natural Sources	460
Agriculture	417
Contaminated Sediments	388
Loss of Riparian Habitat	367
Combined Sewer Overflows	308
Dam or Impoundment	247
Habitat Modification - other than Hydromodification	242
Site Clearance (Land Development or Redevelopment)	210
Livestock (Grazing or Feeding Operations)	205
Upstream Impoundments (e.g., Pl-566 NRCS Structures)	180
Impacts from Abandoned Mine Lands (Inactive)	173
Petroleum/natural Gas Activities	171
Non-irrigated Crop Production	81
Industrial Point Source Discharge	128
Highway/Road/Bridge Runoff (Non-construction Related)	118
Runoff from Forest/Grassland/Parkland	107
Acid Mine Drainage	79
Sanitary Sewer Overflows (Collection System Failures)	65
On-site Treatment Systems (Septic Systems and Similar Decentralized Systems)	60
Dam Construction (Other than Upstream Flood Control Projects)	57
Other Recreational Pollution Sources	56
Mine Tailings	48
Irrigated Crop Production	29
Golf Courses	20
Unpermitted Discharge (Domestic Wastes)	18
Other Spill Related Impacts	15
Lake Fertilization	14
Wet Weather Discharges (Point Source and Combination of Stormwater, SSO or CSO)	13
Drainage/Filling/Loss of Wetlands	11
Highways, Roads, Bridges, Infrastructure (New Construction)	10
Coal Mining (Subsurface)	7
Dredging (E.g., for Navigation Channels)	4
Industrial Land Treatment	4
Managed Pasture Grazing	3

Inland Lakes

Aquatic life, fish consumption, primary contact (swimming), secondary contact, public food and processing water supply, aesthetic quality, and indigenous aquatic life uses were individually assessed in lakes for degree of use support as shown in Table C-33. Of the total 318,477 acres of lakes and ponds in Illinois, 147,361 acres (366 lakes) were assessed for at least one of these seven uses. Aquatic life use was Fully Supporting in 69.4 percent of the lake acres assessed for this use.

Table C-33. Statewide Individual Use-Support Summary for Inland Lakes.

Designated Use	Total Acres	Acres Assessed	Acres Fully Supporting (Good)	Acres Not Supporting (Fair)	Acres Not Supporting (Poor)	Acres Not Assessed	Acres as Insufficient Information
Aesthetic Quality	316,877	141,941	9,621	94,938	37,382	166,266	8,670
Aquatic Life	316,877	141,941	98,448	43,475	18	166,266	8,670
Fish Consumption	318,477	86,879	6,840	79,988	51	231,598	0.0
Indigenous Aquatic Life	1,600	1,600	1,600	0.0	0.0	0.0	0.0
Primary Contact	316,877	1,814	1,092	722	0.0	315,063	0.0
Public and Food Processing Water Supply	76,784	76,603	4,833	71,770	0.0	181	0.0
Secondary Contact	318,477	1,092	1,092	0.0	0.0	317,385	0.0
Designated Use	**Acres Assessed**	**Percent of Total Acres Assessed**	**Percent of Acres Fully Supporting (Good) (1)**	**Percent of Acres Not Supporting (Fair) (1)**	**Percent of Acres Not Supporting (Poor) (1)**	**Percent of Total Acres Not Assessed**	**Percent of Acres as Insufficient Information**
Aesthetic Quality	141,941	44.8	6.8	66.9	26.3	52.5	2.7
Aquatic Life	141,941	44.8	69.4	30.6	0.00	52.5	2.7
Fish Consumption	86,879	27.3	7.9	92.1	0.0	72.7	0.0
Indigenous Aquatic Life	1,600	100.0	100.0	0.0	0.0	0.0	0.0
Primary Contact	1,814	0.6	60.2	39.8	0.0	99.4	0.0
Public and Food Processing Water Supply	76,603	99.8	6.3	93.7	0.0	0.2	0.0
Secondary Contact	1,092	0.3	100.0	0.0	0.0	99.7	0.0
Designated Use	**Number of Lakes Assessed**	**Percent of All Lakes Assessed (2)**	**Percent of Lakes Fully Supporting (Good) (1)**	**Percent of Lakes Not Supporting (Fair) (1)**	**Percent of Lakes Not Supporting (Poor) (1)**	**Percent of All Lakes Not Assessed (2)**	**Percent of Lakes as Insufficient Information**
Aesthetic Quality	345	0.4	13.3	72.5	14.2	99.5	0.1
Aquatic Life	345	0.4	89.0	10.7	0.3	99.5	0.1
Fish Consumption	95	0.1	2.1	96.8	1.1	99.9	0.0
Indigenous Aquatic Life	1	100.0	100.0	0.0	0.0	0.0	0.0
Primary Contact	15	0.02	46.7	53.3	0.0	99.98	0.0
Public and Food Processing Water Supply	76	95.0	23.7	76.3	0.0	5.0	0
Secondary Contact(3)	7	0.01	---(3)	---(3)	---(3)	99.99	0

Note: Numbers and percentages may not add up due to slight rounding errors.
1. The percentages of "Good, Fair and Poor" indicate the percent of lake acres (or lake numbers) assessed.
2. Based on a statewide total of 91,456 lakes and ponds, except for Indigenous Aquatic Life (which applies to only one lake) and Public and Food Processing Water Supply (which applies to only 80 lakes in Illinois).
3. By definition, Secondary Contact Use is "Fully Supporting" in all waters in which Primary Contact Use is "Fully Supporting"; otherwise, assessment guidelines are not yet developed for determining the level of use attainment.

As described in Section C-1, the Volunteer Lake Monitoring Program (VLMP) is an educational program for Illinois citizens to learn about lake ecosystems, as well as a cost-effective method of gathering fundamental information about inland lakes. While VLMP data are considered insufficient for making use-support determinations and 303(d) listings, such data are useful for evaluating lake resource quality as good, fair or poor. A total of 125 lakes totaling slightly more than 8,670 acres had VLMP data available for evaluating resource quality. For these lakes, 95 percent of the total number and 98 percent of the total acres were rated as good resource quality for *aquatic life* use. Another five percent of the number and two percent of the acres were rated as fair.

Potential causes of use impairment for inland lakes are summarized in Table C-34. Potential sources of use impairment in inland lakes are summarized in Table C-35. Trophic status of inland lakes is summarized in Table C-36. Use assessment information for individual lakes is available in Appendix B-3

"Significant Publicly-Owned Inland Lakes" are defined as having 20 acres or more surface area; however, some smaller inland lakes, which provide substantial public access and benefits to the citizens of Illinois, have also been defined as "significant." For summary information regarding "significant publicly-owned inland lakes," refer to Appendix C.

Table C-34. Statewide Summary of Potential Causes of All Use Impairments in Inland Lakes.

Potential Cause of Impairment	Acres Impaired
Phosphorus (Total)	109,078
Aquatic Algae	106,680
Total Suspended Solids (TSS)	105,390
Mercury	71,589
Manganese	67,185
Atrazine	26,977
Aquatic Plants (Macrophytes)	26,992
Polychlorinated biphenyls	25,817
Cause Unknown	17,128
Sedimentation/Siltation	13,925
Oxygen, Dissolved	12,221
Silver	7,266
Nonnative Fish, Shellfish, or Zooplankton	6,259
pH	5,117
Chlordane	4,820
Nitrogen, Nitrate	4,585
Aldrin	3,869
Zinc	2,631
Heptachlor	2,107
Ammonia (Total)	1700
Non-Native Aquatic Plants	1,631
Fecal Coliform	722
Cadmium	524
Nickel	325
Total Dissolved Solids	250
Turbidity	172

Table C-35. Statewide Summary of Potential Sources for All Impaired Uses in Inland Lakes.

Potential Source of Impairment	Acres Impaired
Crop Production (Crop Land or Dry Land)	116,317
Source Unknown	110,504
Littoral/shore Area Modifications (Non-riverine)	90,322
Other Recreational Pollution Sources	77,123
Atmospheric Deposition - Toxics	71,589
Runoff from Forest/Grassland/Parkland	49,888
Contaminated Sediments	46,795
Urban Runoff/Storm Sewers	40,998
Municipal Point Source Discharges	25,053
On-site Treatment Systems (Septic Systems and Similar Decentralized Systems)	12,031
Rcra Hazardous Waste Sites	9,156
Impacts from Hydrostructure Flow Regulation/modification	9,114
Industrial Point Source Discharge	8,086
Site Clearance (Land Development or Redevelopment)	7,057
Dredging (E.g., for Navigation Channels)	5,966
Waterfowl	4,298
Introduction of Non-native Organisms (Accidental or Intentional)	2,195
Agriculture	2,092
Rural (Residential Areas)	1,700
Livestock (Grazing or Feeding Operations)	1,283
Pesticide Application	1,090
Highway/Road/Bridge Runoff (Non-construction Related)	665
Streambank Modifications/destabilization	407
Residential Districts	260
Combined Sewer Overflows	250
Impacts from Abandoned Mine Lands (Inactive)	250
Lake Fertilization	248
Wet Weather Discharges (Point Source and Combination of Stormwater, SSO or CSO)	225
Golf Courses	201
Landfills	172
Wildlife Other than Waterfowl	148
Highways, Roads, Bridges, Infrastructure (New Construction)	135
Channelization	135
Impervious Surface/Parking Lot Runoff	96
Pollutants from Public Bathing Areas	96
Specialty Crop Production	71
Loss of Riparian Habitat	59
Other Spill Related Impacts	40
Other Marina/Boating On-vessel Discharges	23
Yard Maintenance	14
Permitted Silvicultural Activities	11
Upstream Impoundments (e.g., Pl-566 NRCS Structures)	4

Table C-36. Trophic Status – All Illinois Inland Lakes.

Trophic Status	Number of Lakes*	Total Acres
Hypereutrophic (TSI ≥70)	120	68,529.11
Eutrophic (TSI ≥50 & <70)	286	75,572.21
Mesotrophic (TSI ≥40 & <50)	55	7,780.17
Oligotrophic (TSI <40)	10	387.3
Unknown*	90,985	166,208.25
Totals:	91,456	318,477

*The unknown category is based on an estimated 91,456 lakes and ponds in Illinois.

Lake Michigan

Table C-37 provides a summary of Lake Michigan assessment results for each individual use: *aquatic life*, *fish consumption*, *primary contact (swimming)*, *secondary contact*, *aesthetic quality* and *public and food processing water supply*. Tables C-38 and C-39 provide summaries of causes and sources of use impairment for Lake Michigan-basin waters. Of the total 1,526 square miles of Lake Michigan open waters in Illinois jurisdiction, only 151 square miles were assessed. All 151 square miles were rated as Fully Supporting *aquatic life* use. Complete assessment results for individual segments are shown in Appendices B-4, B-5 and B-6.

Table C-37. Statewide Individual Use-Support Summary for Lake Michigan-Basin Waters.

Lake Michigan Bays and Harbors; Units: Square Miles

Designated Use	Total Size	Total Assessed		Size Fully Supporting (Good)	Size Not Supporting (Fair)	Size Not Supporting (Poor)	Size Not Assessed
		Size	%				
Aesthetic Quality(1)	2.5	0	0	0	0	0	2.5
Aquatic Life	2.5	2.46	98.3	2.40	0	0.06	0.05
Fish Consumption	2.5	2.46	98.3	0	0	2.46	0.05
Primary Contact	2.5	0	0	0	0	0	2.5
Secondary Contact(1)	2.5	0	0	0	0	0	2.5

Lake Michigan Open Water; Units: Square Miles

Designated Use	Total Size	Total Assessed		Size Fully Supporting (Good)	Size Not Supporting (Fair)	Size Not Supporting (Poor)	Size Not Assessed
		Size	%				
Aesthetic Quality(1)	1,526	0	0.	0	0	0	1526
Aquatic Life	1,526	151	9.9	151	0	0	1375
Fish Consumption	1,526	151	9.9	0.0	0	151	1375
Primary Contact	1,526	151	9.9	151	0	0	1375
Public and Food Processing Water Supplies	151	151	100	151	0	0	0
Secondary Contact(1)	1,526	151(2)	9.9(2)	151(2)	0(2)	0(2)	1375

Lake Michigan Shoreline; Units: Miles

Designated Use	Total Size	Total Assessed		Size Fully Supporting (Good)	Size Not Supporting (Fair)	Size Not Supporting (Poor)	Size Not Assessed
		Size	%				
Aesthetic Quality(1)	63	0	0.0	0	0	0	63
Aquatic Life	63	0	0.0	0	0	0	63
Fish Consumption	63	63	100	0	0	63	0
Primary Contact	63	63	100	0	0	63	0
Secondary Contact(1)	63	0	0.0	0	0	0	63

Note: Illinois EPA did not use the Insufficient Information category for Lake Michigan-basin waters in 2008.
1. Assessment guidelines are not yet fully developed; see section C-2 Assessment Methodology.
2. By definition, Secondary Contact Use is "Fully Supporting" in all waters in which Primary Contact Use is "Fully Supporting"; otherwise, assessment guidelines are not yet developed for determining the level of use attainment.

Table C-38. Statewide Summary of Potential Causes of All Use Impairments in Lake Michigan-Basin Waters.

Lake Michigan Bays and Harbors; Units: Square Miles

Potential Cause of Impairment	Total Size
Mercury	2.46
Polychlorinated biphenyls	2.46
Copper	0.06
Zinc	0.06
Phosphorus (Total)	0.06
Cadmium	0.06
Lead	0.06
Chromium (total)	0.06

Lake Michigan Open Water; Units: Square Miles

Potential Cause of Impairment	Total Size
Mercury	151
Polychlorinated biphenyls	151

Lake Michigan Shoreline; Units: Miles

Potential Cause of Impairment	Total Size
Escherichia coli	63
Mercury	63
Polychlorinated biphenyls	63

Table C-39. Statewide Summary of Potential Sources of All Use Impairments in Lake Michigan-Basin Waters.

Lake Michigan Bays and Harbors; Units: Square Miles

Source	Total Size
Source Unknown	2.50
Atmospheric Deposition - Toxics	2.50
Contaminated Sediments	0.06
Industrial Point Source Discharge	0.06
Urban Runoff/Storm Sewers	0.06

Lake Michigan Open Water; Units: Square Miles

Source	Total Size
Atmospheric Deposition - Toxics	151
Source Unknown	151

Lake Michigan Shoreline; Units: Miles

Source	Total Size
Atmospheric Deposition - Toxics	63
Source Unknown	63
Urban Runoff/Storm Sewers	2
Combined Sewer Overflows	2

C-4 Wetlands Monitoring and Assessment Program

Wetlands have been defined as areas between terrestrial and aquatic systems where the water table is usually at or near the surface, or the land is covered by shallow water. Wetlands, such as marshes, swamps and bogs, support plants and animals adapted for life in water or in saturated soil.

Illinois once contained more than eight million acres of wetlands. Currently, approximately 920,000 wetland acres remain. Palustrine, riverine, and lacustrine wetlands are found in Illinois along the margins of lakes and ponds, throughout river flood plains, and as isolated depressions. Wetlands provide valuable habitat for 40 percent of the state's threatened and endangered species, as well as benefits such as flood storage, water quality improvement and groundwater recharge. Demands for improved public health and safety and pressures of agriculture and economic development continue to threaten modification, degradation, and conversion of the remaining wetlands. Alteration methods include dredging, filling, bridge construction, draining, flooding, and construction of dikes and levees. Besides these human activities, drought, sedimentation, overgrazing by wildlife, and other natural impacts can reduce a wetlands ability to function. It is difficult, if not impossible, to re-create or replace the multitude of benefits when wetland functions are lost.

Wetlands, as they relate to water quality, can prove to be valuable assets in pollution treatment and in providing high quality habitat. The onset of development of the land for agricultural purposes and community development required the conversion of vast wetland areas to well drained, functional open lands.

The value of wetlands has become more evident as these areas have been depleted. Increased public awareness of wetland function and value has placed special emphasis on the protection and creation of wetlands. This is reflected in state legislation. In the late 1980s, using federal guidelines, standards, specifications, and class systems and working with the federal government, the state completed an inventory of Illinois' remaining wetlands. This inventory has been included in the National Wetlands Inventory of the U.S. Fish and Wildlife Service. The inventory is being used by the Natural Resource Conservation Service in identification of areas subject to the provisions of the Food Security Act and by Illinois EPA's Bureau of Water as part of its review process required for permit issuance, as well as other uses. State agencies have developed working agreements resulting in the reduction of wetland loss by state agency's actions. The Illinois Wetlands Protection Act (IWPA) established state policy and procedures that minimize the destruction of existing wetlands in Illinois as a result of state and state-supported activities. The IWPA, however, provides for those instances when adverse impacts to wetlands are unavoidable by requiring coordination with the Illinois Department of Natural Resources and mitigation of the unavoidable losses.

In order to meet the requirements of the Clean Water Act (CWA), Illinois EPA has developed a comprehensive document entitled *Wetland Monitoring and Assessment Program for the State of Illinois*. This document will be used to implement a statewide wetland monitoring and assessment program that allows for the collection of data and accurate assessment of wetland resources, as needed, to meet CWA Section 305(b) and 303(d) (Integrated Report) requirements.

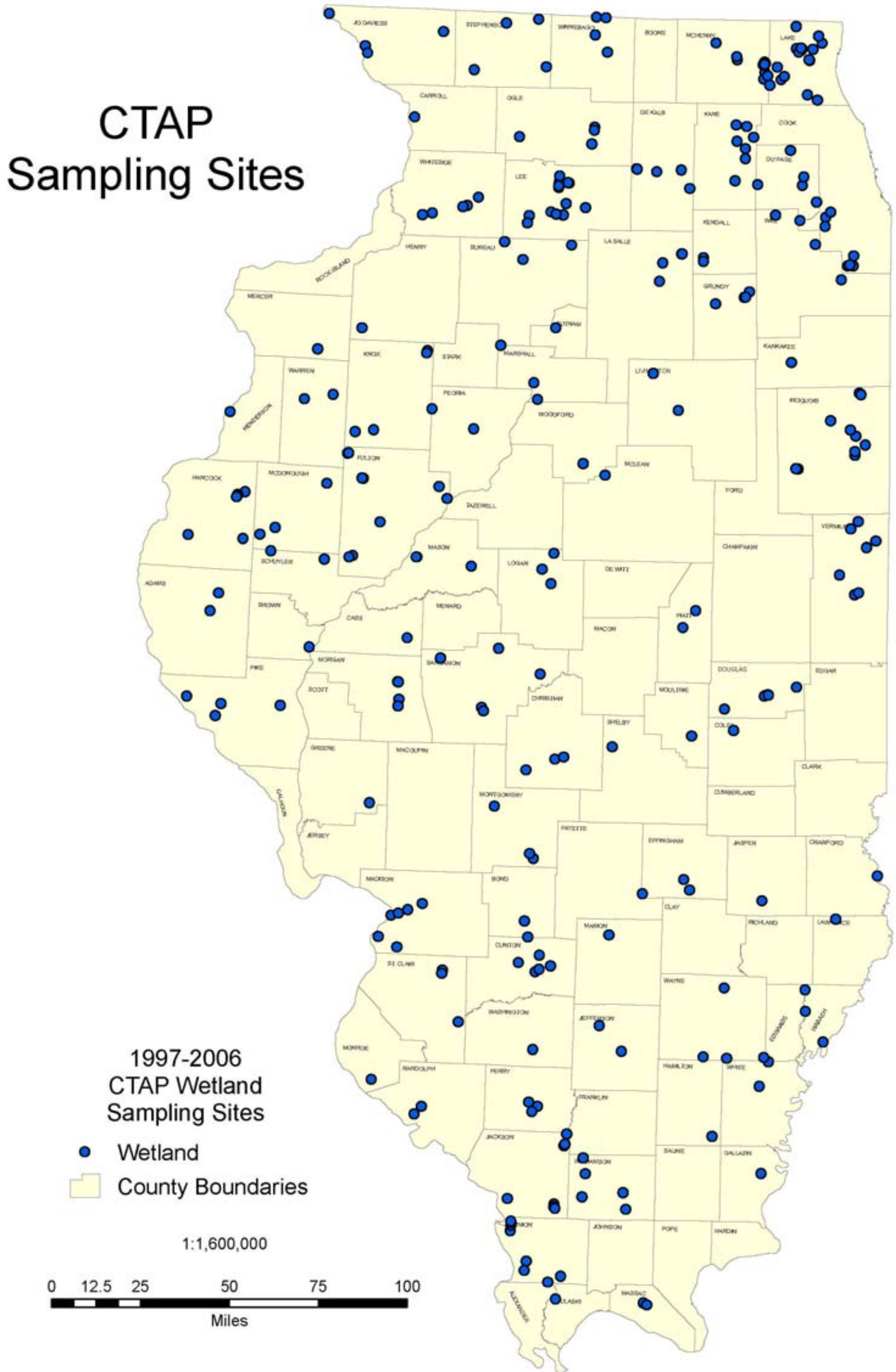
To accomplish this, Illinois EPA has coordinated with other state and federal agencies, academic institutions, research entities, and others to form a Technical Working Group comprised of individuals with expertise in wetland characterization, monitoring, sampling, and assessment. This working group, initiated in January, 2006, provided much of the technical expertise to analyze available data, design needed research efforts, formulate the monitoring and assessment protocols, and author the program document. The U.S. Geological Survey played a key role by assimilating and analyzing existing data and directing the research and protocol development efforts of the workgroup. Additionally, the input of the Illinois Department of Natural Resources – Critical Trends Assessment Program (CTAP), which is conducted by the Illinois Natural History Survey, played a critical role in development of sampling protocol (chemistry, biology, and habitat) as well as future development of a wetlands IBI (Level 3 Assessment). Currently, the CTAP monitors 226 wetland resources throughout the state on a five-year rotational basis. Additionally, CTAP will be adding approximately 30 wetland reference sites to the wetland monitoring network over the next few years. Figure C-4 shows the wetlands sampled through the CTAP program as of 2006. Details on the CTAP, including site selection procedures and monitoring protocols, can be found in Appendix 6 and at http://ctap.inhs.uiuc.edu/mp/monitoring.asp. The following table shows the number of wetlands currently monitored in each primary wetland class.

