

Subgoal 3

Can we swim in the water?

What is our target for sustainability?

Lake Michigan beaches are recognized as a consistently healthy place to visit and enjoy and are open more than 90% of the time.

Why is this important?

With the passage of the Beach Act in 2000, Lake Michigan states received federal funding to develop monitoring at high use beaches. This increased beach closings as the program commenced, but it also identified gaps in testing and technology for *E.coli* measurement as well as the need for best management practices. Research shows that factors like geography, water depth, weather, beach grooming practices and nearby animal populations also contribute to the beach closing problem in addition to the more obvious stormwater runoff, combined sewer overflows and animal feeding operations up stream.

What is the current status?

Beach closures have decreased slightly in recent years despite the fact that monitoring is increasing. Most closures occurred at the same beaches. New monitoring strategies based on predictive models have allowed beach managers in some areas to make better decisions regarding whether a beach should be closed. Currently, closure decisions are usually based on data from the day before due to limits of testing procedures.

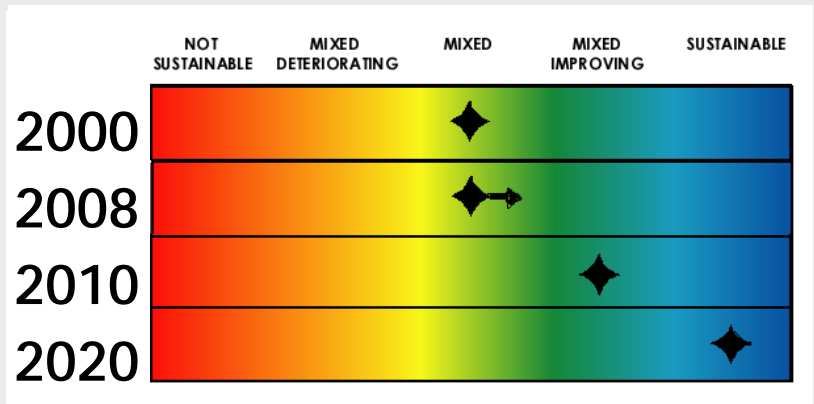
What are the major challenges?

- Climate Change: Possibility of intense storms increase high runoff events promoting pathogen and algae growth with adverse effects on water quality.
- Increasing bacteriological monitoring on beaches.
- Increasing use of predictive beach modeling and document its effectiveness
- Upgrading wastewater treatment systems as well as green infrastructure
- Encouraging increased energy conservation at water facilities

What are the next steps?

- Continue to implement actions outlined in the Great Lakes Regional Collaboration's Coastal Health Strategy
- Continue to improve beach monitoring and public notification.
- Develop and disseminate a standardized sanitary survey tool to identify contamination sources at Great Lakes beaches.
- Promote measures that will reduce or eliminate pollution sources at Great Lakes beaches.
- Continue support of Great Lakes Beach Association conferences.
- Disseminate information and training tools on the use of forecast models at Great Lakes beaches.

Lake Michigan Target Dates for Sustainability





What are some tools for addressing the challenges?

- Beach Health Resources
- Lake Michigan States' Beach Program Web Pages
- Great Lakes Beach Association

What are the State of the Lakes Ecosystem (SOLEC) indicators used to help assess the status of the subgoal?

[Indicator # 4200 - Beach Advisories, Postings and Closures](#)

Lake Michigan: Status: Fair; Trend: Undetermined (due to vast increase in number of reported beaches)

For more information on status of indicators, see <http://www.epa.gov/solec/sogl2007/>

Background

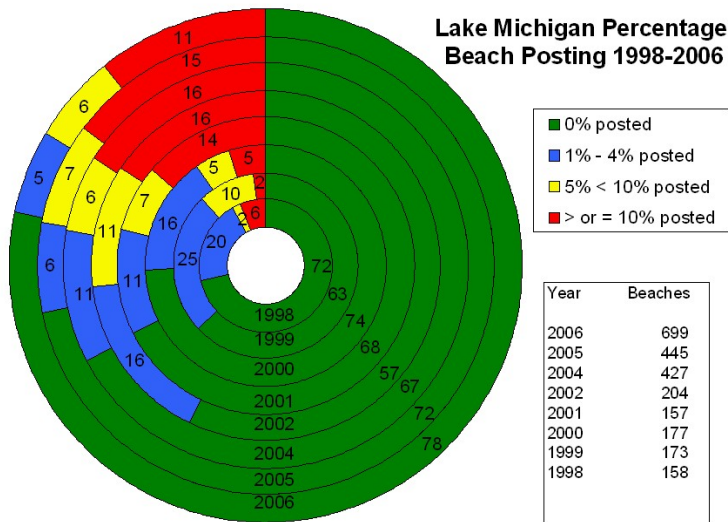
Lake Michigan contains the world's largest collection of freshwater sand dunes and associated beaches, particularly along its eastern shore. Of a total of 3,100 coastal acres, 1,200 acres is publicly owned and available for use, while an additional 1,200 privately owned acres has significant potential for public use. It is important to note that most shoreline areas along Lake Michigan support swimming and secondary contact recreation. However, some areas do experience elevated levels of *E. coli* bacteria. This may be due to wet weather that causes overflows from aging wastewater collection systems or treatment plants, storm water runoff from cities and farms, improperly sited or maintained septic systems, and natural sources such as waterfowl. These sources of contamination may release pathogens into tributaries and the lake. When *E. coli* levels exceed standards, "Beach Advisory or Closure" notices are posted to protect human health. Recent studies show other factors like geography, water depth, weather, beach grooming practices and nearby animal populations also contribute to beach advisories or closures. As a result, the current status of the goal is mixed, but appears to be improving.