	Monitored (1997-2006)	
Class	**Number**	**Percentage**
Forested wetland	58	26
Scrub-shrub wetland	2	1
Emergent wetland	166	73

Utilizing water chemistry, biology, and habitat metrics this program will be able to assess the health of various wetland resources throughout the state. Because it is impractical to individually sample every wetland in the state, a probabilistic monitoring design will be used to provide a reasonable determination of the health of the state's wetland resources while also being economically feasible, logistically practical, and statistically valid. Once fully implemented, this program will yield comprehensive data and information, that will be used to 1) establish a baseline of wetland resources and conditions from which to determine trends and changes in quantity and quality over time, 2) determine reference conditions for the various classes of Illinois wetlands, 3) develop and maintain a database which can provide for management and compensatory mitigation decisions, 4) provide information from which to evaluate wetlands restoration, creation, mitigation, and protection programs, 5) incorporate wetlands into the State's 305 (b) assessments and the Integrated Report, and 6) provide necessary information required to develop applicable water quality standards.

In accordance with the program's objectives, funding has been secured to update the National Wetland Inventory database for Illinois in order to conduct a GIS/Remote Sensing based inventory (Level 1 Assessment) with an expected completion date of September 2009. Funding has also been obtained to allow for the development of a wetland IBI (Level 3 Assessment) based on ten years of probabilistic survey data collected by CTAP. After these two components are developed, future development of a rapid assessment protocols (Level 2 Assessment) will also be explored.

Figure C-4. Wetlands monitored through the Critical Trends Assessment Program from1997-2006.



C-5 Trends in Surface Waters

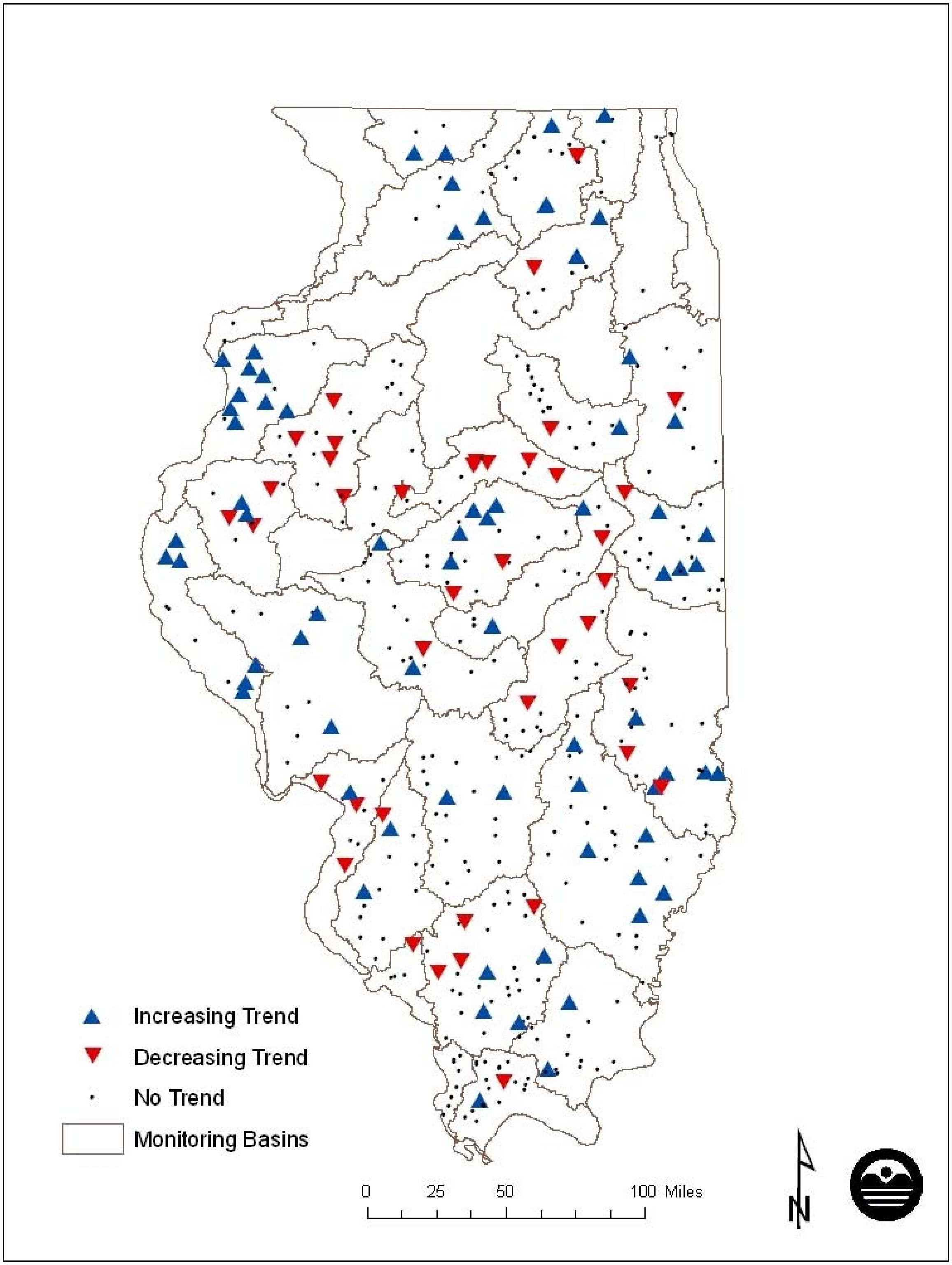
Illinois Streams Trends Assessment

To assess changes in ecological health of streams throughout Illinois, a trend analysis was performed utilizing readily available fish assemblage data collected from 1981 – 2004 as part of the Illinois EPA/IDNR Cooperative Intensive Basin Survey program. From this data set, an Index of Biotic Integrity for fish (Fish IBI) was calculated for each fish sample and used to assess changes in the ecological health of Illinois streams. Fish data were chosen for this comparison as it is the most representative, long-term, primary biological data set available in Illinois.

To evaluate trends, data were split into two separate groups: sites where only two Fish IBI scores (259 sites) were available and sites where three or more Fish IBI scores (159 sites) were available. For each of these 418 sites the Fish IBI scores were plotted against the year of collection. To document changes in stream condition, a meaningful trend was defined as a difference in Fish IBI score of 11 or more points between sample years. This 11 point cutoff was used as it is widely recognized in scientific literature, as well as the Illinois Department of Natural Resources internal analysis, as the point distinguishing meaningful differences in fish IBI scores (+/- 5 point difference plus one point to eliminate ties).

Each Fish IBI score for each year was plotted as a range of values that reflect the precision of a score; specifically, this range is depicted as a vertical line that extends five points above and below each Fish IBI score for any given year. For each site we compared the earliest Fish IBI score to the most recent one. Non-overlapping IBI ranges (i.e., greater than or equal to an 11 point difference) were interpreted as having a meaningful trend (increasing or decreasing). Out of this data set (418 stream sites), our analysis found no trend in Fish IBIs at 305 sites (73%), a decrease at 42 sites (10%), and an increase at 71 sites (17%) (Figure C-5).

Figure C-5. Statewide Trends in Fish Index of Biotic Integrity for Streams in Illinois, 1981-2004.



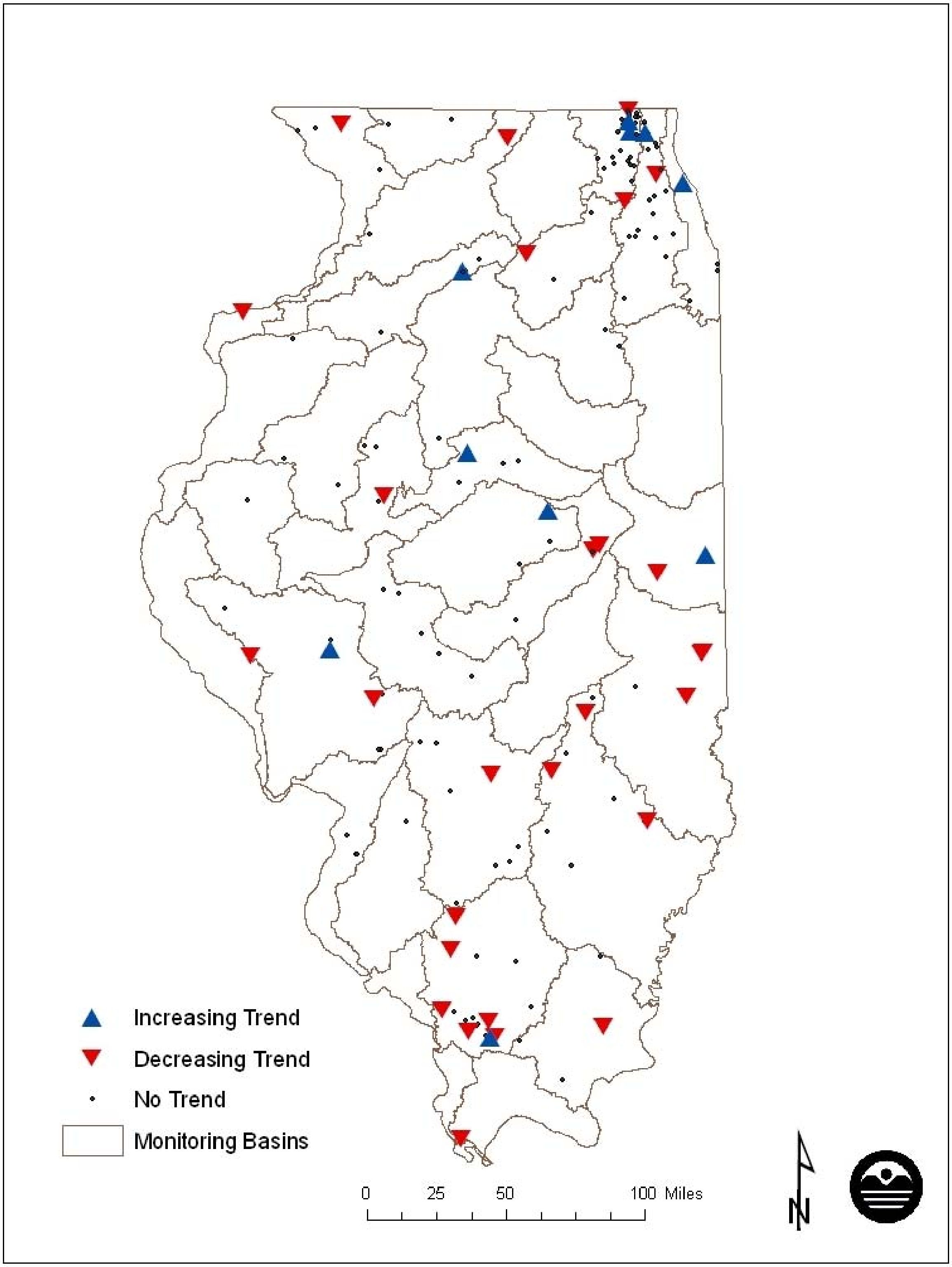
Illinois Inland Lake Trends Assessment

To assess and document changes in lake water quality throughout Illinois, a trend analysis was performed utilizing a data set which contains almost 30 years worth of lake data from several sources including the Illinois EPA's Ambient Lake Monitoring Program, Illinois Clean Lakes Program, and Volunteer Lake Monitoring Program, as well as from outside sources. The most consistently available measurement across all data sets was found to be Secchi disk transparency, which is a widely recognized indicator of overall lake water quality. Additionally, Secchi disk transparency can be directly correlated to other water quality parameters such as total suspended solids, total nutrients, and chlorophyll concentrations.

In order to assess trends within an individual lake over time, a nonparametric Mann-Kendall test for trends was used. A trend was defined as a significant change in Secchi disk transparency over time ($\alpha = 0.10$). For lakes with a sample size greater than ten, the data was subjected to a normal approximation to reduce the effects of tied values (zeros) in the data matrix. To minimize the effects of variability within a year, only data from July and/or August were utilized in the trend analysis. This also corresponds to the time period when water quality issues are most likely to have developed (i.e., reduced water clarity, increased algal productivity, elevated nutrient concentrations, etc) and provides a good assessment of quality during peak lake usage in Illinois. The median of all available values from within these two months was calculated and used as the representative Secchi disk transparency value for that year. Furthermore, for a lake to be included in the analysis, at least four years of Secchi disk transparency data were required.

The initial data set consists of Secchi disk transparency readings from 296 lakes (1979 - 2006). After applying minimum requirements (at least four years with July and/or August Secchi disk transparency data), the data set was reduced to 157 lakes with an n value (years) ranging from 4 to 27. Out of this data set (157 lakes), our analysis found no significant trend at 119 lakes (75.8%), a significant decrease at 28 lakes (17.8%), and a significant increase at 10 lakes (6.4%) (Figure C-6).

Figure C-6. Statewide Trends in Secchi Disk Transparency for Inland Lakes in Illinois, 1979 – 2006.



C-6 Public Health Issues

USEPA guidance asks states to provide information regarding public health issues including information on *fish consumption*, *primary contact* (swimming) and *public and food processing water supply* uses. The summaries of use support for these three uses are shown in Table C-40. Potential causes of impairment for these uses are shown in Table C-41.

Table C-40. Statewide Individual Use-Support Summary for Public Health Related Uses.

Streams: Designated Use	**Total Miles**	**Miles Assessed**	**Miles Fully Supporting (Good)**	**Miles Not Supporting (Fair)**	**Miles Not Supporting (Poor)**	**Miles Not Assessed**
Fish Consumption	71,394	3,827	0	3,516	310	67,567
Primary Contact	70,777	3,915	740	1,417	1,759	66,862
Public and Food Processing Water Supply	1,108	1,108	100	1,008	0	0
Inland Lakes: Designated Use	**Total Acres**	**Acres Assessed**	**Acres Fully Supporting (Good)**	**Acres Not Supporting (Fair)**	**Acres Not Supporting (Poor)**	**Acres Not Assessed**
Fish Consumption	318,477	86,879	6,840	79,988	51	231,598
Primary Contact	316,877	1,814	1,092	722	0	315,063
Public and Food Processing Water Supply	76,784	76,603	4,833	71,770	0	181
Lake Michigan Harbors: Designated Use	**Total Square Miles**	**Square Miles Assessed**	**Miles Fully Supporting (Good)**	**Miles Not Supporting (Fair)**	**Miles Not Supporting (Poor)**	**Square Miles Not Assessed**
Fish Consumption	2.5	2.46	98.3	0	0	2.46
Primary Contact	2.5	0	0	0	0	0
Lake Michigan Open Water: Designated Use	**Total Square Miles**	**Square Miles Assessed**	**Miles Fully Supporting (Good)**	**Miles Not Supporting (Fair)**	**Miles Not Supporting (Poor)**	**Square Miles Not Assessed**
Fish Consumption	1,526	151	9.9	0.0	0	151
Primary Contact	1,526	151	9.9	151	0	0
Public and Food Processing Water Supplies	151	151	100	151	0	0
Lake Michigan Shoreline: Designated Use	**Total Miles**	**Miles Assessed**	**Miles Fully Supporting (Good)**	**Miles Not Supporting (Fair)**	**Miles Not Supporting (Poor)**	**Miles Not Assessed**
Fish Consumption	63	63	100	0	0	63
Primary Contact	63	63	100	0	0	63

Note: Numbers may not add up due to slight rounding errors.

Table C-41. Potential Causes of Impairment for *Public and Food Processing Water Supply*, *Primary Contact* and *Fish Consumption* Uses in Illinois Waters.

STREAMS: Potential Causes of Impairment	Miles
Fish Consumption Causes	
Mercury	2,930
Polychlorinated biphenyls	2,796
Dioxin (including 2,3,7,8-TCDD)	130
Chlordane	79
Primary Contact Causes	
Fecal Coliform	3,175
Public and Food Processing Water Supply Causes	
Manganese	865
Atrazine	162
Sulfates	117
Nitrogen, Nitrate	83
Phenols	59
Iron	25

INLAND LAKES: Potential Causes of Impairment	Acres
Fish Consumption Causes	
Mercury	71,589
Polychlorinated biphenyls	25,788
Chlordane	4,820
Primary Contact Causes	
Fecal Coliform	722
Public and Food Processing Water Supply Causes	
Manganese	67,185
Nitrogen, Nitrate	4,585
Atrazine	2,397
Total Dissolved Solids	250

LAKE MICHIGAN BAYS AND HARBORS: Potential Causes of Impairment	Square Miles
Fish Consumption Causes	
Polychlorinated biphenyls	2.5
Mercury	2.5

LAKE MICHIGAN OPEN WATERS: Potential Causes of Impairment	Square
Fish Consumption Causes	
Polychlorinated biphenyls	151
Mercury	151

LAKE MICHIGAN SHORELINE: Potential Causes of Impairment	Miles
Primary Contact Causes	
Escherichia coli	63
Fish Consumption Causes	
Polychlorinated biphenyls	63
Mercury	63

PART D: GROUNDWATER MONITORING AND ASSESSMENT

D-1.   Resource-Quality Monitoring Program

Hydrologic Background

To assess the groundwater resources of the state, the Illinois EPA utilizes three primary aquifer classes (O'Hearn and Schock, 1984). These three "principal aquifers" are sand and gravel, shallow bedrock and deep bedrock aquifers, as illustrated in figures D-1 thru D-3. A principal aquifer is defined as having a potential yield of 100,000 gallons per day per square mile and having an area of at least 50 miles.

Figure D-1. Principal Sand and Gravel Aquifers in Illinois.

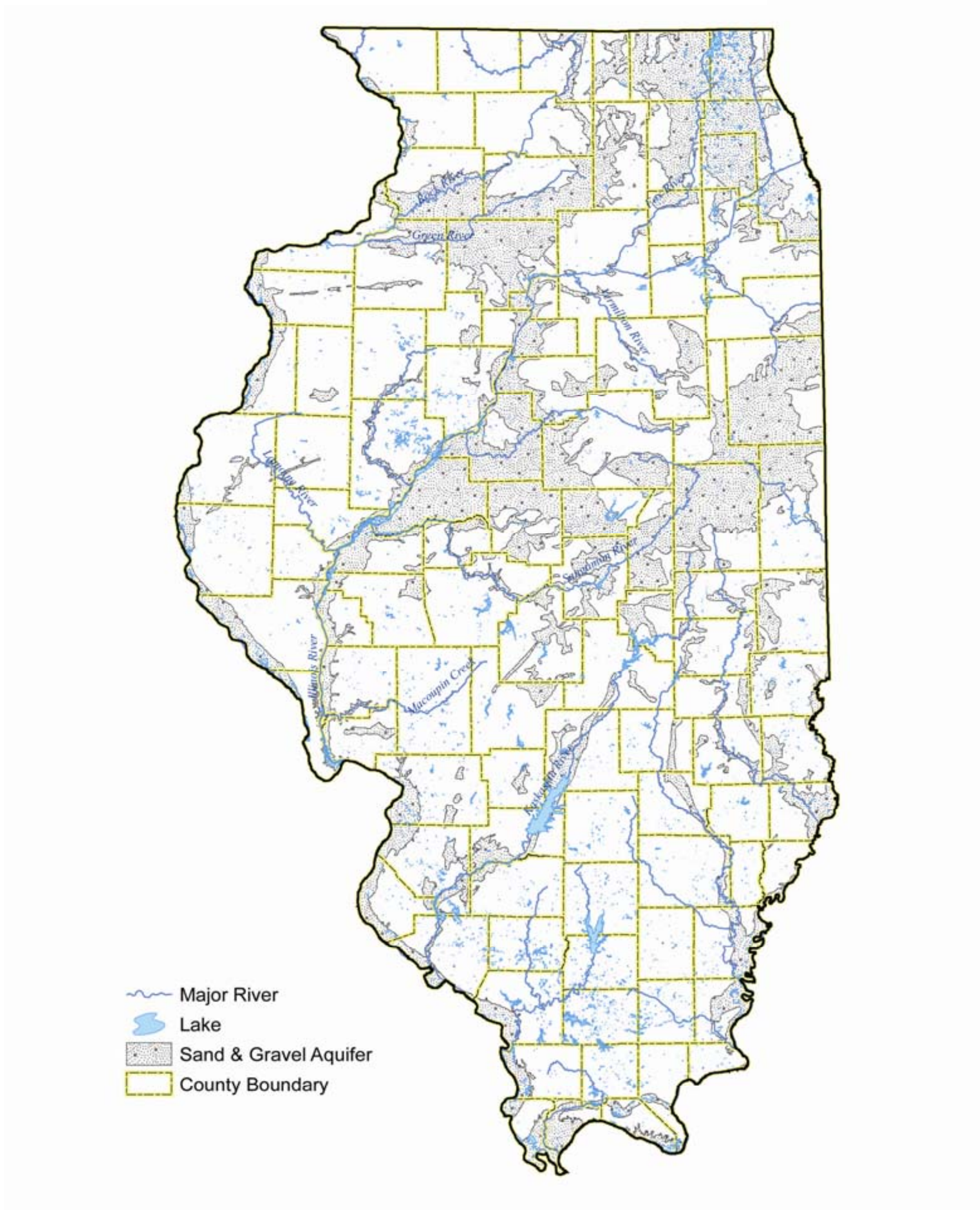


Figure D-2. Principal Shallow Bedrock Aquifers in Illinois.