Beach advisories or closures resulting from high

pathogen loads have a negative effect on the lake's significant tourism industry. To improve water quality testing at the beach and to help beach managers better inform the public when there are water quality problems, Congress passed the Beaches Environmental Assessment and Coastal Health (BEACH) Act on October 10, 2000. The BEACH Act requires adoption of consistent bacterial standards at coastal waters nationwide, research on new pathogens and pathogen indicators, and publication of new or revised water quality criteria for pathogens within five years. The BEACH Act also authorizes EPA to award grants to eligible states, tribes, and territories to develop and implement a program at coastal and Great Lakes beaches, and to notify the public when bacteria levels are exceeded.

Progress on Developing and Implementing Beach Monitoring and Notification Plans

Since passage of the BEACH Act, approximately \$11.7 million in BEACH grants have been issued to Great Lakes states to implement beach programs, which has resulted in a significant increase in the number of monitoring and notification programs at Great Lakes beaches. All of the Lake Michigan states



The number of beaches closed every year has decreased despite the increase in the number of beaches tested for *e.coli*.

Cladophora Algae Becoming Larger Problem in Lake Michigan

Cladophora is a branching, green filamentous algae found naturally along the coastline of most of the Great Lakes. Research in the 1960's and 70's linked *Cladophora* blooms to high phosphorus levels in the water, mainly as a result of human activities such as fertilizing lawns, poorly maintained septic systems, inadequate sewage treatment, agricultural runoff and detergents containing phosphorus. Phosphorus levels declined due to tighter regulations and *Cladophora* blooms were largely absent in the 1980's and 90's.

There has been a resurgence of macroalgae, predominantly *Cladophora*, along the coast of Lake Michigan. These algae blooms lead to unsightly and foul-smelling beaches and have a negative impact on the economy as a result of lowered beach use. *Cladophora* blooms result in reduced quality of drinking water and decreased property values. Possible causes include increased nutrient inputs, increased water clarity, increased water temperature and changing lake level. While there have been some efforts to remove *Cladophora* from beaches, ultimately the solution to the *Cladophora* problem requires the identification of the factors promoting *Cladophora* growth, and mitigating those factors.

It is unknown if there are increased nutrient concentrations entering the lake via streams and rivers or if zebra mussels redistribute existing nutrients from the phytoplankton they consume to the *Cladophora*. Both may be happening. (Source: Great Lakes Water Institute, University of Wisconsin-Milwaukee)

For more information on *Cladophora*, see chapter 8 and www.uwm.edu/Dept/GLWI/cladophora and www.miseagrant.umich.edu/SOLM2007/images/presentations/GLBA/Beach_2207_sadowsky.pdf and www.miseagrant.umich.edu/SOLM2007/images/presentations/GLBA/Kleinheinz-GLBA07.pdf.



Cladophora
Photo courtesy of Brenda Moraska Lafrancois

Type E Botulism Causes Bird Die-Off at Sleeping Bear Dunes

Sleeping Bear Dunes National Lakeshore experienced extensive waterbird die-offs in 2006 within the waters of Lake Michigan which included nearly 3,000 grebes, gulls, cormorants, loons and mergansers. Poisoning from Type E botulism toxin was identified as the cause of the die-off. Initial indications are that recent increases in native *Cladophora* algae have become common in shoreline locations across the Great Lakes and initial research indicates that these die-offs are related to an upwelling of lake-bottom sediments containing the Type E Botulism. The sediment contain the bacteria are being filtered by non-native Zebra Mussels, concentrating the Botulism in the mussels. The mussels are then eaten by non-native Round Gobies. The Gobies are then eaten by the birds who ingest the virus, become sick, and die. A network of scientists are joining together to address the problem. More information is available at www.epa.gov/glnpo or www.miseagrant.umich.edu.



Photo courtesy of Kenneth Hyde

Combined Sewer Overflows (CSOs): Climate Change and Adaptation a Priority

There are currently 30 CSO communities with 347 CSO outfalls that discharge within the Lake Michigan basin. Eighteen of the Lake Michigan CSO communities are in Indiana, 11 are in Michigan, and one is in Wisconsin.

- In Indiana, all 18 CSO permittees in the Lake Michigan basin discharge in the vicinity of 303(d)-impaired waters. Thirteen of these permittees discharge to waters where pathogens (*E. coli*) and/or siltation were cited as reasons or causes of impairment.
- In Michigan, 10 of the 11 CSO communities discharge to 303(d)-impaired waters. The waters in close proximity to the CSO community of Norway have not been assessed. Three CSO permittees in Michigan (Manistee, Niles, and St. Joseph CSO) discharge to 303(d)-listed waters that specifically cite "CSO pathogen (Rule 100)" as a source of impairment. In addition, three CSO permittees (East Lansing, Lansing, and Crystal Falls CSO) discharge to waterbodies where pathogens or pathogens and dissolved oxygen are cited as reasons or causes of impairment.
- In Wisconsin, the Milwaukee Metropolitan Sewerage District (MMSD) operates the only combined sewer system (CSS) in the Lake Michigan basin. MMSD's CSOs discharge to, or in close proximity to, 303(d)-impaired waters where pathogens and/or dissolved oxygen have been cited as reasons or causes of impairment.