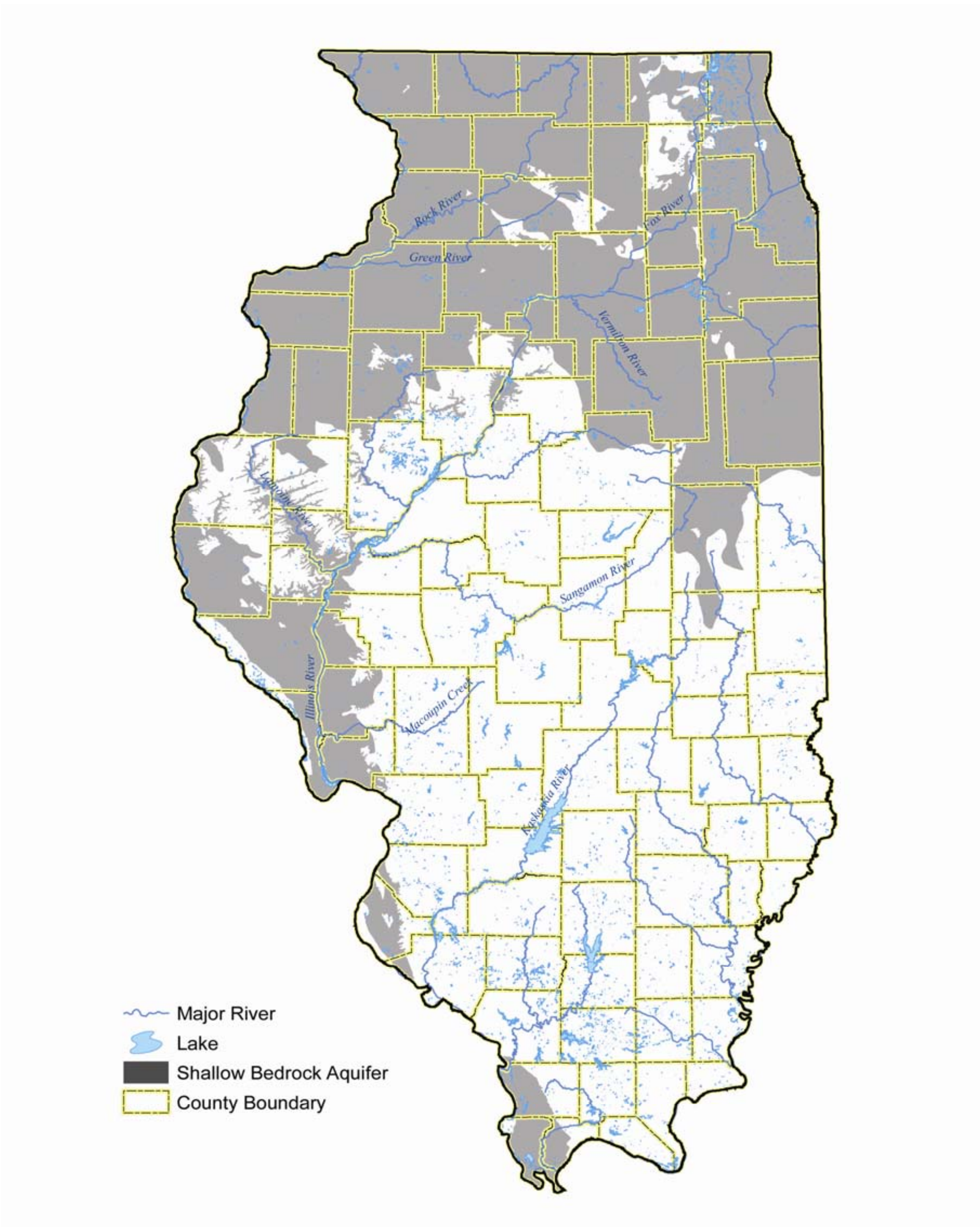
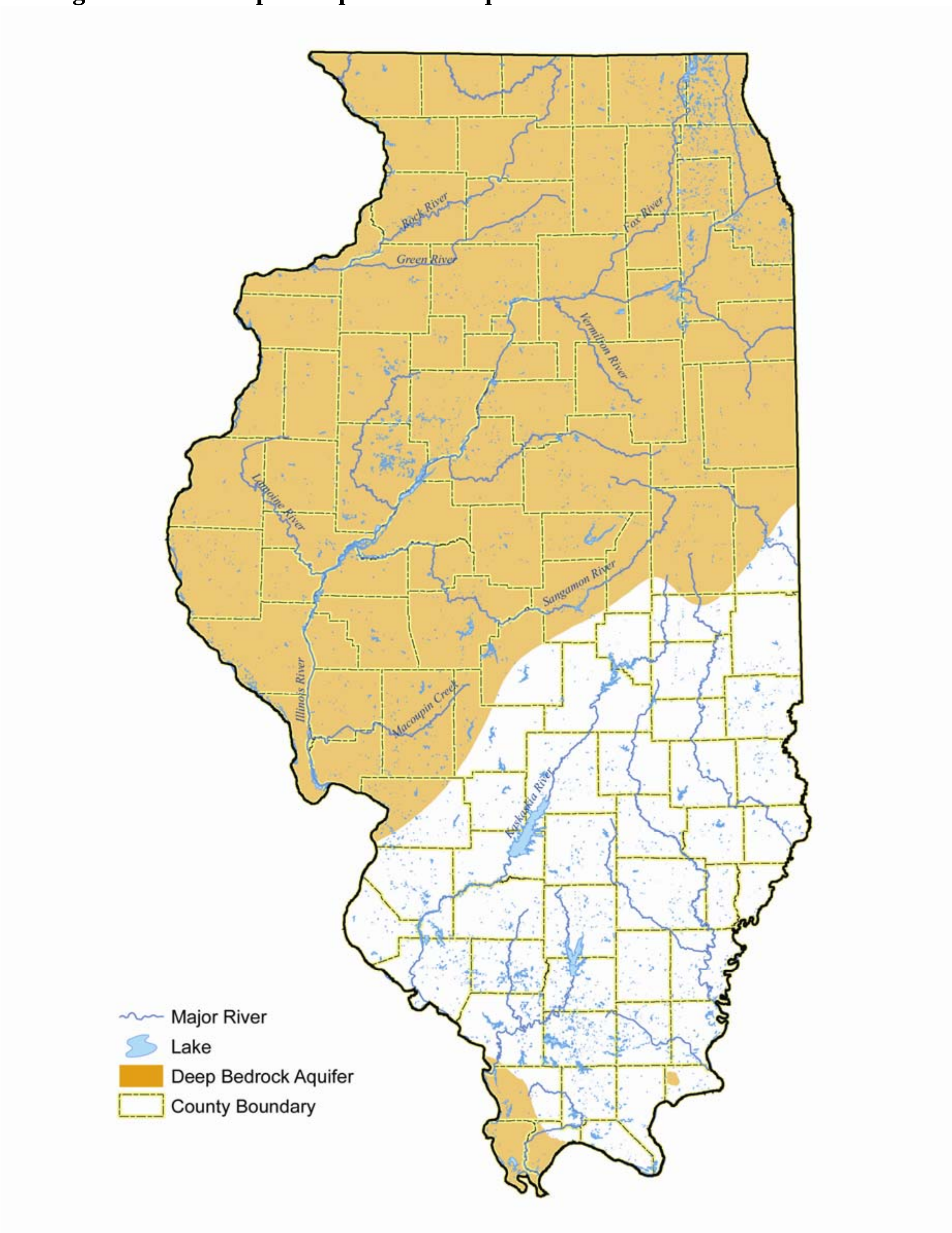


Figure D-3. Principal Deep Bedrock Aquifers in Illinois.



Water resource availability can be expressed in a number of ways. In the groundwater field, the term “potential yield” or “safe yield” is often used (Wehrmann, 2003). Potential aquifer yield is the maximum amount of groundwater that can be continuously withdrawn from a reasonable number of wells and well fields without creating critically low water levels or exceeding recharge (Wehrmann, 2003). Statewide estimates of groundwater availability, based on aquifer potential yield estimates, were developed in the late 1960s (Illinois Technical Advisory Committee on Water Resources, ITACWR, 1967). The ITACWR report presented maps of the estimated potential yields, expressed as recharge rates in gallons per day per square mile (gpd/mi^2), of the principal sand and gravel and shallow bedrock aquifers of Illinois. For reference, a recharge rate of 100,000 gpd/mi^2 is equal to 2.1 inches/year. (Wehrmann, 2003).

The 1967 ITACWR report stated the following:

> “The potential yield of the principal sand and gravel and bedrock aquifers in Illinois are estimated to be **4.8 and 2.5 billion gallons per day (bgd)**, respectively. The **total groundwater potential in Illinois based on full development of either sand and gravel or bedrock aquifers, whichever has the higher recharge rate, is estimated to be 7.0 bgd**. Principal sand and gravel aquifers underlie only about 25 percent of the total land area in Illinois. **About 3.1 bgd, or about 65 percent of the total potential yield of the principal sand and gravel aquifers in the state, is concentrated in less than 6 percent of the total land area in Illinois and is located in alluvial deposits that lie directly adjacent to major rivers such as the Mississippi, Illinois, Ohio, and Wabash.** About 0.5 bgd, or about 10 percent of the total potential sand and gravel yield is from the principal sand and gravel aquifers in the major bedrock valleys of the buried Mahomet valley in east-central Illinois and in the river valleys of the Kaskaskia, Little Wabash, and Embarras Rivers in southern Illinois. **Of the total estimated yield of bedrock aquifers in the State, 1.7 bgd, or 68 percent, is available from the shallow bedrock aquifers, mainly dolomites in the northern third of the State.** The potential yield of the shallow dolomite varies. In areas where the **more permeable shallow dolomites lie directly beneath the glacial drift, the potential yield ranges from 100,000 to 200,000 gpd/mi^2.** In areas where less permeable dolomites lie directly beneath the drift or are overlain by thin beds of less permeable rocks of **Pennsylvanian age, the potential yield ranges from 50,000 to100, 000 gpd/mi^2. Where the overlying Pennsylvanian rocks are thick, the potential yield is less than 50,000 gpd/mi^2.” (**Emphasis added)

Approximately 58 percent (32,000 square miles) of the state is underlain by principal aquifers; of these, about 33 percent (18,500 square miles) are shallow groundwater sources. The following are numbers of community water supply wells that withdraw from these aquifers: Out of 3,390 active CWS wells:

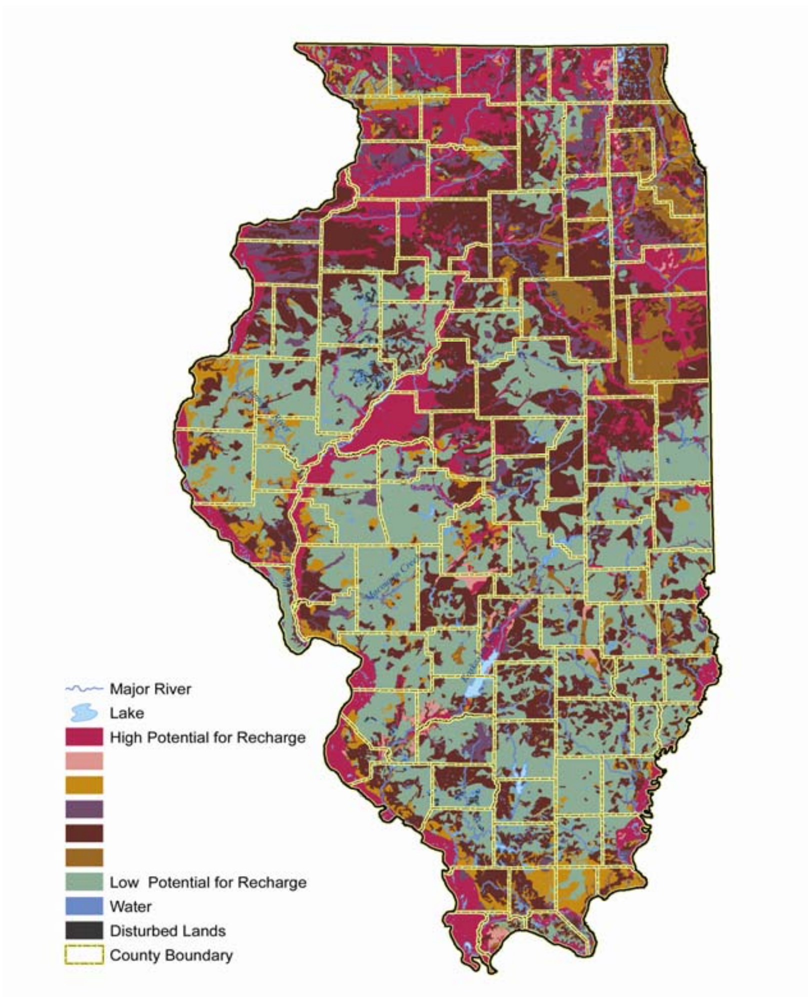
- 46 percent (1,553) utilize a sand and gravel aquifer;
- 23 percent (776) utilize a shallow bedrock aquifer;
- 23 percent (774) utilize a deep bedrock aquifer;
- 5 percent (176) utilize a combination of two or more of the above aquifers; and
- 3 percent (101) are undetermined.

There are approximately 5,550 groundwater dependent public water supplies in the state, of which 1,199 are community water supplies (CWS). The Illinois Department of Public Health estimates approximately 400,000 residences of the state are served by private wells[(5)].

Water that moves into the saturated zone and flows downward, away from the water table is recharge. Generally, only a portion of recharge will reach an aquifer. The overall recharge rate is affected by several factors, including intensity and amount of precipitation, surface evaporation, vegetative cover, plant water demand, land use, soil moisture content, depth and shape of the water table, distance and direction to a stream or river, and hydraulic conductivity of soil and geologic materials (Walton, 1965).

Figure D-4 illustrates the potential for aquifer recharge, defined as the probability of precipitation reaching the uppermost aquifer. The map is based on a simplified function of depth to the aquifer, occurrence of major aquifers, and the potential infiltration rate of the soil. This simplification assumes that recharge rates are primarily a function of leakage from an overlying aquitard (fine grained non-aquifer materials). Moreover, recharge may also be occurring from outside of a watershed boundary. Additionally, pumping stresses from potable water supply wells located adjacent to watershed boundaries may change the natural groundwater flow directions. Therefore, aquifer boundaries may not be consistent with surface watershed boundaries.

Figure D-4. Potential for Aquifer Recharge in Illinois.

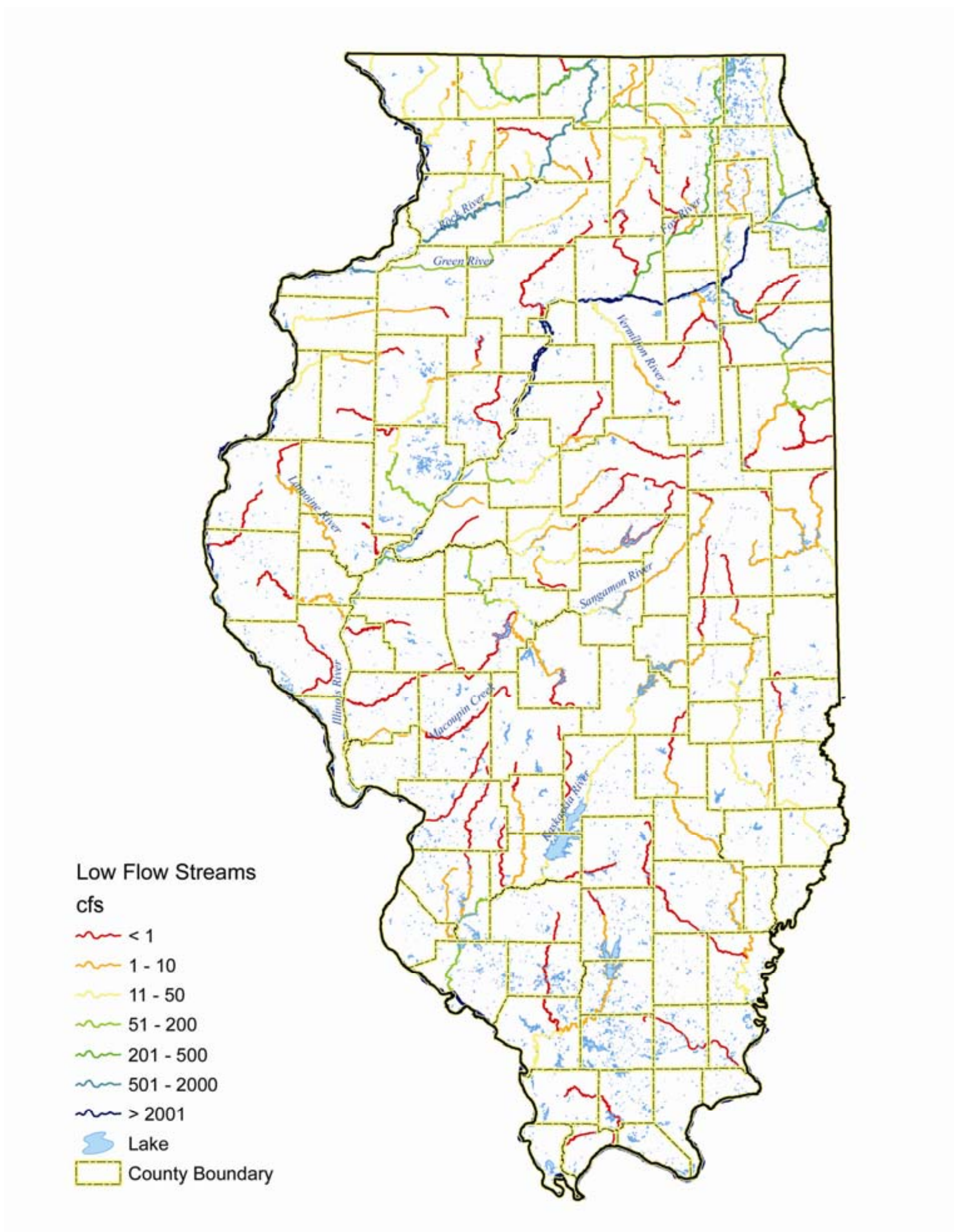


Additional and more detailed information is available via Illinois EPA's Environmental Facts Online (ENFO): [http://www.epa.state.il.us/enfo/.](http://www.epa.state.il.us/enfo/)

5 "Private Water System" means any supply which provides water for drinking, culinary, and sanitary purposes and serves an owner-occupied single family dwelling. (Section 9(a)(5) of the Illinois Groundwater Protection Act [415 ILCS 55/9(a)(5)])

Groundwater contribution to stream flow in the form of base flow was analyzed for 78 drainage basins in Illinois (O'Hearn and Gibb, 1980). This study determined that median base flow per square mile of drainage area generally increases from the southwest to the northeast at all three flow durations. Figure D-5 shows the three-year low flow streams. This provides a good indictor of groundwater base flow in surface water.

Figure D-5. Three-Year Low Flow Streams in Illinois.



Illinois Groundwater Monitoring Network

Section 13.1 of the Act (415 ILCS 5/13.1) requires the Illinois EPA to implement a groundwater monitoring network to assess current levels of contamination in groundwater and to detect future degradation of groundwater resources. Further, Section 7 of the IGPA (415 ILCS 55/7) requires the establishment of a statewide ambient groundwater monitoring network comprised of community water supply wells, non-community water supply wells, private wells, and dedicated monitoring wells. The ICCG serves as a groundwater monitoring coordinating council. The following provides a summary of: the USGS NAWQA network; IDA dedicated monitoring well network for pesticides; and the Illinois EPA's network of CWS wells (including the pesticide sub-network).

Prototype Ambient Groundwater Monitoring

The collection of high quality chemical data is essential in assessing groundwater protection efforts. In 1984, the Illinois State Water Task Force published a groundwater protection strategy. This strategy lead to the addition of Section 13.1 to the Act (415 ILCS 5/13.1) which required the Illinois EPA to develop and implement a Groundwater Protection Plan (Plan) and to initiate a statewide groundwater-monitoring network. In response to these requirements, the Illinois EPA and the United States Geological Survey (USGS) Illinois District Office, located in Urbana, began a cooperative effort to implement a pilot groundwater monitoring network (i.e., ambient monitoring network) in 1984 (Voelker, 1986). CWS well ambient network design started with pilot efforts in 1984, moved to implementation of the ISWS network design (O'Hearn, M. and S. Schock, 1984) for several years, and was followed by sampling all of Illinois' CWS wells (3,000+) (Voelker, 1988 and 1989).

The prototype monitoring efforts included development of quality assurance and field sampling methods. Illinois EPA's quality assurance and field sampling methods, originally developed in 1984 in cooperation with the USGS, were compiled into a field manual in 1985 (Cobb and Sinnott,1987 and Barcelona et al, 1985). This manual has since been revised many times to include quality improvements. Monitoring at all stations sampled by Illinois EPA is completed by using Hydrolab® samplers to insure that in situ groundwater conditions are reached prior to sampling. Water quality parameters include: field temperature, field specific conductance, field pH, field pumping rate, inorganic chemical (IOC) analysis, synthetic organic compound (SOC), and VOC analysis. All laboratory analytical procedures are documented in the Illinois EPA Laboratories Manual.

In the year 2000, the Illinois EPA tasked the USGS to conduct a year long independent evaluation of our groundwater quality sampling methodology. The USGS concluded that Illinois EPA's sampling program (sampling methodology guidelines, water quality meter calibration, and sampling performance) is considered to provide samples representative of aquifer water quality. Only minor revisions to the sampling program were suggested (Mills and Terrio 2003). In addition, Illinois EPA also participates in the annual USGS National Field Quality-Assurance Program.

Interagency Coordination and Monitoring

The Plan led to the development and adoption of the IGPA in 1987. Section 7 of the IGPA (415 ILCS 55/7) required the establishment of a statewide ambient groundwater monitoring network comprised of community water supply wells, non-community water supply wells, private wells, and dedicated monitoring wells. The IGPA also established the Interagency Coordinating Committee on Groundwater (ICCG). The ICCG is required to report biennially to the Governor and General Assembly on groundwater quality and quantity and the state's enforcement efforts. In summary, the ICCG is responsible for:

- Reviewing and coordinating the state's policy on groundwater protection;
- Reviewing and evaluating state laws, regulations, and procedures that relate to groundwater protection;
- Reviewing and evaluating the status of the state's efforts to improve the quality of the groundwater, the state enforcement efforts for protection of the groundwater, and make recommendations in improving the state's efforts to protect the groundwater;
- Recommending procedures for better coordination among state groundwater programs and local programs related to groundwater protection;
- Reviewing and recommending procedures to coordinate the state's response to specific incidents of groundwater pollution and coordinate dissemination of information between agencies responsible for the state's response;
- Making recommendations for and prioritizing the state's groundwater research needs; and
- Reviewing, coordinating, and evaluating groundwater data collection and analysis.

The ICCG is chaired by the Director of the Illinois EPA and is comprised of members from ten state agencies/departments that have some jurisdiction over groundwater (Table D-1).

Table D-1. Members of the Interagency Coordinating Committee on Groundwater.

Environmental Protection Agency (Chair)	Marcia Willhite, designee
Department of Natural Resources Office of Water Resources Office of Mines and Minerals	Todd Rettig, designee Gary Clark, designee Scott Fowler, designee
Department of Public Health	Jerry Dalsin, designee
Office of the State Fire Marshal	Shelly Bradley, designee
Department of Agriculture	Dennis McKenna, designee
Emergency Management Agency, Division of Nuclear	Gary McCandless, designee
Department of Commerce and Economic Opportunity	John Knittle, designee
Also attending the ICCG meetings are: Steve Gobelman, Illinois Department of Transportation's Division of Highways; Allen Wehrmann, Illinois State Water Survey; David Larson, Illinois State Geological Survey; and George Groschen, United States Geological Survey.	

The ICCG serves as a groundwater monitoring coordinating council.

Coordinated Ambient Monitoring

From the experience gained from these prototype networks, implemented pursuant to Section 13.1 of the Act, Illinois EPA designed a probabilistic monitoring network of CWS wells (Gibbons 1995). The design of this network was completed in coordination with the USGS, the Illinois State Geological Survey (ISGS), and the ISWS, with USGS performing the detailed design. The goal of the network is to represent contamination levels in the population of all active CWS wells. The network wells were selected by a random stratified probability-based approach using a 95 percent confidence level (CWS probabilistic network). This results in an associated plus or minus 5 percent precision and accuracy level. Further, the random selection of the CWS wells was stratified by depth, aquifer type and the presence of aquifer material within 50 feet of land surface to improve precision and accuracy. Illinois EPA used geological well log and construction log detail to perform this process.

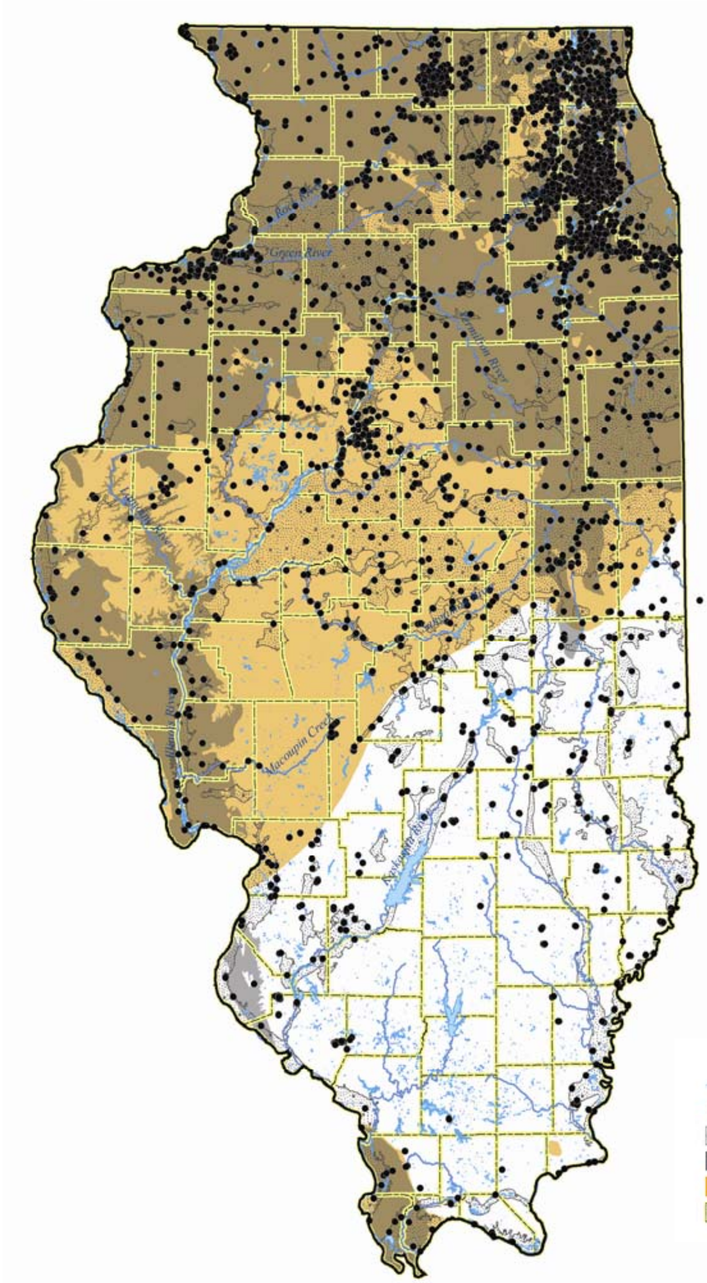
The random stratified selection process included nearly 3,000 CWS wells resulting in 356 fixed monitoring locations see Figure D-6. Additionally, in order to prevent spatial or temporal bias 17 random groups of 21 wells, with alternates, were selected from all the 356 fixed station wells. To further assure maximum temporal randomization within practical constraints, the samples from each sample period are collected within a three-week timeframe.

This probabilistic network is designed to provide an overview of the groundwater conditions in the CWS wells; provide an overview of the groundwater conditions in the principle aquifers (e.g., sand and gravel, Silurian, Cambrian-Ordovician, etc.,); establish baselines of water quality within the principle aquifers; identify trends in groundwater quality in the principle aquifers; and evaluate the long-term effectiveness of the IGPA, Clean Water Act (CWA) and Safe Drinking Water Act (SDWA) program activities in protecting groundwater in Illinois. Illinois EPA has also developed an integrated surface and groundwater monitoring strategy. Figure D-7 shows the probabilistic groundwater monitoring network wells and the surface water monitoring stations.

During the 1997 monitoring cycle, Illinois EPA initiated a rotating monitoring network of CWS wells. Illinois EPA rotates every two years from the probabilistic (fixed station) network to special intensive or regional studies.

Figure D-6. Active Community Water Supply Wells and Community Water Supply Probabilistic Network Wells.

All CWS Wells in Illinois



CWS Probabilistic Network Wells in Illinois

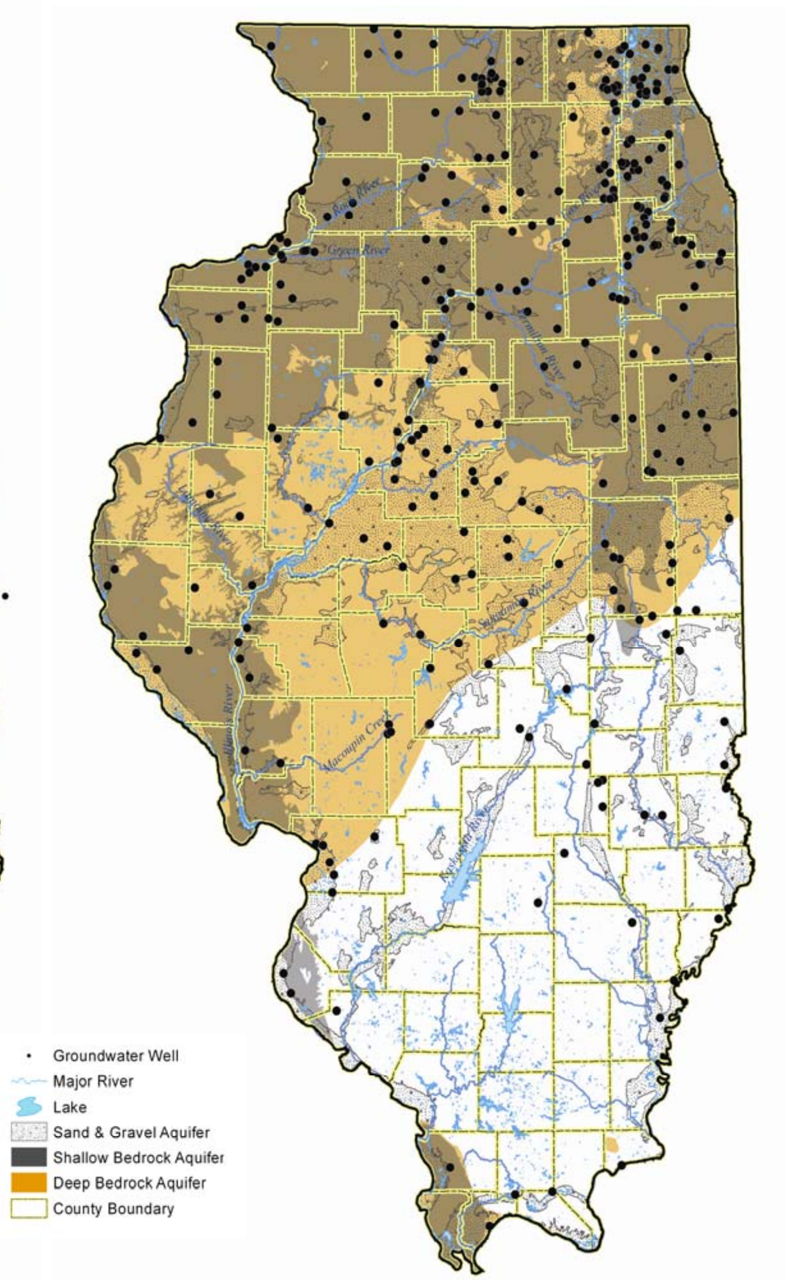
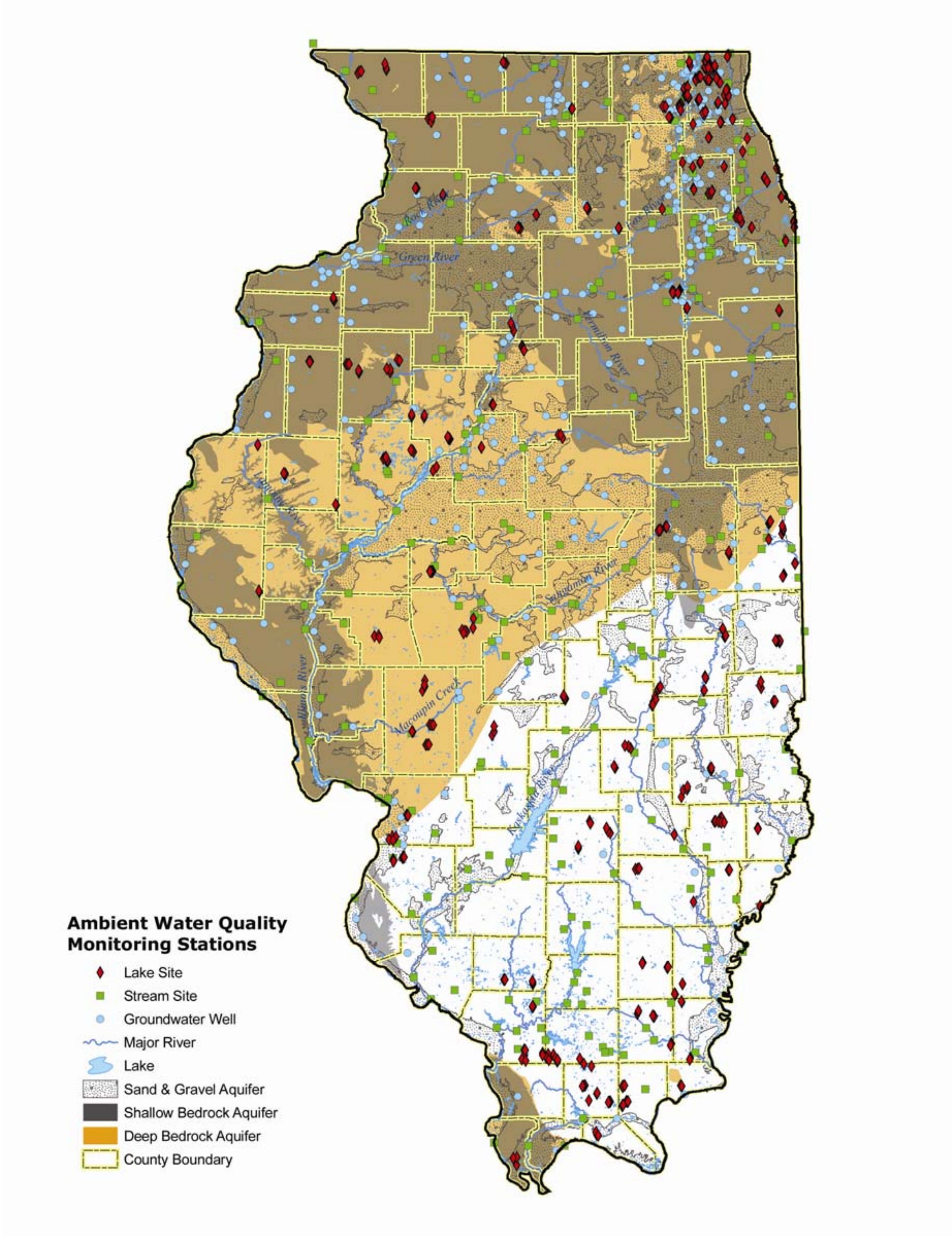
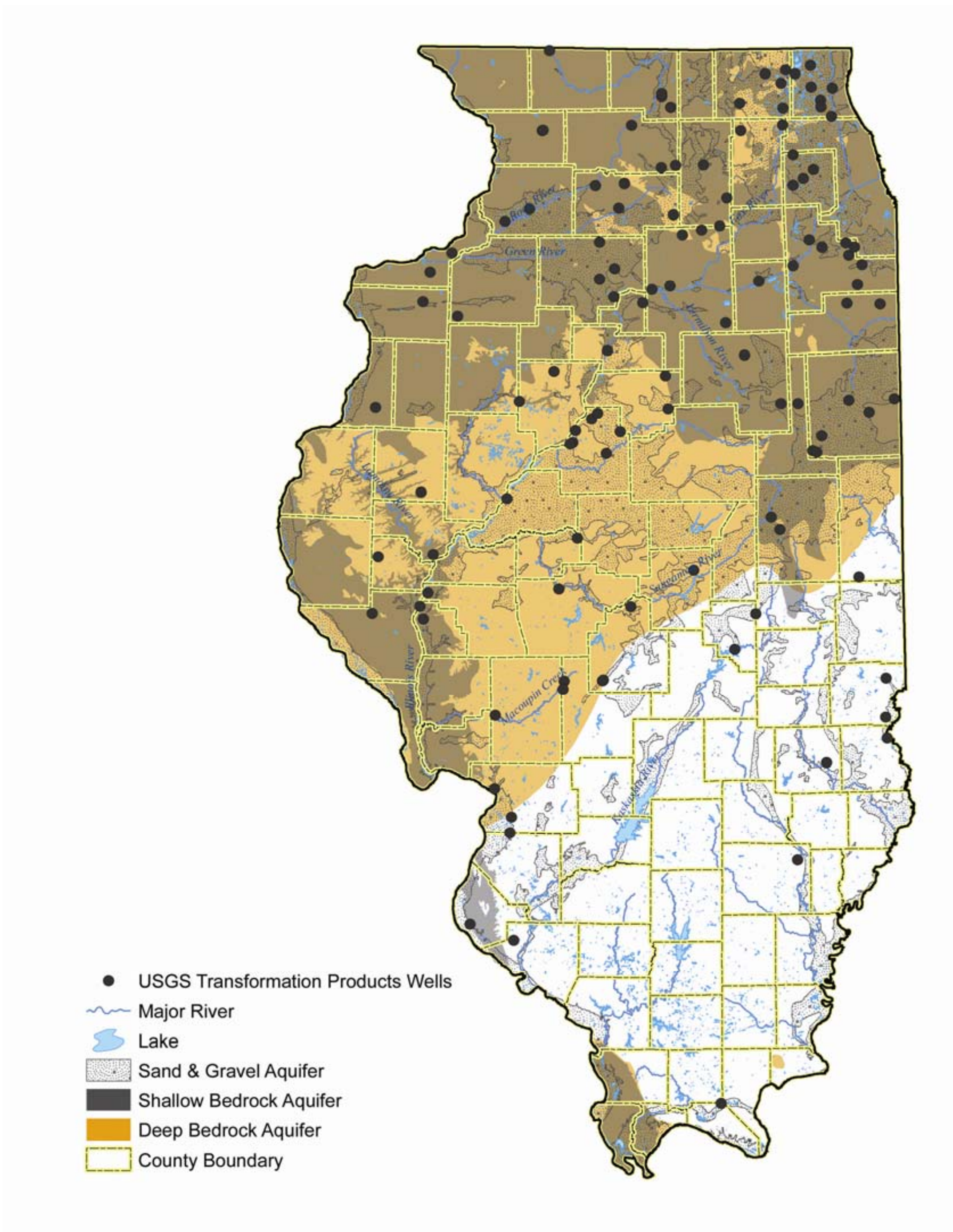


Figure D-7. Illinois EPA's integrated surface and groundwater monitoring network sites.