The proximity of a CSO outfall to an impaired water segment does not in and of itself demonstrate that the CSO is the cause of the impairment. EPA believes the association between CSO location and impaired waters is due to a number of factors in addition to CSO discharges. For example, CSOs are generally located in urban areas where waterbodies also receive relatively high volumes of storm water and other pollutant loads. Nevertheless, the strong correlation between CSO location and impaired waters does suggest that CSOs should be considered as a potential source of pollution when developing a total daily maximum load (TMDL) for an impaired waterbody.

While these CSOs all have long-term plans, climate change could have a major impact as pointed out in the February 2008 USEPA report, "Screening Assessment of Potential Impact of Climate Change on CSOs in the Great Lakes (EPA600R-07/033F)". More information is available at: www.epa.gov/ncea.



Lake Michigan CSO communities
Source: USEPA

have beach monitoring and public notification programs in place at most of their coastal beaches and at all of their high priority or frequently used coastal beaches.

During 2006, 83% of Lake Michigan beaches were open more than 95% of the time. Increased monitoring has resulted in approximately twice as many postings since 2000. Several groups are collaborating to identify and remediate sources of beach contamination in Lake Michigan. Following are beach program summaries for Illinois, Indiana, Michigan, and Wisconsin.

Illinois' Beach Program

The Illinois Department of Public Health (IDPH), which licenses bathing beaches in Illinois, has received \$1,469,228 in BEACH Act grants since 2001. Illinois' Lake Michigan beaches are monitored five to seven days a week during the swimming season. To augment beach water quality monitoring, IDPH is working with the Lake County Health Department (LCHD) to validate and implement predictive models at several Lake Michigan beaches. Because health warnings are generally based on *E. coli* concentrations from samples taken the previous day, predictive models based on continuously measured hydro-meteorological variables provide an excellent alternative to monitoring. In the summer of 2004,

SwimCast predictive modeling systems were installed by the LCHD to predict whether water quality standards would be exceeded at two Lake Michigan beaches: Illinois Beach State Park-South Beach (IBSP) in Zion, Illinois, and Forest Park Beach (FP) in Lake Forest, Illinois. SwimCast measures air and water temperature, wind speed and direction, precipitation, relative humidity, wave height, lake stage, insolation (light energy), and other water quality parameters. SwimCast accurately predicted whether *E. coli* concentrations were above or below the 235-cfu/100 ml threshold for full body contact 85% of the time during the 2004 swimming season. SwimCast was 89% accurate at IBSP beach and 95% accurate at FP beach when used in 2005. The SwimCast predictive model will be extended to Chicago beaches where a model will be pilot tested during the 2008 beach season. To access the SwimCast Real Time Data Link, go to:

www.co.lake.il.us/health/ehs/SwimCastDataAP.asp

IDPH continues to develop and distribute educational resources. An educational beach pamphlet titled, "Why is the beach closed?" was developed and distributed to beach patrons. IDPH also provides beach closure and program information to beachgoers through signs and its website at: www.idph.state.il.us/envhealth/beachhome.htm Please Don't Feed the Waterfowl signs have been posted at several Lake Michigan beaches to discourage visitors from feeding birds, which have the potential to contribute significant fecal loads to beach water. Information on water quality for Lake Michigan beaches in Lake County, Evanston, Winnetka and Wilmette, Illinois, can be found at www.earth911.org/waterquality/default.asp?cluster=0 and information about Chicago's beaches can be found at: www.chicagoparkdistrict.com/index.cfm/fuseaction/swim_report.home.cfm The City of Chicago also has a website and web site links are provided through NBC Channel 5.

In 2007, IDPH developed a DVD for beach managers about predictive models used in the Great Lakes, including SwimCast. The DVD covers data collection, equipment installation, quality assurance, the public's view of the models, and costs. It also discusses innovative beach management measures to reduce beach closures through storm water management and beach grooming techniques.

Source identification work is being conducted by IDPH which received a grant from U.S. EPA to pilot a

beach sanitary survey tool in 2007 to identify pollution sources at two Great Lakes beaches: Jackson Park (63rd Street) Beach in Chicago, and Rosewood Beach in Highland Park, Illinois. Preliminary results of the sanitary survey suggest that Jackson Park Beach is influenced by a large land area of rainwater runoff. Also, the beach has a relatively shallow water depth, a shallow beach and lake bottom slope, and has a configuration that may trap water and inhibit entry and mixing of cleaner lake water. Presence of gulls and other birds may contribute to bacterial load especially after rainfall and potentially after high wave events. At Rosewood Beach, a total of 173 pipe structures were mapped, 44 of which were from sanitary sewer sources; the remainder of the pipe structures were storm water or drainage sources. At the time of survey, however, there was little to no flow in the tributaries (only one pipe had measurable flow), so a more thorough investigation is needed.

In 2008, beach managers along Lake Michigan formed a beach management association to standardize beach monitoring protocols and methods by which the public will be notified about beach water quality.

Indiana's Beach Program

The Indiana Department of Environmental Management (IDEM) administers the Beach Monitoring and Notification Program at Indiana's Lake Michigan beaches. IDEM has received \$1,235,353 in BEACH Act grants since 2001. The beach program is currently being operated in conjunction with the Lake County Parks and Recreation Department, the Hammond Sanitary District, the City of East Chicago Health Department, the Gary Sanitary District, the Town of Ogden Dunes, and the LaPorte County Health Department.