A cooperative was established with the USGS to evaluate the occurrence of pesticides and their transformation products in CWS wells (Mills and McMillan, 2004). A random stratified statistical method was used to select 117 wells from the 356 well fixed station network to ensure representation of the major aquifer types in Illinois. Figure D-8 illustrates the 117 wells in this sub-network relative to the major aquifers (Note: the term major and principal aquifers are used interchangeably).

Figure D-8. USGS Sub-network of Pesticides and Their Transformation Products.



As previously described, Section 7 of the IGPA required the establishment of a statewide ambient groundwater monitoring network coordinated by the ICCG, and comprised of CWS wells; non-CWS[6] wells; private wells; and dedicated monitoring wells. Illinois also used a statistically-based approach for designing: a pilot rural private well monitoring network (Schock et al. 1992) and the Illinois Department of Agriculture (IDA) dedicated pesticide monitoring well network (Mehnert et al. 2005). The ICCG also coordinates with the USGS on groundwater monitoring.

The ISWS has evaluated groundwater quality data from the Illinois EPA's data base for CWS wells in northeastern Illinois (Kelly and Wilson, 2004). Kelly and Wilson indicate that: "Historical shallow groundwater chloride (Cl^-) concentrations from the Chicago metropolitan area have been evaluated for data quality and temporal trends. Chloride concentrations are increasing in municipal wells in the outermost counties of the Chicago metropolitan area, with road salt runoff likely the largest source of contamination. In the vast majority of municipal wells in DuPage, Kane, McHenry, and Will Counties, Cl^- concentrations have been increasing. More than half of the wells in these four counties have rate increases greater than 1 mg/L per year (yr) and approximately 13% have increases greater than 4 mg/L/yr. On the other hand, Cl^- concentrations have not been increasing in most municipal wells in Cook and Lake Counties. Approximately 16% of the samples collected from municipal wells in northeastern Illinois in the 1990s had Cl^- concentrations greater than 100 mg/L; median values were less than 10 mg/L prior to 1960, before extensive road salting."

Additionally, the ISWS conducted studies in Kane County that shows that there is an increasing trend of total dissolved solids (TDS) concentrations of samples (private wells) from the eastern third of the county were significantly higher than elsewhere in the county (Kelly, 2005). According to the ISWS, the ions of greatest concern are chloride and sulfate. Almost two-thirds of the samples from the eastern wells sampled had TDS, chloride, and/or sulfate concentrations above drinking water standards (Kelly, 2005).

Dedicated Monitoring Well Network for Illinois Generic Management Plan for Pesticides in Groundwater

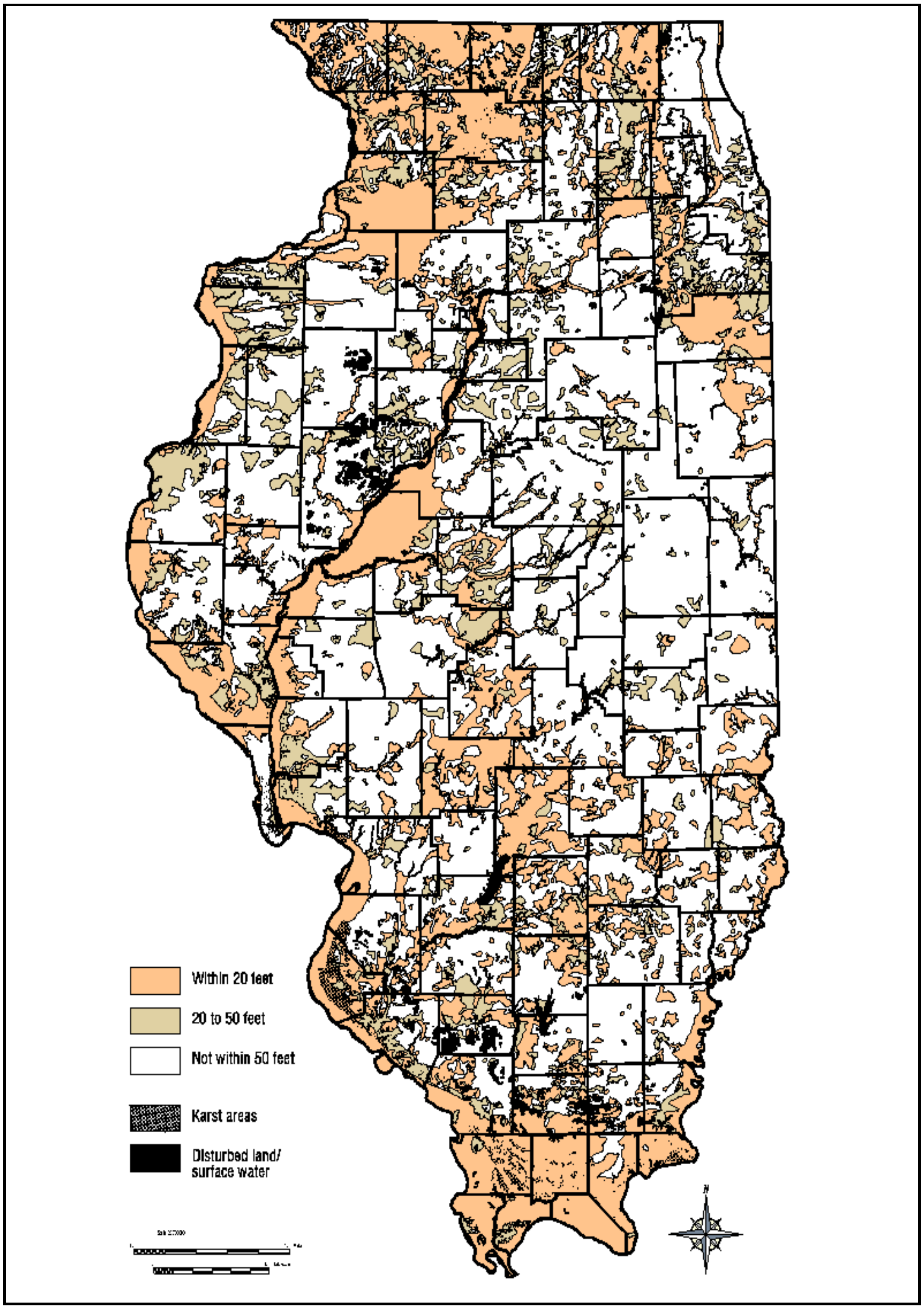
The monitoring well network is designed to provide statistically reliable estimates on the occurrence of selected pesticides (the pesticides include herbicides) in groundwater within shallow aquifers (depth to the top of aquifer material less than 50 feet below land surface shown in Figure D-9) in areas of corn and soybean production. Occurrence is defined as the presence of a specific pesticide at a concentration above the minimum reporting level.

The network was designed to determine the regional impacts of pesticide leaching from nonpoint sources, not the impacts of site-specific point sources. The network is not a research program, but a tool for the management of pesticides in Illinois. Consequently, the pesticides selected as analytes are those with high use in Illinois and/or were previously detected in groundwater in Illinois or other Midwestern states. Also reflecting the management tool approach is the decision to set minimum reporting levels at a maximum of five percent of the groundwater reference

[6] "Non-Community Water System" means a public water system which is not a community water system, and has at least 15 service connections used by nonresidents, or regularly serves 25 or more nonresident individuals daily for at least 60 days per year. (Section 9(a)(4) of the Illinois Groundwater Protection Act [415 ILCS 55/9(a)(4)]).

value, but not to expend limited laboratory resources on detecting pesticides at very low concentrations. The monitoring network and IDA's pesticide laboratory operate in compliance with U.S. EPA-approved quality assurance project plans.

Figure D-9. Aquifer material less than 50 feet below land surface.



The network currently consists of 144 shallow groundwater-monitoring wells located throughout the state, varying in depth from 10 to 83 feet (Figure D-10). Wells are constructed of two-inch inside diameter PVC well casing. Most wells have a five-foot long slotted well screen. Each well is located in public rights-of-way adjacent to row crop fields. All of the wells are installed in areas where aquifer materials occur within 50 feet of land surface.

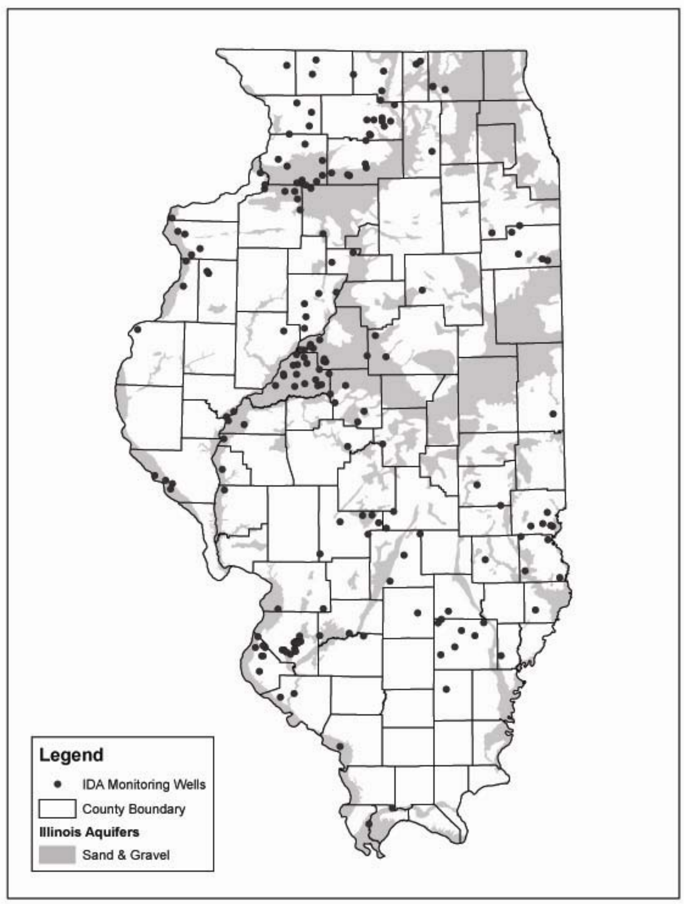
Each well in the network is sampled once during a two-year period. The ISGS and ISWS conducted a one-time sampling of the network beginning in the fall of 1998 and sampled the network from September 2000 through June 2001. IDA assumed responsibility for all sampling in July 2001. IDA will continue to sample the entire network of wells in two-year cycles. IDA intends to continue to follow the sampling and analysis plan laid out in the generic management plan and the quality assurance project plan for the foreseeable future. If current trends in the occurrence of pesticides continue, some adjustments to the sampling plan may be considered.

USGS Illinois River Basin National Water Quality Studies

As part of the National Water Quality Assessment (NAWQA) program, the USGS is assessing both the Lower and Upper Illinois River Basins (LIRB and UIRB, respectively). A summary report of the LIRB data collection is available (USGS Circular 1209); a similar summary of the UIRB activities (USGS Circular 1230) was completed in December 2003.

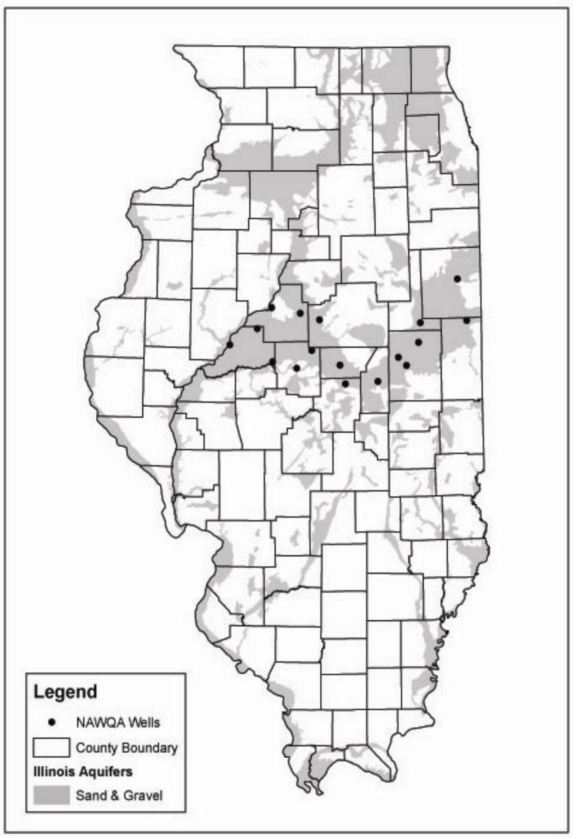
In July and August 2007, the USGS NAWQA program sampled 17 public supply wells in the Mahomet Aquifer (Figure D-11) in a one-time assessment of raw and treated groundwater source drinking water. Raw groundwater was collected at a specific well and analyzed for VOCs, pesticides, selected pesticide transformation products, compounds specific to human waste water, and bacteria (Table D-2). Treated wastewater was also sampled and analyzed for a similar set of constituents plus trihalomethanes.

Figure D-10. IDA dedicated pesticide monitoring well network locations.



In 2002 and 2005, a five-well subset of the original Mahomet Aquifer network of wells was resampled for suites of pesticides, trace elements, and VOCs. In May and June of 2007, the NAWQA program resampled a network of 30 wells in the Mahomet Aquifer that were first sampled in 1996. The wells are mostly private water supplies and a few production wells. They were sampled for a large suite of constituents including VOCs, pesticides, and dissolved hydrogen. A subset of five of these wells is resampled in odd-numbered years.

Figure D-9. NAWQA Wells in the Mahomet Aquifer.

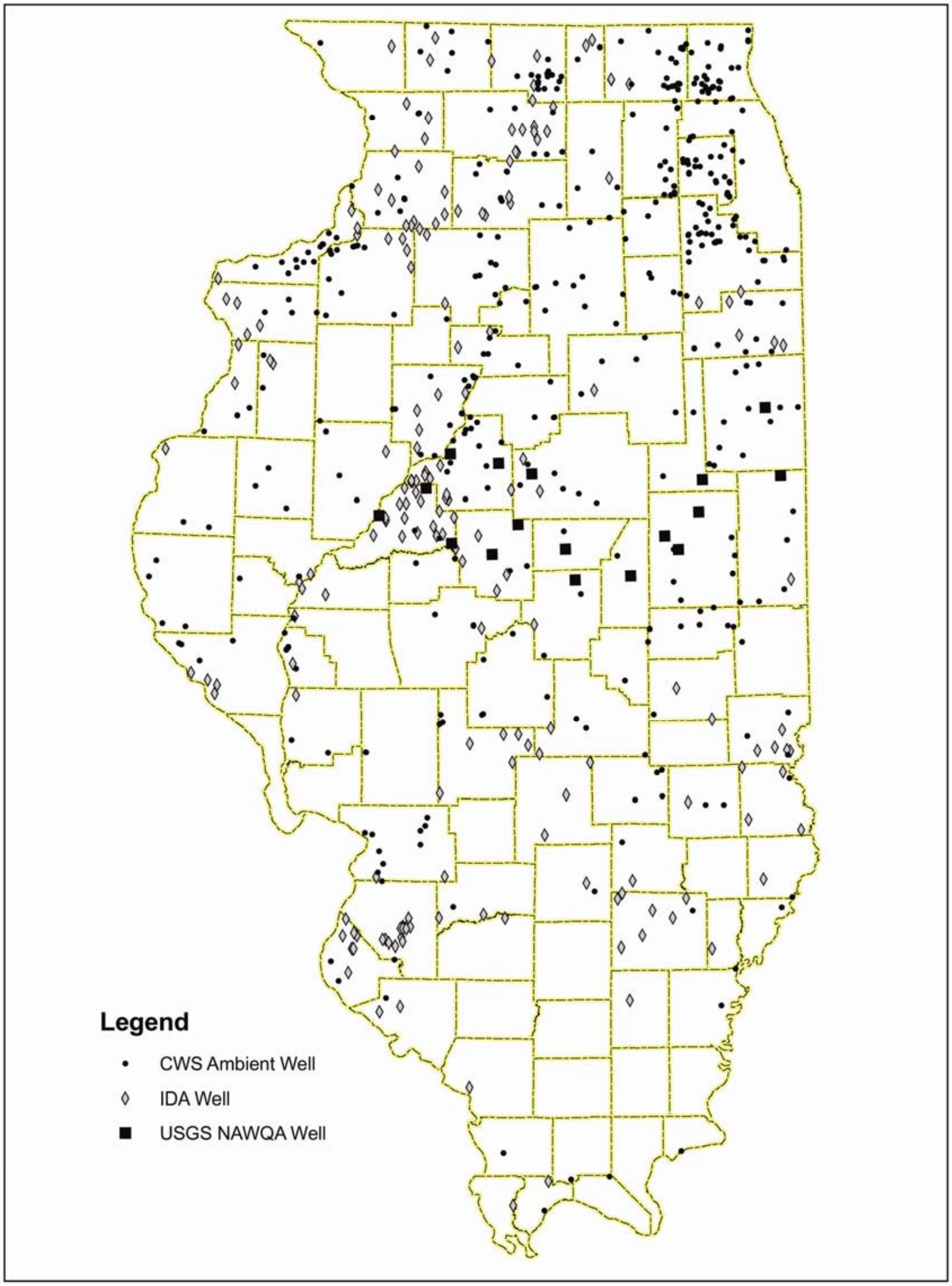


Two UIRB land use groundwater study networks were resampled in 2002, 2005, and 2007. These were also five-well subsets of the networks sampled originally. The five-well sample subsets of the land use studies will continue to be collected in odd-numbered years. In 2004 and 2005, a new urban land use network of monitoring wells was installed in the St. Louis metropolitan area as part of cycle two of the LIRB. The complete network of 24 monitor wells (13 in Illinois and 11 in Missouri) in recently developed (since 1980) residential or commercial land cover, plus two reference wells, was sampled during July and August 2005. Samples were analyzed for pesticides, VOCs, and trace elements. Most well samples were also analyzed for sulfur hexafluoride to estimate the date of groundwater recharge. A subset of five wells and a reference well were resampled in July 2007. This subset of six will be resampled in odd-numbered years, and the entire network will be resampled in 2015. Figure D-12 provides an integrated picture of the Illinois EPA, IDA, and USGS monitoring network wells.

Table D-2. Other anthropogenic compounds analyzed in the NAWQA network wells.

Compound	Primary Use or Source
1-Methylnaphthalene	Gasoline
2,6-Dimethylnaphthalene	Gasoline
2-Methylnaphthalene	Gasoline
3-beta-Coprostanol	Plant- or animal-derived biochemical
3-Methyl-1(H)-indole (Skatole)	Plant- or animal-derived biochemical
3-*tert*-Butyl-4-hydroxy anisole (BHA)	Personal care and domestic use products
4-Cumylphenol	Personal care and domestic use products
4-*n*-Octylphenol	Personal care and domestic use products
4-*tert*-Octylphenol	Personal care and domestic use products
5-Methyl-1H-benzotriazole	Manufacturing additive
Acetophenone	Personal care and domestic use products
Acetyl hexamethyl tetrahydronaphthalene (AHTN)	Personal care and domestic use products
Anthracene	Pavement & combustion
Anthraquinone	Organic synthesis compound
Benzo[*a*]pyrene	Pavement & combustion
Benzophenone	Personal care and domestic use products
beta-Sitosterol	Plant- or animal-derived biochemicals
beta-Stigmastanol	Plant- or animal-derived biochemicals
Bisphenol A	Manufacturing additive
Caffeine	Personal care and domestic use products
Camphor	Personal care and domestic use products
Carbazole	Organic synthesis compound
Cholesterol	Plant- or animal-derived biochemical
Cotinine	Personal care and domestic use products
d-Limonene	Personal care and domestic use products
Fluoranthene	Pavement & combustion
Hexadydrohexamethylcyclopentabenzopyran (HHCB)	Personal care and domestic use products
Indole	Personal care and domestic use products
Isoborneol	Personal care and domestic use products
4-octylphenol diethoxylate (OPEO2)	Personal care and domestic use products
4-octylphenol monoethoxylate (OPEO1)	Personal care and domestic use products
4-Nonylphenol	Personal care and domestic use products
p-Cresol	Solvent
Pentachlorophenol	Fungicide
Phenanthrene	Pavement & combustion
Phenol	Personal care and domestic use products
Pyrene	Pavement & combustion
Tri(2-butoxyethyl)phosphate	Manufacturing additive
Tri(2-chloroethyl)phosphate (TCEP)	Manufacturing additive
Tributyl phosphate	Manufacturing additive
Triclosan	Personal care and domestic use products
Triethyl citrate (ethyl citrate)	Personal care and domestic use products
Triphenyl phosphate	Manufacturing additive
Tris(dichlorisopropyl)phosphate (TCPP)	Manufacturing additive

Figure D-12. Integrated Illinois EPA, IDA, and USGS monitoring network wells.



D-2. Assessment Methodology

Overall Use Support

Though there are many uses of groundwater in Illinois, the groundwater use assessments are based primarily upon CWS chemical monitoring analyses. The assessment of chemical monitoring data essentially relies on the Board's Class I: Potable Resource Groundwater standards.

The fixed station probabilistic network of CWS is utilized to predict the likelihood of attaining full use support in the major aquifers in Illinois. As previously described, the overall use support is based on compliance with Illinois' Class I GWQS. Class I standards include the nondegradation standards. The attainment of use support is described as Full and Nonsupport, as described below:

<u>Full Support</u>
Good - indicates that no detections occurred in organic chemical monitoring data and inorganic constituents assessed were at or below background levels for the groundwater source being utilized.

<u>Nonsupport</u>
Fair - indicates that organic chemicals were detected and therefore exceed the nondegradation standard, but measured levels are less than the numerical Class I GWQS, and inorganic constituents assessed were above background level (nondegradation standard) but less than the numerical Class I GWQS.

Poor - indicates that organic chemical monitoring data detections were greater than the Class I GWQS and inorganic chemicals assessed were greater than both the background concentration and Class I GWQS.

Organic results in the probabilistic network of CWS wells, which are commonly known to be anthropogenic in nature, were analyzed by well and year. It was determined that a detection of an organic contaminant would be recorded and not averaged. In this manor, the Illinois EPA is able to track the contamination and determine if a trend in that CWS well exists.

Individual Use Support

Groundwater in Illinois supports many uses. For over 50 years, the USGS has been collecting data on estimated water withdrawals by state, source of water, and category. According to the USGS[(7)], the major uses of groundwater in Illinois are domestic, public water supply, agricultural, livestock, industrial, and thermoelectric.

According to the USGS, Illinois uses approximately 13.8 billion gallons of fresh water per day. Only a small percentage - 816 million gallons per day (MGD), is from groundwater sources (Figure D-13). Public water supplies use most of the groundwater with over 365 MGD (43%), followed by irrigation - 160 MGD (18%). Domestic, which includes private well usage, withdraws slightly more than 135 MGD (17%), followed by industrial at 132 MGD and livestock - 38 MGD (5%). Thermoelectric sources round off the bottom of this list with approximately 6 MGD (1%) of groundwater usage in the State.

In addition, the ISWS conducts an annual survey of Illinois CWSs as to how much water they use in a year. These data are presented in Figure D-14 in million gallons per day. For purposes of this discussion, only community CWS use will be considered for the following assessment. All other uses are assumed to be full with the exception of Domestic, which is assessed by the Illinois Department of Public Health.

The ISWS has updated an analysis of groundwater use to aquifer potential yield in

Figure D-13. Groundwater Withdrawals in Illinois.

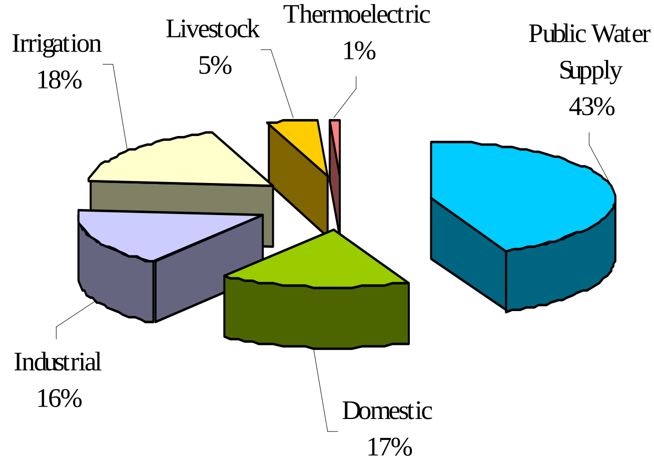
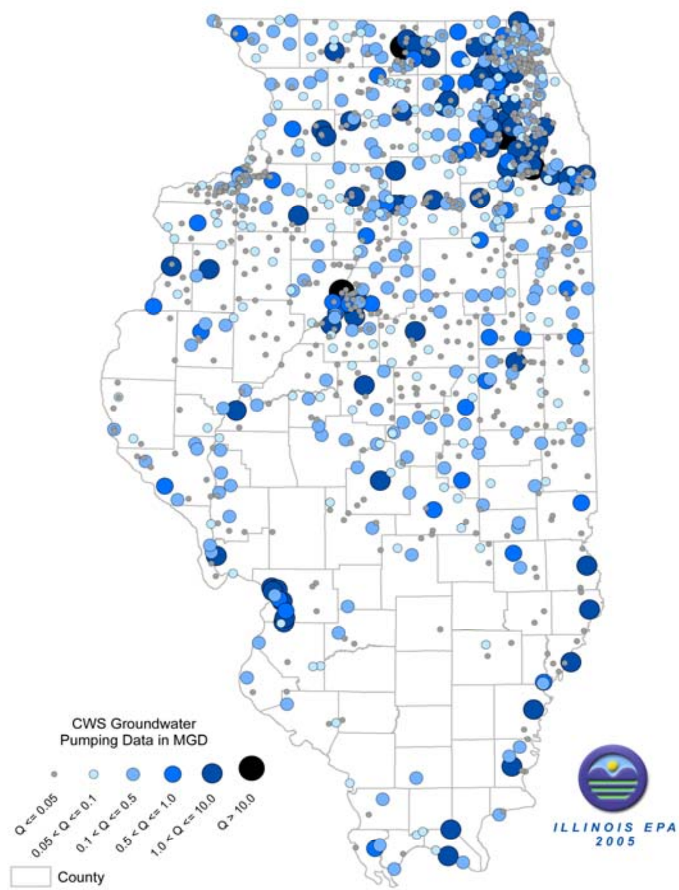


Figure D-14. Statewide CWS Pumping Rates (ISWS, 2004)



[7] Based on USGS Circular 1268, March 2004, which can be found at http://water.usgs.gov/pubs/circ/2004/circ1268/index.html

Illinois and prepared a report summarizing the findings (Wehrmann, 2003). This report compared Year 2000 groundwater withdrawals against estimated aquifer potential yields. The comparison is presented as a ratio of groundwater use (withdrawals) to groundwater yield (i.e., potential aquifer yield) on a township basis. A high use-to-yield ratio (e.g., >0.9) suggests an area where groundwater availability problems exist or could be impending[8] (Wehrmann, 2003). For further, detail see the ISWS report at: http://www.sws.uiuc.edu/pubdoc/CR/ISWSCR2004-11.pdf.

Wehrmann (2003) pointed out that major withdrawals from sand and gravel aquifers can be seen in the Metro-East area of St. Louis and in Quincy along the Mississippi River; in the Peoria-Pekin area along the Illinois River, in the Fox River corridor in northeastern Illinois, and in the Champaign area of east-central Illinois. Major withdrawals from the shallow bedrock aquifers can be clearly seen almost solely in northeastern Illinois in southern Cook, Kankakee and Will counties for communities such as Crest Hill, Lockport, Manteno, New Lenox, Park Forest, and Romeoville (Wehrmann, 2003). Major withdrawals from deep bedrock aquifers are found spread across northern Illinois, particularly in the Rockford area of north-central Illinois, the Fox River corridor, and farther south in the area of Joliet and the I-55 industrial corridor near Channahon (Wehrmann, 2003).

Groundwater contributes to stream flow in the form of base flow in many of these river corridors. Thus, stream flows may also be impacted in areas where the ratio of use to yield is > 0.9. This is especially true in northeastern Illinois due to the following factors: Supreme Court limitations on Lake Michigan; continued population growth; and a deep aquifer condition beyond sustainable recharge. It is predicted that these factors will force an increased reliance on the use of sand and gravel and shallow bedrock aquifer resources. These shallow aquifers are in direct hydraulic connection to surface waters. Decreased base flow in the stream may have an impact on surface water quality and stream habitat.

In addition, some groundwater in Illinois is designated as "special resource." Special Resource Groundwater is described as the groundwater contributing to highly sensitive areas such as dedicated nature preserves that supports ecologically sensitive areas such as the Parker Fen in McHenry County and the Southwest Sinkhole Karst Plain located in Monroe, St. Clair and Randolph counties.

[8] (Note: The delineation of high groundwater use to-yield areas by this method should be considered simply as a means for calling attention to areas to prioritize on a statewide basis for water resources planning and management (Wehrmann, 2003).)

D-3. Potential Causes and Potential Sources of Impairment

Potential Causes of Impairment

As previously stated, when possible, assessments of overall groundwater use support is based upon application of Illinois' GWQS (including non-degradation standards) to water quality sample measurements from the probabilistic network of CWS wells. Generally, a detection of an organic contaminant above the laboratory practical quantification limit or the detection of an inorganic constituent above the naturally occurring background level in a CWS well is considered a cause of less than full use support.

Potential Sources of Impairment

Illinois EPA used its database of potential sources that have been inventoried as part of well site surveys, hazard reviews; groundwater protection needs assessments, source water assessments, and other special field investigations to evaluate potential sources of contamination relative to CWS WHPAs. Further, the Illinois EPA utilized its Geographic Information System (GIS) to calculate land use activities proximate to the probabilistic network of CWS wells[9]. Table D-3 describes the most prevalent (common) potential sources of groundwater contamination in Illinois relative to CWS WHPAs.

[9] County by county land cover grid data for Illinois derived from Thematic Mapper (TM) Satellite data from the Landsat 4 sensor. Dates of the imagery used range from April 1991 to May, 1995.

Table D-3. Most Prevalent Potential Sources of Ground Water Contamination(10).

Contaminant Sources	Occurrence of Potential Source(11)	Contaminants(12)
AGRICULTURAL ACTIVITIES		
Agricultural chemical facilities	587	A, B, E
Animal feedlots	66	E, J, K, L
Drainage wells	3	A, B, C, D
Fertilizer applications	323	A, B, E
Irrigation practices	63	A, B, E
Pesticide applications	174	A, B, E
STORAGE AND TREATMENT ACTIVITIES		
Land Application	14	A, B, D, E, G, H, J
Material stockpiles	683	G, H
Storage tanks (above ground)	2,249	C, D
Storage tanks (underground)	2,878	C, D
Surface impoundments	236	E, G, H, J, K, L
Waste piles	231	E, G, H
Waste tailings	9	G, H, I, J
DISPOSAL ACTIVITIES		
Deep injection wells	9	A, B, C, D, E, F, G, H, I, M
Landfills	40	C, D, G, H, J
Septic systems	6,290	E, G, H, J, K, L
Shallow injection wells	9	A, B, C, D, E, F, G, H, J, K, L
OTHER		
Hazardous waste generators	-	A, B, C, D, G, H
Hazardous waste sites	97	A, B, C, D, G, H
Industrial Facilities	1,565	A, B, C, D, G, H
Material transfer operations	232	A, B, C, D, E, F, G, H
Mining and mine drainage	19	G, H, M
Pipelines and sewer lines	111	C, D, E, G, H, J, K, L
Salt storage and road salting	76	G
Salt water intrusion	-	G
Spills	9	A, B, C, D, E, G, J
Transportation of materials	164	A, B, C, D, E
Manufacturing/repair shops	1,554	C, D, G, H
Urban runoff	1,184	A, B, D, E, G, H, J, K, L
Other sources (potential routes of contamination such as drainage wells, improperly abandoned potable water wells, or sand & gravel quarries)	249	A, B, D, E, J, K, L
FACILITY TREATMENT AND RECREATION		
Former Storage Facility	113	A, B, C, D, E, G, H
Commercial Waste or Chemical Handling Facility	1,078	C, D, E, G, J
Public Utilities Facility	203	E, F, G, H, J, K, L
Waste Treatment Facility	202	E, G, H, J, K, L
Recreational facility of area	581	J, L
Agriculture Materials Storage and Sales	-	A, B, E, G, M

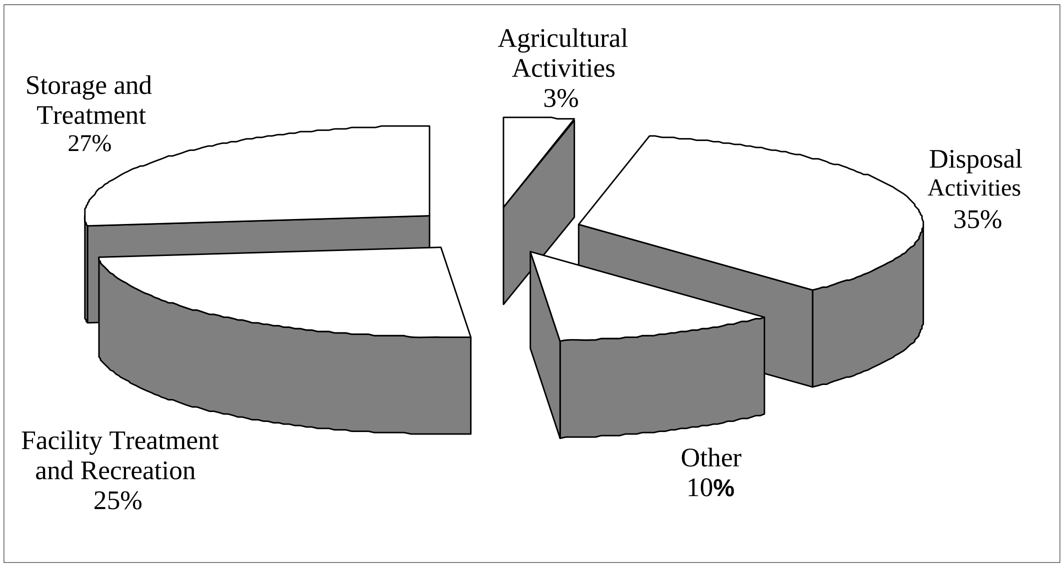
10 The basis for the analysis provided in this table is a combination of existing monitoring data and potential source of groundwater contamination data from the completed CWS well site survey reports which Illinois EPA has conducted over the past 20 years.

11 Occurrences are based solely on the Illinois EPA Groundwater Section's existing databases. This is only an estimate and should not be used as anything more than an approximation of potential sources of contamination to CWS wells in Illinois.

12 Contaminants: A. Inorganic pesticides; B. Organic pesticides; C. Halogenated solvents; D. Petroleum compounds; E. Nitrate; F. Fluoride; G. Salinity/brine; H. Metals; I. Radio-nuclides; J. Bacteria; K. Protozoa; L. Viruses; and M. Other.

The Illinois EPA identified 16,354 potential sources of contamination of which 1,163 are considered threatening. Figure D-15 shows the most threatening potential contamination sources associated with CWS wells with VOC detects. The most prevalent potential source grouping was land disposal activities (2,953 sites) and the most threatening potential source grouping was chemical/petroleum processing/storage (255 sites) facilities.

Figure D-15. Most threatening potential contamination sources in community water supply wells with volatile organic compound detections.



In addition, ISWS research on CWS wells in Northeastern Illinois has also determined that road salting is the most threatening potential source causing and contributing to Cl- contamination above background in Northeastern Illinois. Approximately 16% of the samples collected from CWS wells in northeastern Illinois in the 1990s had Cl_- concentrations greater than 100 mg/L, and median values were less than 10 mg/L, prior to 1960, before extensive road salting (Kelly and Wilson, 2004).

The current occurrence of herbicide compounds found in the pesticide sub-network of the CWS probabilistic network of wells indicates that various factors, along with current agricultural land use contribute to herbicide occurrence. It appears that many areas that were once rural agricultural land use have now been encompassed by urban land use. The USGS study of herbicide transformation and parent products determined:

> "… a strong inverse relation (-0.81) between current use of land for corn and soybean production and the current occurrence of herbicide compounds in underlying aquifers indicates that various factors, along with current agricultural land use contribute to herbicide occurrence. These factors include, among others, land-use history, ground-water age, ground-water flow patterns, geology, soil microbiology, and chemistry and persistence of the herbicide compounds (Mills and McMillan, 2004)."

IDA's dedicated monitoring network wells are located in right-of-ways adjacent to agricultural cropland. Thus, agricultural cropland is the most threatening potential source of pesticide contamination in this network.

D-4. Monitoring Results

IDA Dedicated Pesticide Monitoring Well Network Results

Four rounds of sampling of the monitoring wells have been completed. During these periods, analytical detection levels and minimum reporting levels have varied. In order to allow comparison between the sampling periods, the following data on the frequency of occurrence reflect the presence of a pesticide at or above the minimum reporting levels used in the most recent sampling round in 2004 through 2006 (Table D-4). The overall frequency of occurrence refers to the presence of any pesticide, or multiple pesticides, from a single groundwater sample. For example, the occurrence of two pesticides present in a single well sample at concentrations above the minimum reporting level is considered a single detection above the minimum reporting level.

From September 1998 through August 1999, samples were collected from 112 network wells and analyzed for the presence of 14 pesticides (Mehnert et al. 2001). Results indicate an overall frequency of occurrence of 6.3 percent. Results of the second round of sampling of the network wells (148 samples collected between September 2000 and August 2002) indicate an overall frequency of occurrence of 3.4 percent. Atrazine was detected in three samples and two of those samples had concentrations (0.58 and 0.85 ug/L) above the action level of 0.3 ug/L. Cyanazine, metribuzin, and metolachlor were each detected in one sample, but none of those samples had concentrations above levels of concern. Results of the third sampling period (142 samples collected from October 2002 through September 2004) indicate that parent pesticides were detected in three of the 142 samples (2.1 percent). Atrazine was detected in two samples, and metolachlor was detected in one sample. None of those samples had concentrations above levels of concern. One or more of the atrazine transformation products (desethylatrazine, desisopropylatrazine, and desethyldeisopropyl atrazine) were present above the minimum reporting levels in 18.3 percent of the samples.

Table D-4. Minimum reporting levels, action levels, and groundwater reference levels.

Analyte	Minimum Reporting Level (ug/L)	Action Level Value (ug/L) (1)	Groundwater Reference Value (ug/L)	2004-2006 Frequency of Occurrence (%)
acetochlor	0.10	0.2	2 (2)	0
acetochlor ESA	0.30	--	--	8.7
acetochlor OXA	0.30	--	--	0.7
alachlor	0.10	0.2	2	0
alachlor ESA	0.30	--	--	36.9
alachlor OXA	0.30	--	--	0
atrazine	0.15	0.3	3 (3)	4.3
desethylatrazine (DEA)	0.15	--	--	8
desisopropylatrazine (DIA)	0.15	--	--	3.6
deethyldesisopropylatrazine (DEDIA)	0.15	--	--	12.3
metolachlor	1.0	10	100 (4)	2.2
metolachlor ESA	0.30	--	--	50.7
metolachlor OXA	0.30	--	--	13.8
metribuzin	1.0	20	200 (4)	0
prometon	1.0	10	100 [4]	0
simazine	0.40	0.4	4 (3)	0

[1] Action level equals 10 percent of the Groundwater Reference *http://www.epa.gov/waterscience/drinking/standards/dwstandards.pdf*
[2] Calculated on the basis of the Reference Dose, which is an estimate (with uncertainty spanning perhaps an order of magnitude) of a daily oral exposure to the human population (including sensitive subgroups) that is likely to be without an appreciable risk of deleterious effects during a lifetime.
[3] Groundwater Quality Standards for Class I: Potable Resource Groundwater, Illinois Admin. Code Part 620.410.
[4] HA: Health Advisory. An estimate of acceptable drinking water levels for a chemical substance based on health effects information; a Health Advisory is not a legally enforceable federal standard, but serves as technical guidance to assist federal, state, and local officials.

Results of the most recent sampling period (138 samples collected from October 2004 through September 2006) indicate that parent pesticides were detected in eight of the 138 samples (5.8 percent). Atrazine was detected in six samples, and metolachlor was detected in three samples. None of those samples had concentrations above levels of concern. One or more of the atrazine transformation products (desethylatrazine, desisopropylatrazine, and desethyldeisopropyl atrazine) was present above the minimum reporting levels in 14.5 percent of the samples. In 2004, IDA added transformation products of the chloroacetanlide herbicides (alachlor, acetochlor, and metolachlor) to the list of analytes. One or more of these transformation products was detected in more than 50 percent of the samples.

CWS Probabilistic Monitoring Network Results

Statistics have a critical role in determining environmental impacts to groundwater quality, especially with respect to IOCs. The problem is technically interesting: given a new measurement for a well in the network, drilled in a particular aquifer, and analyzed for a particular substance, what is the probability that the measurement represents an effect of an unnatural source (Gibbons, 1995). Thus, this becomes a problem of statistical prediction. Given a collection of historical or background measurements for a substance, what limit or interval will contain the new measurement with a desired level of confidence. The wells in the CWS probabilistic network are not necessarily located in areas geographically removed from potential sources of contamination, as described above (Gibbons, 1995).