Indiana has approximately 23 miles of beaches located along the Lake Michigan shoreline, including the Indiana Dunes National Lakeshore, which has 9 nine beaches, and the Indiana Dunes State Park, with 2 two main sections of beaches, along with 14 other county and city beaches. Prior to the BEACH Act, *E. coli* monitoring occurred only one day per week at Indiana's Lake Michigan beaches. Since receiving funding, Indiana beach program managers relying strictly on water quality samples now sample as frequently as three to seven days per week at most of its Lake Michigan beaches.

IDEM has also used BEACH Act grant funds to keep the public informed about beach water quality risks to enable beachgoers to make better informed decisions regarding recreational choices. Beach managers notify the public of elevated bacteria levels by posting beach advisory or closure signs. The public can also access beach open/closure status information on the beach notification project web site (www.in.gov/idem/beaches). IDEM hired a contractor to install 25 kiosks at several coastal beaches which provide beachgoers with up-to-date information regarding the status of beach waters as well as additional information about the possible sources and causes of *E. coli* contamination. Recommendations are also provided as to how beachgoers and watercraft operators can reduce the likelihood of causing an *E. coli* release.

Several organizations have collaborated to identify sources of contamination at beaches near Burns Ditch, Indiana. There are 13 beaches in Porter County and Lake County, Indiana, west of the Burns Ditch outfall (a major point source of pollution), that are subject to beach closures due to high counts of *E. coli*. IDEM participated in a model project collaborating with USGS, NOAA, the City of Gary Sanitary District, the National Park Service, and local health departments, to characterize the movement of *E. coli* from Burns Ditch and to better understand the relative effect of bacteria contamination on beach waters. They studied the relationship between *E. coli* counts in Burns Ditch and beaches to the west, and hydro-meteorological factors, and this information was used to develop a predictive model for high *E. coli* counts at these beaches.

IDEM has used BEACH Act grant dollars to fund the installation of two predictive models at two Lake Michigan beaches with the goal of providing the public with more rapid information about water quality at beaches along Indiana's Lake Michigan shoreline. During the 2006 beach season, IDEM implemented project SAFE at the beaches west of Burns Ditch (Portage Beach, Ogden Dunes, West Beach, Wells Street Beach, Marquette Beaches, and Lake Street Beach). During 2007, IDEM implemented the predictive model, "SAFE" (Swimming Advisory Forecast Estimates) for the Gary and Ogden Dunes beaches. Gary and Ogden Dunes beaches using SAFE model still performed water quality testing at least once per week. A partnership between IDEM and the City of Gary made the above predictive modeling efforts possible.

The Importance of Predictive Modeling and Sanitary Surveys

Public health agencies are starting to use predictive modeling based on statistics to make real-time decisions regarding whether a beach should remain open or not.

Health departments and researchers compile a record of how factors like rainfall, water temperature and the presence of seagulls affect the *E. coli* count. Some of this data collection can be done by researchers and agencies, but statistics can also be obtained from records kept by other sources, such as local airports and the National Weather Service.

The models use these data to identify when the factors most associated with high levels of *E. coli* occur in combination with each other. In many cases, these models are more accurate for determining the exact days when beaches should be closed as opposed to the current system when beaches may be closed when they are safe, and open when levels of *E. coli* are unsafe.

More communities are using or are investigating the use of predictive modeling for making decisions on closing beaches

While monitoring and predictive modeling are reactive, Beach Sanitary Surveys are a proactive tool that can be employed by local beach managers to help determine probable sources of contamination in recreational water.

More funding was made available to do these surveys over the last two years. In response to the recommended actions of the Great Lakes Regional Collaboration's Coastal Health Strategy, the USEPA released over \$500,000, draft tools, and a guidance document to pilot a standardized sanitary survey tool throughout the Great Lakes in 2007.

Advanced Monitoring Initiative is a program coordinated through U.S. EPA's Office of Research and Development. It seeks to model the fate of indicator bacteria as they move downstream of the Valparaiso, Indiana, POTW to the Little Calumet River and eventually Lake Michigan. The study focuses on the relationship of quantitative Polymerase Chain Reaction (qPCR) and cultural counts of indicator

bacteria. The relationship among independent factors such as sunlight, flow, turbidity and fecal indicator bacteria are being investigated. The study will be integrated with IDEM's SAFE, NOAA OHHI and USGS Oceans Research Priority Planning programs.