Illinois EPA is using box and whisker plots to represent a snapshot of IOC measurement results for network wells drilled in particular aquifers. As illustrated in Figure D-15 a box and whisker plot provides a statistical prediction of the concentration of a substance bounded by percentiles. In other words, the box plot shows what concentration occurs between 90, 75, and 25 percent of the time for a CWS drilled in a particular aquifer. However, because the historical data set for the network may include measurement results that are due to unnatural sources, additional regional and/or site specific evaluation may be needed to determine if measurements are occurring due to natural versus unnatural sources. For example, recent ISWS research regarding historical shallow groundwater Cl^- concentrations from the Chicago metropolitan area has been evaluated for data quality and temporal trends. Chloride concentrations are increasing in municipal wells in the outermost counties of the Chicago metropolitan area, with road salt runoff likely the largest potential source of contamination. In the vast majority of municipal wells in DuPage, Kane, McHenry, and Will Counties, Cl^- concentrations have been increasing. More than half of the wells in these four counties have rate increases greater than 1 mg/L/yr and approximately 13% have increases greater than 4 mg/L/ yr. On the other hand, Cl^- concentrations have not been increasing in most municipal wells in Cook and Lake counties (Kelly and Wilson, 2004).

Figures D-16(a-d) show the IOC results for the CWS probabilistic network wells drilled in sand and gravel, shallow bedrock, deep bedrock, and mixed aquifers. The immediate figure to the left (Figure D-15) is a key to reading the box plots that are contained in those figures

Table D-15. A sample box plot for the following figures.

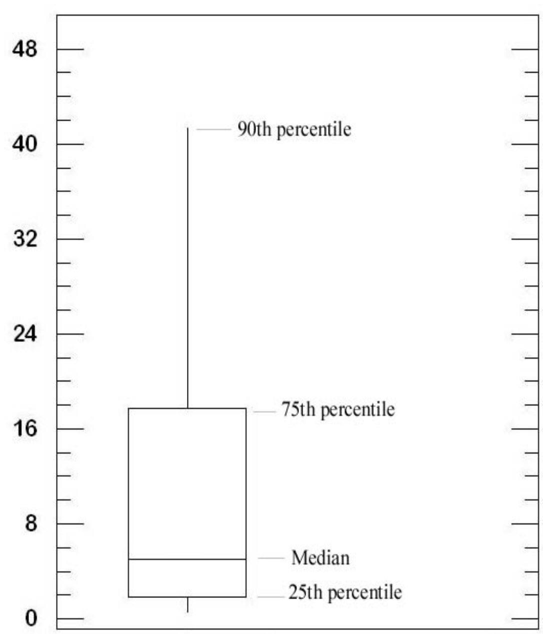


Figure D-16a. Inorganic Water Quality Data in Illinois Principal Aquifers.

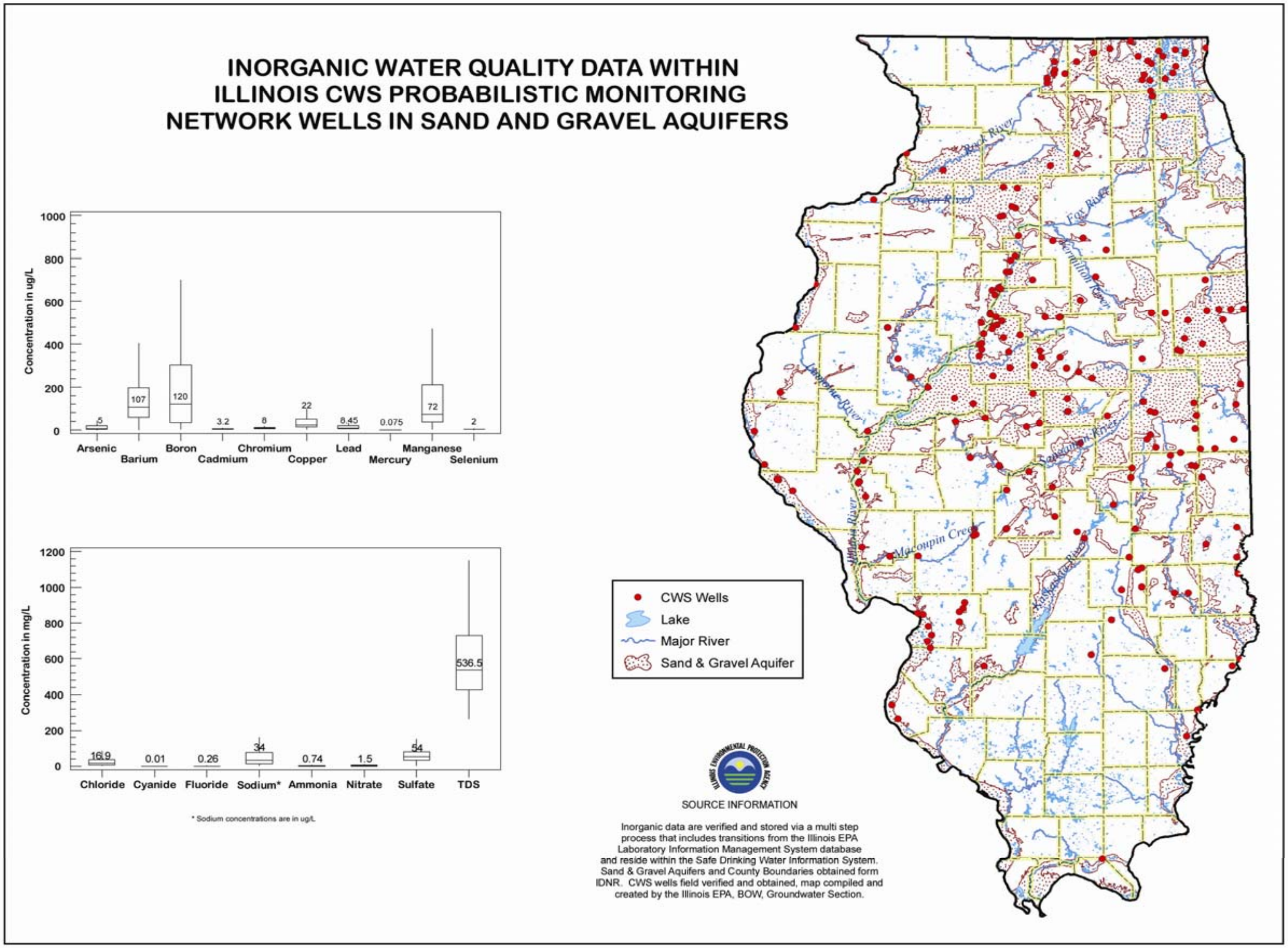


Figure D-16b. Inorganic Water Quality Data in Illinois Principal Aquifers.

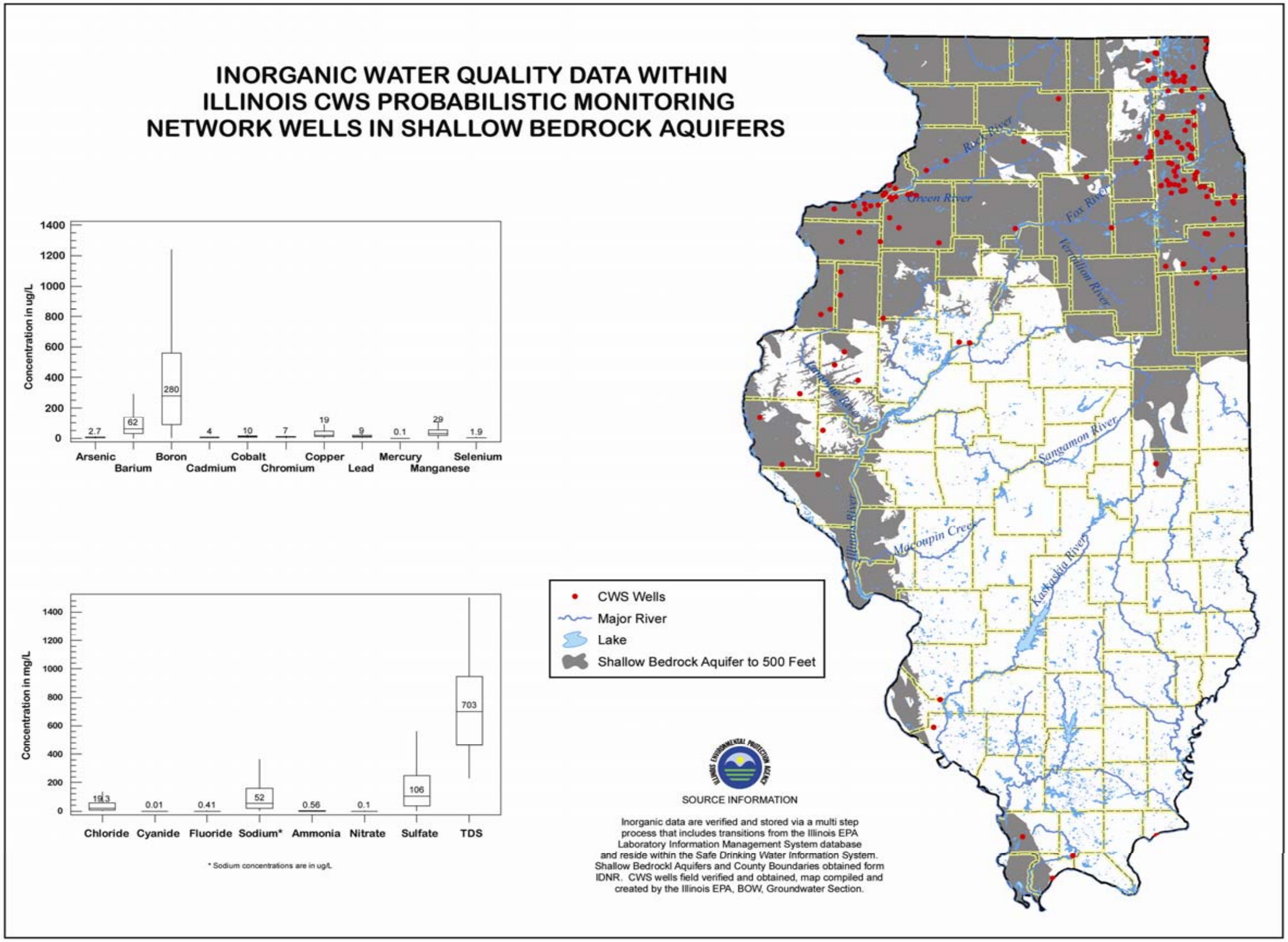


Figure D-16c. Inorganic Water Quality Data in Illinois Principal Aquifers.

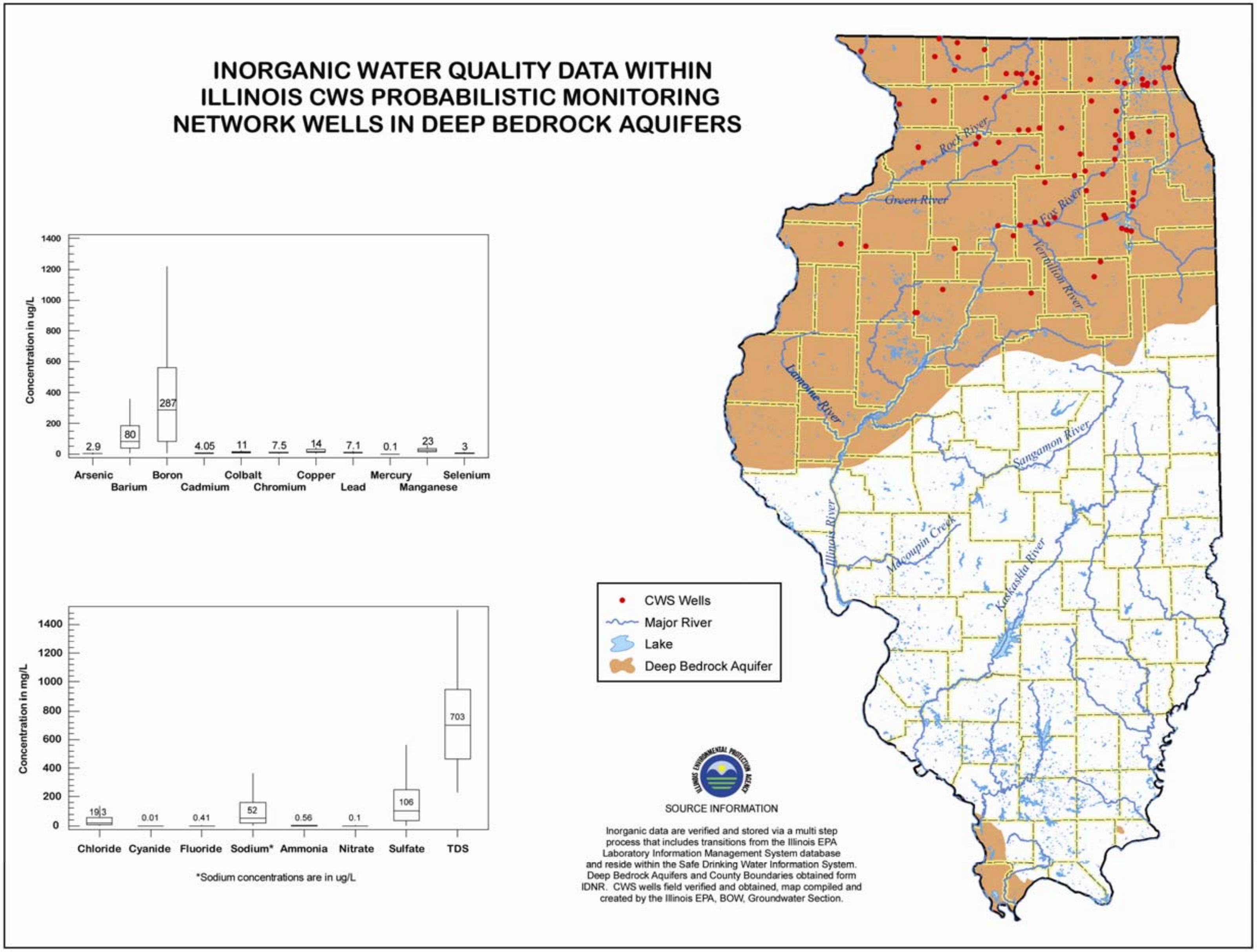
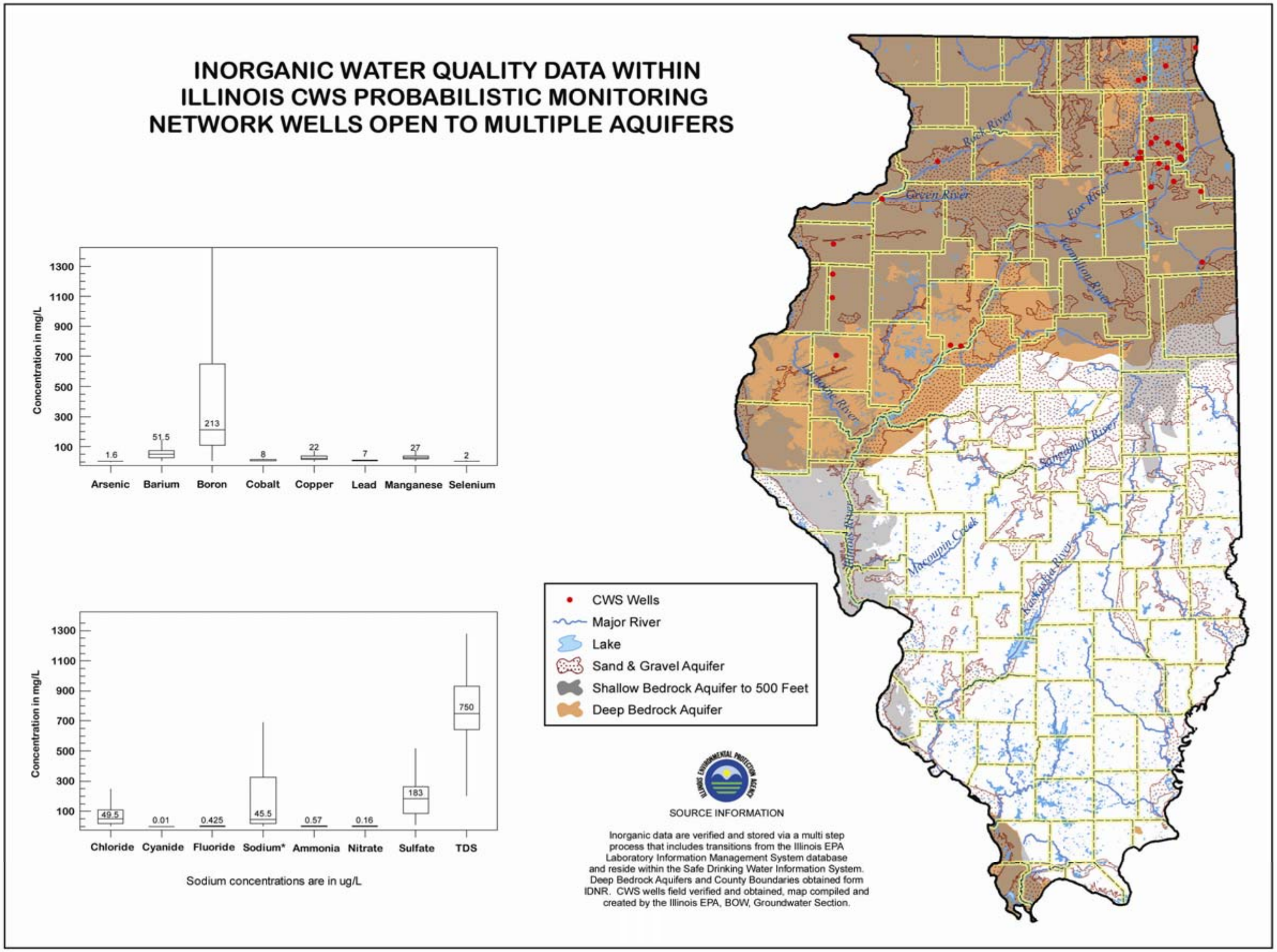


Figure D-16d. Inorganic Water Quality Data in Illinois Principal Aquifers.



The results of sampling the pesticide sub-network of the CWS probabilistic network shows that pesticide compounds were prevalent in Illinois' source-water aquifers, as indicated by the frequency (Table D-5) and spatial distribution of detected pesticides and (or) transformation products (Figure D-17). Parent pesticides (atrazine and metolachlor) were detected in 4 percent of all samples, and parent pesticides and transformation products were detected in 34 percent of samples. Multiple pesticide compounds were detected in 70 percent of samples, with a median of three and a maximum of eight compounds in samples in which more than one compound was detected. Of the 11 detected compounds, 9 were transformation products (Table D-5; Figure D-17). Six chloroacetanilide transformation products, including alachlor ESA (28 percent), metolachlor ESA (26 percent), metolachlor OA (14 percent), and acetochlor ESA (9 percent), were the most frequently detected compounds. Detection frequencies of ESA compounds consistently exceeded those of OA compounds for all chloroacetanilides (for example, alachlor ESA, 28 percent; alachlor OA, 6 percent) (Mills and McMillan, 2004).

Concentrations of detected pesticide compounds ranged from the reporting limit of 0.05 μg/L to 7.24 μg/L (metolachlor ESA), with concentrations of parent pesticides substantially lower than those of their transformation products (Table D-5; Figure D-17). The median concentration of detected parent pesticides was 0.07 μg/L, whereas the median concentration of all detected pesticide compounds, including transformation products, was 0.16 μg/L. The highest concentration of a parent herbicide (atrazine) was 0.22 μg/L, whereas concentrations of the chloroacetanilide transformation products in seven samples (including metolachlor ESA in four samples) exceeded 1 μg/L. Concentrations (maximum, mean, and usually median) of ESA compounds exceeded those of OSA compounds and both exceeded the concentrations of their parent compounds.

As indicated by these findings, the frequency of detection and the concentration greatly increase for most herbicides when their transformation products also are considered (Table D-5; Figure D-17) (Mills and McMillan, 2004).

Figure D-18. Concentrations of detected pesticide compounds and their transformation products.