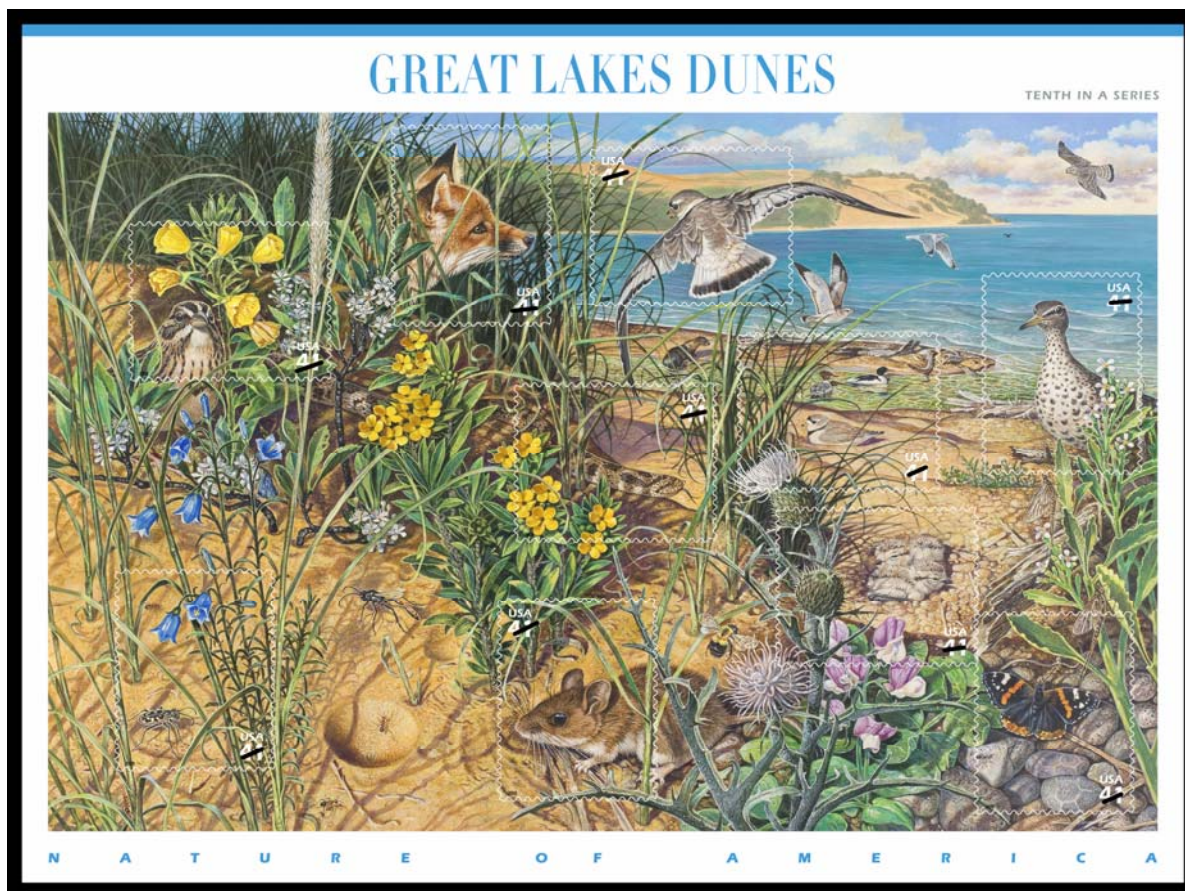
Michigan's Beach Program

The Michigan Department of Environmental Quality (MDEQ) has received a total of \$1,708,572 in BEACH Act funding since 2002 to support beach monitoring and notification programs for 440 public beaches in 58 counties along the state's 3,200 miles of Great Lakes shoreline. Along Lake Michigan:

- There are 299 public beaches on Lake Michigan in 18 counties.
- In 2007, of the 110 Lake Michigan beaches that were monitored, 25 beach closures or advisories were reported due to water quality standards being exceeded.

Waters associated with public beaches are considered to not attain water quality standards when *E. coli* monitoring data collected by county health departments during the total body contact recreation season of May 1 to October 31 meet one or more of the following decision elements:

Great Lakes Dunes Stamps Issued in 2008



A series of stamps commemorating Great Lakes dunes will be released this year by the U.S. Postal Service. The series will be offered as a single sheet depicting a dense grouping of plants and animals at Sleeping Bear National Lakeshore on Lake Michigan, with the 10 individual stamps as insets in the scene. All of the 27 different plants and animals depicted on the sheet may be found in the Sleeping Bear Dunes area.

More information is available at: www.usps.com/communications/newsroom/2007/sr07_084.htm.

- *E. coli* concentrations exceed the geometric average water quality standard of 130 *E. coli* per 100 ml based on weekly samples collected over a minimum of 16 weeks.
- Ten percent of the sample results exceed the daily maximum water quality standard of 300 *E. coli* per 100 ml based on weekly samples collected over a minimum of 16 weeks.
- Two or more sample results collected at any time during the total body contact recreation season of May 1 to October 31 exceed the partial body water quality standard of 1,000 *E. coli* per 100 ml.

The monitoring of beaches in Michigan is voluntary and is conducted by the local health departments, which are required to notify various entities of the test results within 36 hours, and may petition the Circuit Court for an injunction ordering the owners of a beach to close the beach. The MDEQ provides Clean Michigan Initiative-Clean Water Fund (CMI-CWF) and BEACH Act grants to the local health departments to aid in the implementation or enhancement of their beach monitoring programs. The CMI-CWF and BEACH Act grants are designed to fund proposals that determine and report levels of *E. coli* in the swimming areas of public beaches. The objectives of MDEQ's beach program are to:

- Assist local health departments to implement and strengthen beach monitoring programs.
- Determine whether waters of the state are safe for total body contact recreation.
- Create and maintain a statewide database.
- Compile data to determine overall water quality.
- Evaluate the effectiveness of MDEQ programs in attaining water quality standards for pathogen indicators.

Local health departments request an average of \$380,000 in BEACH Act funds per year from the MDEQ for local beach monitoring programs for 212 high-priority beaches. Since passage of the BEACH Act, there has been a dramatic increase in the number of monitoring and notification programs at coastal beaches in Michigan. The number of Great Lakes beaches in Michigan that were monitored at least once a week has grown from 83 in 2002 to 212 in 2007.

Local health departments provide beach monitoring program information to the public via press releases, brochures, beach signs, beach seminars, and Internet access.

In 2006, monitoring was conducted at 207 Great Lakes public beaches in 37 counties in Michigan. Out of 2,422 daily samples collected, 85 (3.5 percent) exceeded Michigan's water quality standards. The exceedances were reported from 50 beaches (24 percent of monitored Great Lakes beaches), 41 of which reported beach closures or advisories (52 incidents lasting a total of 333 days).

All beach monitoring data are reported to and evaluated by the MDEQ. The MDEQ incorporates beach monitoring data into other water pollution prevention programs to encourage strategic improvements in water quality. Michigan's Beach Monitoring web site immediately provides current and historical test results for *E. coli* and beach closings/advisories as they are reported from health departments for all public beaches in Michigan. All public beaches are required to post a sign indicating whether the beach is monitored and where the results can be found. More information is available at www.deq.state.mi.us/beach/public/default.aspx.

Source identification work is also being conducted by MDEQ which received a grant from U.S. EPA to pilot a beach sanitary survey tool in 2007 to identify pollution sources at 15 Lake Michigan beaches. Preliminary results of the surveys indicate that numerous sources of pollution have been identified along with potential remediation measures to help reduce beach water contamination. Recommended remediation measures include gull management techniques such as harassment by border collies, installation of wires above the beach to deter gulls from landing, and enacting an ordinance to ban feeding of waterfowl. Other remediation measures may include better beach maintenance, beach grooming, educating beach goers, and implementation of storm water best management practices.

Wisconsin's Beach Program

The Wisconsin Department of Natural Resources (WDNR) operates Wisconsin's Beach Monitoring and Notification Program, the primary goal of which is to reduce beach visitors' risk of exposure to disease-causing microorganisms in water. Since 2001, WDNR has received \$1,460,130 in BEACH Act grants to develop and implement monitoring and notification programs at beaches along Lake Michigan and Lake Superior. Passage of the BEACH Act has enabled WDNR to substantially increase the number of coastal beaches it monitors from six to 123.

WDNR issues grants to communities along Lake Michigan and Lake Superior to monitor beach water quality. Fifteen health departments along these lakes sample the water at beaches one to five times per week. An advisory sign is posted warning swimmers that there is an increased risk of illness whenever the water quality criterion of 235 colony-forming units (CFU) of *E. coli*/100 ml of water is exceeded. A red stop sign that closes the beach is posted when *E. coli* levels exceed 1,000 CFU/100 ml, indicating a more serious risk of illness. Advisories and closures may also follow rainfall events or storm water and sewage overflows. Other factors that may influence *E. coli* concentrations include the nuisance algae *Cladophora*, wind direction, wave height, water temperature, and beach grooming.

Statewide, the summer of 2006 had more closures and advisories than 2005, but less than 2004. In Wisconsin, 17.5% of the samples taken in 2006 exceeded the *E. coli* standard of 235 CFU/100 ml (676 samples out of 3861 total samples). Approximately 5% of the total samples exceeded 1000 CFU/100 ml and resulted in beach closures.

To design its beach program, the WDNR formed a workgroup comprised of state and local environmental and public health officials, academic researchers and community groups. Using GPS technologies, approximately 55 public beach miles and 192 total coastal beaches were identified along Lake Michigan and Lake Superior. Maps of the beaches can be found at www.dnr.wi.gov/org/water/wm/wqs/beaches/state-map.htm. Additional GPS data layers were added to include the location of all wastewater treatment plant outfalls along with their proximity to the beaches. Additional information was collected for each beach evaluating the potential for impacts from storm water runoff, bather and waterfowl loads, and the location of outfalls and farms. This information was used to rank and classify beaches as high, medium or low priority. These rankings indicate how often the beaches should be monitored to ensure that water quality conditions are safe for swimming.

Wisconsin's beach program workgroup also developed public notification and risk communication measures so water quality monitoring information is made available to the public in order for beach visitors to make informed choices. These measures included the development and posting of signs at beaches to give notice to the public that the



The Lake Michigan Toolbox Beach Health Resources

Federal Government Resources

Assessing and Monitoring Floatable Debris.

www.epa.gov/owow/oceans/debris/floatingdebris/

BEACH Watch. www.epa.gov/waterscience/beaches/

BEACON – Beach Advisory On-line Notification

www.epa.gov/waterscience/beacon/

Great Lakes Monitoring – The Swimmability Index

www.epa.gov/glnpo/glindicators/water/beachb.html

National Beach Guidance and Required Performance

Criteria for Grants www.epa.gov/waterscience/beaches/grants/guidance/index.html

National Pollutant Discharge Elimination System (NPDES)

Combined Sewer Overflow http://cfpub1.epa.gov/npdes/home.cfm?program_id=5

USEPA Report to Congress on Impacts and Control of

CSOs and SSOs http://cfpub.epa.gov/npdes/cso/cpolicy_report2004.cfm

USEPA Report to Congress on Implementation and Enforcement of the CSO Control Policy

http://cfpub.epa.gov/npdes/cso/cpolicy_report.cfm?program_id=5

Centers for Disease Control - Healthy Swimming

www.cdc.gov/healthyswimming/

Non-Governmental Resources

Beaches in the Great Lakes Region

www.great-lakes.net/tourism/rec/beach.html#new

Council of Great Lakes Research Managers – Great

Lakes-St. Lawrence Research Inventory

<http://ri.ijc.org>

Great Lakes Beach Association

www.great-lakes.net/glba/

Great Lakes Beach Association Annual Proceedings, Green Bay, WI, November, 2005.