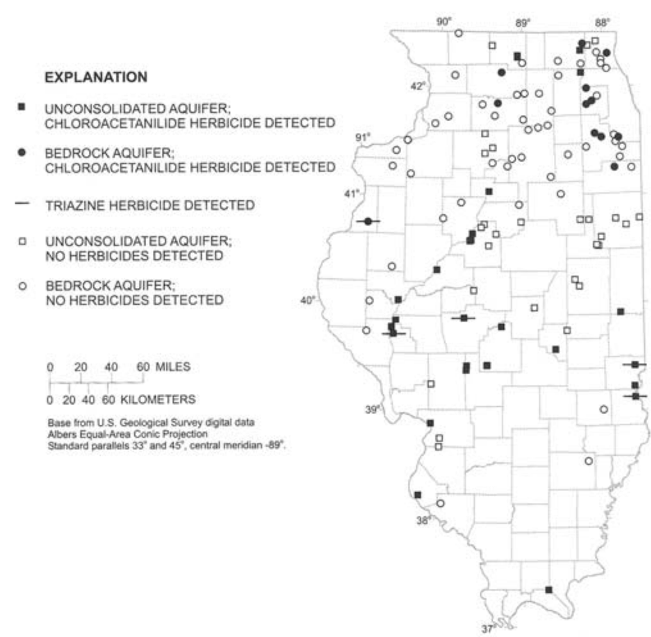


Table D-5. Summary statistics for herbicides and their transformation products in ground-water samples from selected public-supply wells that tap source-water aquifers in Illinois, October 2001–September 2002 (from Mills and McMillan, 2004).

Herbicide compound	Detection frequency (percent)	Median detected concentration (μg/L)	Maximum detected concentration (μg/L)	Herbicide-application rate in Illinois[2] (1,000 pounds)	
2001-02		2001-02	2001-02	1991	2001
Any parent herbicide	4.3	0.07	0.22	na	na
Any herbicide or TP	34.2	0.16	7.24	na	na
Acetochlor	0	na	na	0	8,059
Acetochlor ESA	9.4	0.16	4.18	na	na
Acetochlor OA	5.5	0.16	0.25	na	na
Alachlor	0	na	na	9,400	0
Alachlor ESA	28.2	0.12	2.15	na	na
Alachlor OA	6.0	0.09	0.41	na	na
Atrazine	3.4	0.06	0.22	10,615	14,143
Deethylatrazine[3]	4.3	0.08	0.21	na	na
Deisopropylatrazine[4]	0	na	na	na	na
Cyanazine	0	na	na	4,267	0
Cyanazine amide[5]	0	na	na	na	na
Dimethenamid	0	na	na	0	2,270
Dimethenamid ESA	2.6	0.05	0.16	na	na
Dimethenamid OA	0	na	na	na	na
Glyphosate	0	na	na	381	7,157
Metolachlor	0.9	0.16	0.16	9,277	993
Metolachlor ESA	26.5	0.34	7.24	na	na
Metolachlor OA	14.5	0.18	2.95	na	na
Metribuzin	0	na	na	395	0
Propachlor	0	na	na	0	0
Propachlor ESA[6]	1.0	0.10	0.10	na	na
Propachlor OA	0	na	na	na	na
Simazine	0	na	na	0	265

μg/L = micrograms per liter; na = not applicable. Analyzed for but not detected: acetochlor sulfynil acetic acid (SAA), alachlor SAA, ametryn, flufenacet, flufenacet ethanesulfonic acid (ESA), flufenacet oxanilic acid (OA), glufosinate, AMPA, pendimethalin, prometon, prometryn, propazine, and terbutryn; SAA, ESA, and OA are transformation products (TP) of the associated herbicides; AMPA is a transformation product of glyphosate. Reporting limit for most herbicide compounds was 0.05 μg/L; reporting limit for glyphosate, amino methyl phosphonic acid (AMPA), and glufosinate was 0.10 μg/L.

Maximum contaminant levels (MCL)1 for atrazine, alachlor, simazine, and glyphosate are 3, 2, 4, and 700 μg/L, respectively; health advisory levels1 for cyanazine, metolachlor, and metribuzin are 1, 100, and 200 μg/L, respectively.

1 U.S. Environmental Protection Agency (2003b).

2 U.S. Department of Agriculture (2003). Data are not reported for herbicides applied on less than 1 percent of corn and soybean row-crop acreage or herbicides applied on sweet or processed-corn acreage, which generally represents less than 1 percent of total application on row-crop acreage.

3 Transformation product of atrazine.

4 Transformation product of atrazine, cyanazine, and simazine.

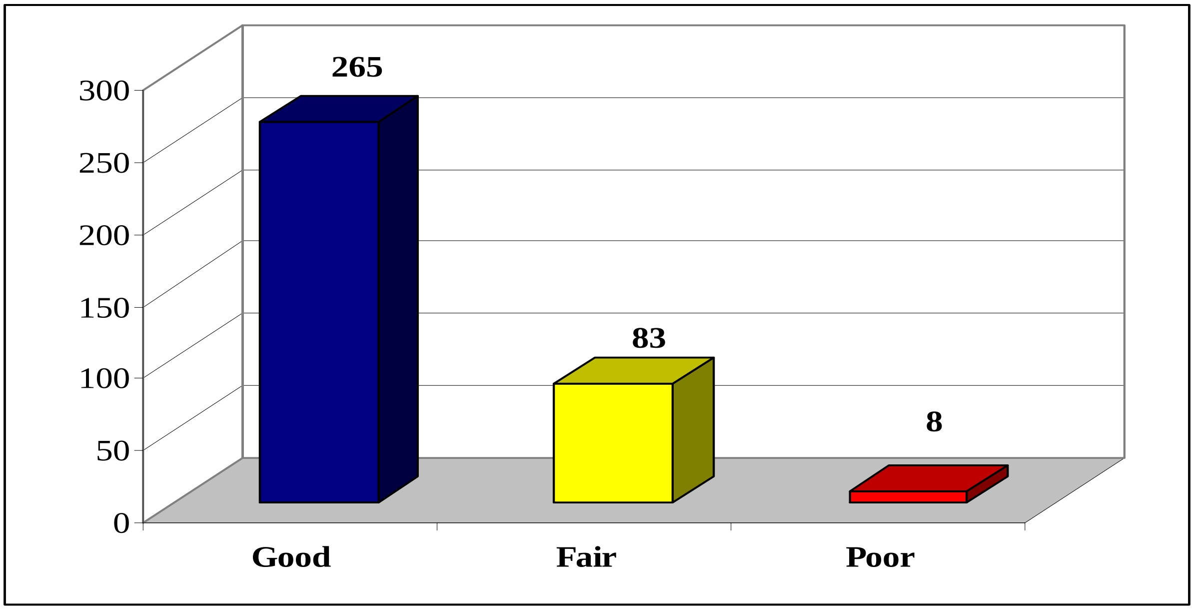
5 Transformation product of cyanazine.

6 Ninety-nine samples were collected for analysis of propachlor ESA and OA, and all SAA compounds.

D-5. Use Support Evaluation

Figure D-18 summarizes use support in the State of Illinois as determined by measurements in the probabilistic network of CWS wells (including the pesticide sub-network).

Figure D-18. Use Support in CWS Network Wells.



The results show that of the 356 CWS probabilistic network wells:

- **8 (2 percent (%))** were determined to be Not Supporting ("poor") due to the elevated levels of nitrate (4 out of 8) and Dichloromethane (4 out of 8). All of these wells draw their water from shallow sand & gravel aquifers, except for one, which is using a deep well from the Cambrian/Ordovician bedrock aquifer in the northern part of the state);
- **83 (23%)** were determined to be Not Supporting ("fair") due to statistically significant increases of total dissolved solids (TDS) and chloride (Cl-) above background, detections of VOCs, nitrate (total nitrogen) greater than 3 mg/l, or pesticides and transformation products that have exceed the non-degradation, but have not exceeded the health-based Groundwater Quality Standards (GWQS); and
- **265 (74 %)** were determined to be Fully Supporting ("good"), which show no detections of any of the above analytes. However, trend analyses for VOC's also shows that there is a statistically significant increase in the number of CWS wells with VOC detections, despite the fact that the number of CWS analyzed for VOC's over the same time period declined, and the detection limit remained constant.

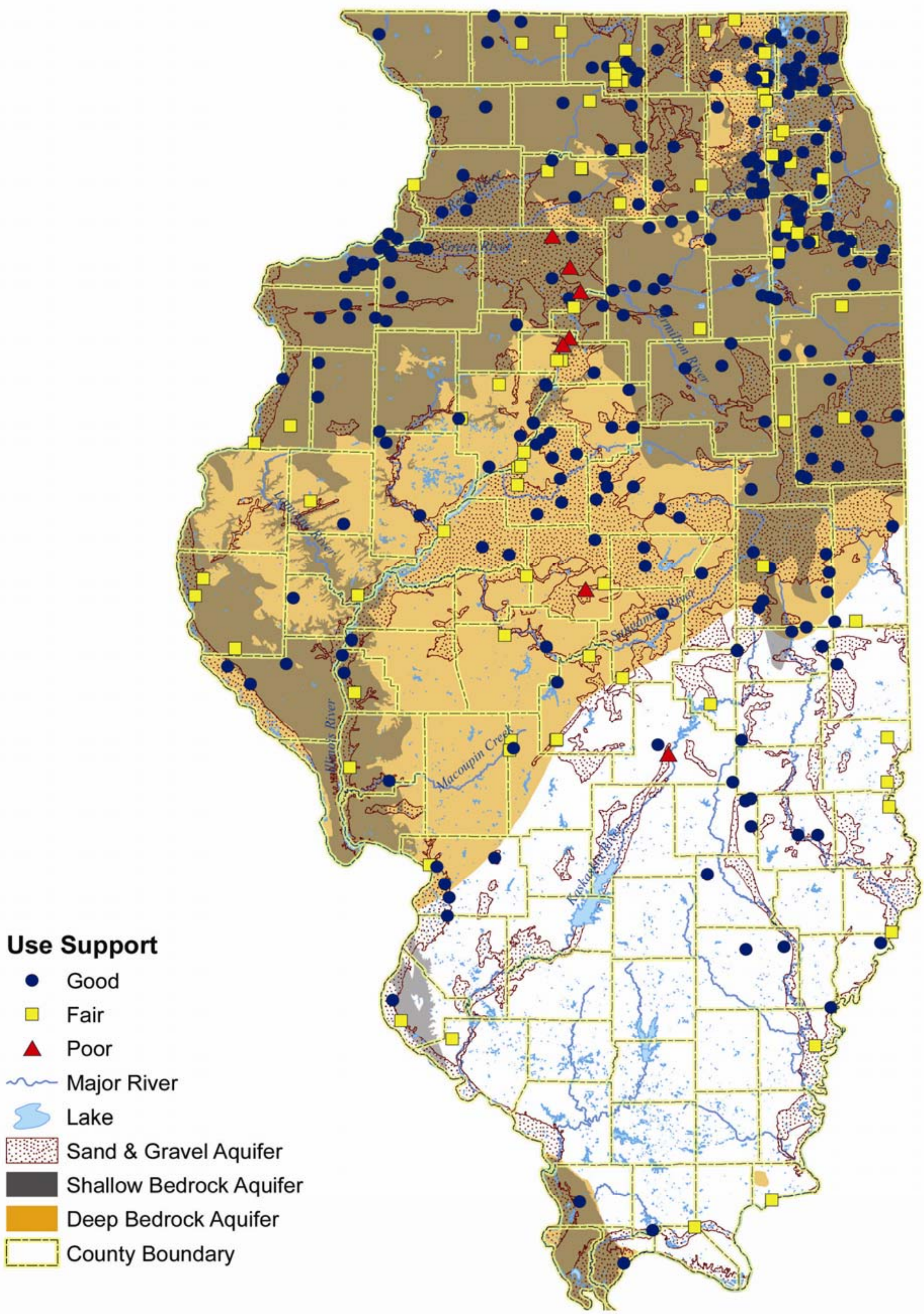
Trend analyses for VOC's also shows that there is a statistically significant increase in the number of CWS wells with VOC detections, despite the fact that the number of CWS analyzed for VOC's over the same time period declined, and the detection limit remained constant.

In addition, Table D-6 and Figure D-19 breakdown the probabilistic network of CWS wells into the principal aquifers (one variable used in designing the random stratified network) from which these wells are withdrawing water.

Table D-6. Support for CWS Probabilistic Network Wells within Illinois' Principal Aquifers.

Sand & Gravel	Good	101
	Fair	50
	Poor	7
Pennsylvanian/Mississippian	Good	12
	Fair	7
	Poor	0
Devonian/Silurian	Good	68
	Fair	12
	Poor	0
Cambrian/Ordovician	Good	64
	Fair	12
	Poor	1
Mixed	Good	21
	Fair	2
	Poor	0

Figure D-19. Use Support for the CWS Ambient Network Wells within Illinois' Principal Aquifers.

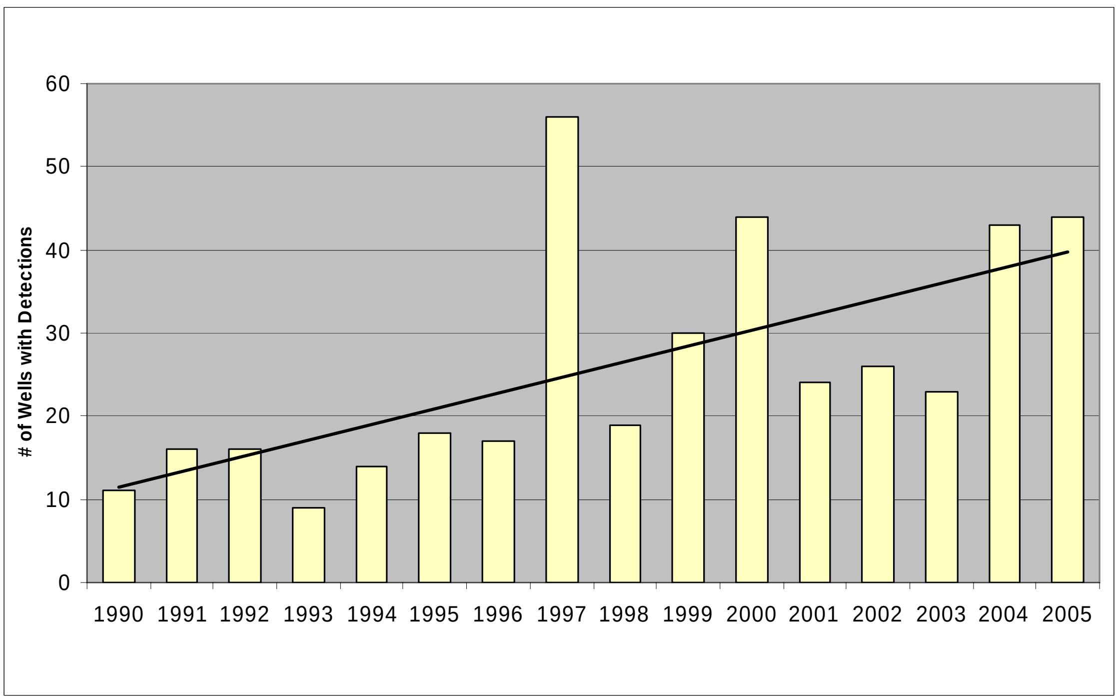


D-6. Potential Causes of Impairment

VOCs in CWS Wells

As previously stated, when possible, assessments of groundwater overall use support is based upon Illinois' GWQS within the probabilistic network of CWS wells. Generally, a detection of an organic contaminant above the laboratory practical quantification limit or the detection of an inorganic constituent above the naturally occurring background level in a CWS well is considered a cause of less than full use support. Detections of VOCs in CWS wells on a statewide basis have fluctuated since 1990 showing the lowest concentration of wells with detections in the early nineties (During the mid-nineties VOC detections exceeded the GWQS a total of five times. However, the findings of the first long term trend analysis conducted for all of the CWS wells (not just the fixed station network wells) monitored for VOC results. The entire data set (1990 to the present) was analyzed and the results are shown in Figure D-20.

Figure D-20. Long-term VOC trend from the full data set.



VOCs analyses of data collected from 1990 to the present shows a statistically significant increasing trend of CWS wells with VOC detections per year. The causal data also show total xylenes and 1,1,1- trichloroethane as the top ranked VOCs detected

Pesticides and their Transformation Products in CWS Wells

The summary from USGS Water Resources Investigations Report prepared for Illinois EPA for the CWS pesticide sub-network indicates that:

> "*Herbicide compounds (field-applied parent herbicides and their transformation products)* were detected in 34 percent of all samples collected; only 4 percent of the samples contained residues of parent herbicides. The six most frequently detected herbicide compounds (from 6 to 28 percent of samples) were transformation products of the chloroacetanilides, metolachlor, alachlor, and acetochlor. The frequent occurrence of transformation products and their higher concentration relative to those of most other parent compounds confirm the importance of obtaining information on transformation products to understand the mobility and fate of herbicides in ground-water."

Groundwater / Surface Water Interaction

Further, it is important to understand the fate and transport relative to the discharge to surface water especially considering the pesticide transformation products being found in surface water in Illinois (King, R.B. 2003). Studies have shown that transformation products are often more prevalent than their parent pesticides in streams and groundwater, particularly when conditions favor transformation to degradates that are chemically persistent. In parts of some hydrologic systems, the concentrations of degradates may exceed those of parent compounds throughout much of the year. In surface waters, degradates often predominate when much of the streamflow is either from groundwater, or from surface runoff occurring long enough after pesticide applications for the parent pesticide to have transformed (Gillion, 2006).

Chlorides in CWS Wells

ISWS research determined that: approximately 16% of the samples collected from CWS wells in northeastern Illinois in the 1990s had Cl^- concentrations greater than 100 mg/L; median values were less than 10 mg/L prior to 1960, before extensive road salting (Kelly and Wilson, 2004).

Pesticides in the IDA Network

The detections of pesticides and their transformation products in the IDA network appear to be related to agricultural application. The transformation products cannot be removed by ordinary treatment techniques.

TDS in Private Wells

The ISWS study of shallow groundwater quality in Kane County indicated that: "Road-salt runoff, vehicular exhaust, and industrial discharges are the most likely sources of these elevated solutes. Because the movement of groundwater is slow, the widespread presence of high TDS groundwater in the eastern urban corridor of Kane County suggests a fairly long history of shallow groundwater contamination." (Kelly, 2005)

Groundwater Degradation

Illinois groundwater resources are being degraded. Degradation occurs based on the potential or actual diminishment of the beneficial use of the resource. When contaminant levels are detected (caused or allowed) or predicted (threat) to be above concentrations that cannot be removed via ordinary treatment techniques, applied by the owner of a private drinking water system well, potential or actual diminishment occurs. At a minimum private well treatment techniques consist of chlorination of the raw source water prior to drinking.

It should be noted that groundwater that is consumed via a CWS has to be treated before it is delivered to the users. This treatment often includes methods for removing various contaminants, including the ones previously mentioned in this section. For more information of waters that are being consumed from CWSs, the public can contact their local CWS or the applicable *Consumer Confidence Report* at http://epadata.epa.state.il.us/water/bowccr/ccrselect.aspx

PART E: PUBLIC PARTICIPATION

The agency solicited information from the public to be used in the use assessment process as described in Section C-2.

We also solicited public input on the assessment results. A draft of the 2008 Integrated Report was placed on the Illinois EPA website (http://www.epa.state.il.us/water/tmdl/303d-list.html) for public review on March 21, 2008 and notices were sent out to all known interested parties of its availability. Hard copies of the report were available for those who requested them. Notice of a public hearing was published on March 24, 2008; March 31, 2008; and April 7, 2008 in the Edwardsville Intelligencer. A public hearing was held on April 24, 2008 to accept public comments. The hearing record was closed at midnight on May 24, 2008. The agency responded to all pertinent comments and incorporated changes into the existing document. Responses to comments are documented in Appendix F.

For TMDL development, the Illinois EPA has a comprehensive approach offering opportunities for stakeholders to participate, review and comment throughout the TMDL development process. For watersheds in which the development of TMDLs is currently underway, the Illinois EPA holds three public meetings.

All public meetings are held at a location within the effected watershed to enable greater local participation. Illinois EPA and its contractor typically provide an update of the progress made. The final public meeting held within the watershed, is on the draft TMDL report. The public/stakeholders have an opportunity to comment 30 days prior to the meeting date, during the meeting and generally 30 days after the meeting. In addition, where applicable, the report is distributed to the Illinois Department of Agriculture, the USDA—Natural Resources Conservation Service and other state and federal partners prior to release to the public for technical review and input.

A TMDL stakeholders group of 30 to 40 members has been assembled. The group consists of representatives from environmental groups, point source dischargers, Illinois Environmental Regulatory Group, USEPA, nonpoint source related organizations including agricultural and commodity associations, and other organizations. Initial meetings of this group were held on February 5, 2002, and May 7, 2002, in Springfield, Illinois. The Illinois TMDL Stakeholders Workgroup may meet from time to time, to serve as a sounding board and review panel for development of various program elements.

In August 2003, the Science Advisory Committee (SAC) was formed made up of staff from the Illinois Department of Agriculture, Illinois Department of Natural Resources, University of Illinois Urbana-Champaign, University of Illinois Extension, Illinois State Water Survey, and an environmental group. The purpose of this committee is to provide technical advice and scientific analysis of issues related to TMDL development in Illinois. It is anticipated that the SAC will review, comment upon and discuss TMDL interim reports throughout the TMDL development process.

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