www.great-lakes.net/glba/2005conference.html

Great Lakes BeachCast – Great Lakes Beach Information (many links from this site)

www.great-lakes.net/beachcast/nr_moreinfo.html



The Lake Michigan Toolbox Lake Michigan States' Beach Program Web Pages

Illinois

- Illinois Beach Monitoring Home page www.idph.state.il.us/envhealth/beachhome.htm
- Chicago Park District's Swim Report www.chicagoparkdistrict.com/index.cfm/fuseaction/swim_report_home.cfm
- Northern Illinois Lake Michigan beach notification Web site (Lake County Health Department, Wilmette Park District, Winnetka beaches and the City of Evanston). www.earth911.org/waterquality/default.asp?cluster=17

Indiana

- Indiana Department of Environmental Management Beach Home page. www.in.gov/idem/beaches
- IDEM beach water quality notification Web site <http://www.earth911.org/waterquality/default.asp?cluster=18>

Michigan

- Michigan Beach Monitoring home page www.michigan.gov/deq/1,1607,7-135-3313_3686_3730---C1,00.html
- Michigan Department of Environmental Quality - Office of the Great Lakes www.michigan.gov/deq/1,1607,7-135-3313_3677---,00.html
- Michigan Sea Grant: www.miseagrant.umich.edu/

Wisconsin

- Wisconsin Beach Health Web site www.wibeaches.us
- Wisconsin Sea Grant www.seagrant.wisc.edu/
- The Door County Beach Contamination Source Identification Interim Report map.co.door.wi.us/swcd/ and map.co.door.wi.us/swcd/Interim_Beach_report_2005.pdf
- Milwaukee Metropolitan Sewerage District. 2003. Deep Tunnel Fact Sheet www.mmsd.com/wastewatertreatment/deep_tunnel_history_facts.cfm
- Water Quality Research www.cityofracine.org/Depts/health/water_quality.aspx

coastal recreational waters are not meeting, or are not expected to meet, water quality standards. These signs, which are in English, Spanish and Hmong, were designed based on feedback from a beach user survey and public meetings held around the state.

Other public notification and outreach products developed by the workgroup include an automatic e-mail service to which the public can subscribe to receive daily updates on beach conditions; a statewide informational brochure, approximately 100,000 copies of which were distributed at local beaches, parks, and health departments; a Beach Health Web page (www.wibeaches.us) for reporting up-to-date as well as historical conditions at all Wisconsin coastal beaches; and an internal web site for local health departments to report their daily advisory and monitoring data in the format required for EPA reporting at the end of the beach season. Also, the WDNR, in collaboration with the State Lab of Hygiene, released a short "how-to" sample *E. coli* movie to the public.

Water quality awareness has increased in Lake Superior and Lake Michigan Counties as more data become available. Some counties and concerned citizens have taken initiative and are working toward finding sources of *E. coli* contamination and solutions to address them.

In 2007, the WDNR received funding from U.S. EPA to conduct sanitary surveys at 18 Wisconsin Great Lakes beaches, including 11 along Lake Michigan. The project has allowed researchers to identify potential sources of microbial contamination at numerous Great Lakes beaches in Wisconsin. Sources of *E. coli* contamination may include agricultural runoff, urban storm water and sewage overflows. Localized sources from wildlife and waterfowl feces also contribute to high levels of *E. coli* in both beach sand and water. This project has also allowed researchers to initiate the process of planning for mitigation of some of the sources of beach water contamination.

The City of Racine is working closely with partners to identify sources of beach water contamination. Research conducted over the 2006 beach season included:

- Characterization of *E. coli* in beach sands relative to sediment size and hydrologic factors. This grant allowed Racine to do hydrogeological assessments of North Beach in Racine and at

Eichelman and Pennoyer beaches in Kenosha County to determine the relationship between *E. coli* density in beach sands as a function of grain size and uniformity. Results indicated that well-sorted, fine sand has the highest concentration of *E. coli* and this is most pronounced at the berm crest, an area prone to continual wetting. Fine sandy beaches may benefit most from beach sand manipulation tactics. Racine's changes to the beach slope, an increased berm crest, and removing swales at North Beach have resulted in improvements in recreational water quality.

- Sampling of gull feces for the isolation of *Campylobacter* spp. In 2006, over 100 gull fecal samples were screened for the presence of enteric pathogens. This research will ultimately help determine if *E. coli* from gulls carries the same health risk to humans as from other sources. This may allow Racine to discount the number of advisories in areas where sources have been adequately characterized.
- Evaluation of real-time, quantitative Polymerase Chain Reaction (PCR) as a method to determine pollutant loading. This project will allow Racine to compare the DNA concentration present in treated wastewater effluent, bypasses, storm water, and surface run-off and to assess pollutant loading in real-time. Analyses will be conducted in conjunction with currently approved agar-based and chemical detection techniques for method comparison. The ability to monitor both point source and non-point source contamination in real-time will allow local governments to undertake effective coastal management measures.

For the first time, Racine's North Beach had five or less advisories. This met the 2002 Great Lakes Strategy goal of being open 95% (or more) of the swimming season.

Door County is one of the most popular summer tourist destinations in Wisconsin. Recreational water is an important resource to the economy of this county. In the summer of 2006, BEACH Act grant funds were used to monitor 28 beaches along Lake Michigan; however, funds could not be used for source identification of microbial contamination. The Door County Soil and Water Conservation Department joined forces with University of Wisconsin-Oshkosh to tackle the question, "Where is the beach water contamination coming from, and is it safe to swim at this beach?" The project objectives included:



The Lake Michigan Toolbox Great Lakes Beach Association

The Great Lakes Beach Association (GLBA) plays an important role in providing a forum for beach managers, researchers, concurrent meeting with the Lake Michigan State of the Lake conference,

More information is available at:

www.great-lakes.net/glba/

- Monitor *E. coli* concentrations at selected beaches after significant rainfall to determine if storm water runoff contributed significantly to microbial contamination of beaches.
- Monitor pathogen concentration (*Campylobacter*) at five selected beaches.
- Isolate *E. coli* from beach water, sand and avian, bovine and human waste in Door County and conduct DNA fingerprinting of these isolates to further characterize the indicator organism used to monitor beach water quality and help to identify the source of contamination.
- Isolate Bacteriodes from avian waste from Door County beaches to try to identify unique sequences in the bacteria DNA that are specific to waterfowl and will allow another mechanism of source tracking microbial contamination in water. Unique DNA sequences previously have been identified in Bacteriodes from bovine and human feces.

The combined efforts between beach monitoring and microbial source tracking in Door County have resulted in another summer's worth of excellent data to be analyzed. In 2006, approximately 1000 *E. coli* isolates were collected from water and waste and the majority have been DNA fingerprinted. This information has been added to the database from previous years and researchers are beginning to see patterns in isolates. In addition, a large amount of spatial and rain data has been collected for the studied beaches in 2005 and 2006. In all cases *E. coli* concentrations were greater in storm water runoff and appear to have a negative impact on beach water quality for at least 8 hours after a significant rainfall event.

Accomplishments Related to Communication to the Public. Because it has been shown that people who engage in recreational water sports have a higher incidence of symptomatic illnesses, it has become increasingly more important to make the public aware of the potential health hazards that are associated with recreational waters. Recent progress has been made on the national and local levels to provide the public with useful tools that can provide needed information regarding the use of recreational waters. At the national level, the following public communication tools are available:

BEACH Watch

This website contains information about U.S. EPA's BEACH Program, including grants, EPA's reference and technical documents including EPA's *Before You Go to the Beach* brochure, upcoming meetings and events, conference proceedings, links to local beach programs, and provides access to BEACON (Beach Advisory and Closing On-line Notification), U.S. EPA's national beach water quality database. www.epa.gov/OST/beaches

Annual Great Lakes Beach Association (GLBA) Conference

In February 2001, an EPA, LaMP, and City of Chicago-sponsored Great Lakes Beach Conference was held to share information on the science and technology of beach monitoring as well as research on exposure, health effects, and water quality indicators. More than 250 environmental and public health officials, beach managers, and regulators attended the 3-day conference. The conclusions of the conference saw the formation of the Great Lakes Recreation Association whose list serve and annual meetings provide quick sharing of research findings. The GLBA is comprised of members from U.S. states, Environment Canada, local environmental and public health agencies, and several universities and NGOs. The GLBA's mission is the pursuit of healthy beach water conditions in the Great Lakes area. Since 2001, the GLBA has held beach conferences annually to bring together beach managers, scientists, and agency officials to exchange information on improving recreational water quality. The next conference is planned for September, 2008, in northwest Indiana: www.great-lakes.net/glba/

BEACHNET

An email discussion list that seeks to facilitate communication among people interested in the improvement of recreational beach water quality in the Great Lakes basin. The listserv is sponsored by the GLBA and is hosted by the Great Lakes Information Network (GLIN). Both the GLBA and the listserv are open to anyone interested in improving beach water quality, understanding bacterial contamination, developing better ways to detect and monitor pollution, or monitoring and assuring beach visitors' health. There are currently several hundred subscribers to BEACHNET. <http://www.great-lakes.net/glba>

BeachCast. This website provides Great Lakes beach goers with access to information on Great Lakes beach conditions, including health advisories, water temperature, wave heights, monitoring data, and more. BeachCast is a service of the Great Lakes Commission and its GLIN. <http://www.glc.org/announce/03/07beachcast.html>

NEEAR Water Study

The National Epidemiological and Environmental Assessment of Recreational (NEEAR) Water Study is a multi-phase research study led by the Centers for Disease Control and EPA's Office of Research & Development and National Health and Environmental Effects Research Laboratory with assistance from USGS and NPS. The study investigates human health effects associated with recreational water use. The objectives of the NEEAR Water Study are to (1) evaluate the water quality at two to three beaches per year for three years concurrently with a health study, (2) obtain and evaluate a new set of health and water quality data for the new rapid, state-of-the-art methods, and (3) develop new federal guidelines and limits for water quality indicators of fecal contamination so that beach managers and public health officials can alert the public about the potential health hazards before exposure to unsafe water can occur. The studies have been conducted at several Great Lakes beaches, including three Lake Michigan beaches: West Beach and Washington Park Beach in Indiana, and Silver Beach in St. Joseph, Michigan. <http://www.epa.gov/nheerl/needar/>



The next State of Lake Michigan Conference and Great Lakes Beach Association meeting will be held in Milwaukee, Wisconsin in October 2009.