# 21. DATA MANAGEMENT

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Data management and analysis are key to using monitoring information wisely in decision making processes. Currently, data from WDNR water monitoring programs is stored in several databases, some (but not all) of which are accessible to the public via the internet. The WDNR introduced a new internet accessible tabular and spatial data system in 2007, the Surface Water Integrated Monitoring System (SWIMS). This section describes SWIMS and other databases currently in use, including their related websites, and is followed by a table indicating which monitoring programs store data in each database.

**Surface Water Integrated Monitoring System (SWIMS)**

Historically, data from different WDNR water monitoring programs had been stored in a number of disparate databases, each used by specific staff. In July of 2004, a 104(b)(3) grant was secured through EPA to develop a unified system to house and extract data from these various systems where possible. The Surface Water Integrated Monitoring System (SWIMS) enables all staff, as well as the public, to access comprehensive sets of data for each waterbody, and to view monitoring results geographically using ArcIMS Web mapping applications called Watershed Webviewer and Surface Water Data Viewer. Users can access the system via the Internet using a user ID and password. SWIMS creates efficiencies by allowing monitors to click and print field forms, allowing automatic generation of station numbers and mailing forms for the State Lab of Hygiene, and thereby enabling timely entry of results into the EPA Water Quality Exchange (WQX) Network. An important precursor to the development of SWIMS was the cleaning of backlogged STORET station data. Data from SWIMS is now sent to the EPA WQX, in place of sending it to the old STORET system, on a regular basis.

Data sets in SWIMS include:

- Sediment
- Aquatic Invasive Species
- Continuous monitoring data
- Lake Water Quality data
- Rivers and Lakes Long Term Trends data
- Macroinvertebrates
- Satellite water clarity
- Plants (UW-Herbarium & Lakes, starting 2008)
- Rivers
- Citizen Based Stream Monitoring Network data
- Miscellaneous Lakes data

More information about SWIMS is available on the internal WDNR website http://intranet.dnr.state.wi.us/int/water/swims.

**STORET and related websites**

STORET (short for STOrage and RETrieval) is a national EPA repository for water quality, biological, and physical data and is used by state environmental agencies, EPA and other federal agencies, universities, private citizens, and many others. STORET consists of two data management systems: the STORET Legacy Data Center (LDC), and Modernized STORET. The LDC is a static, archived database and Modernized STORET is an operational system actively being populated with water quality data.

The LDC contains historical water quality data dating back to the early part of the 20th century and collected up to the end of 1998. Modernized STORET contains data collected beginning in 1999, along with older data that has been properly documented and migrated from the LDC. Both systems contain raw biological,

chemical, and physical data on surface and ground water. Each sampling result in the LDC and in Modernized STORET is accompanied by information on where the sample was taken (latitude, longitude, state, county, Hydrologic Unit Code and a brief site identification), when the sample was gathered, the medium sampled (e.g., water, sediment, fish tissue), and the name of the organization that sponsored the monitoring. In addition, STORET contains information on why the data were gathered; sampling and analytical methods used; the laboratory used to analyze the samples; the quality control checks used when sampling, handling the samples, and analyzing the data; and the personnel responsible for the data.

Both the LDC and Modernized STORET are web-enabled and available to the public. With a standard web browser, both systems can be browsed and queried interactively and files can be created for download. The website is currently located at http://www.epa.gov/storet.

**WDNR 24K Hydrography Layer**

The WDNR 1:24,000 scale Hydrography layer is the base building block structure that supports the integration of all of our water-related data (e.g. outfalls, 303d waters, Outstanding and Exceptional Resource Waters, assessment units, stream order, etc.). Everything we collect related to surface water is located against this structure. This allows us to support a "one stop shop" environment from which to serve water-related data to WDNR staff as well as external customers in either map form or tabular reports. It is a digital representation of the blue lines and polygons that represent surface water on the USGS 7.5 minute topographic maps.

The hydro layer is important because it:

- serves as the "backbone" for locating all of our water related data (e.g. monitoring locations, assessment units, outfalls, engineering studies, dams etc. through the use of the embeddable Locator Tool);
- allows us to provide "one stop shopping" for water-related data (SWIS Query Interface, WT MapViewer, Surface Water Data Viewer);
- serves as the base surface water layer for all mapping applications in the department (DNR Web View, WT Viewer, SWIS Query Interface, WDNRVIEW, DV_MAP, Surface Water Data Viewer); and
- enhances our ability to communicate/share information with others who use our hydrography layer for their activities (e.g. counties, Regional Planning Commissions, federal agencies, etc.).

WDNR uses the hydro layer to "integrate", bringing all of our water-related data together in one place so we can view it, analyze it and map it. We share it with counties, educational institutions, other state and federal agencies, and the general public, as it is the only statewide representation of surface water for Wisconsin at this scale or better. It is used in a broad variety of WDNR programs for specific program needs. For more detailed information about the hydro layer, visit the hydro layer website at http://intranet.dnr.state.wi.us/itworks/gis/hydro.asp.

In FY08, an automated methodology was employed to create specific surface water bodies out of all the remaining unnamed waters in the hydro layer without a water body ID code. Approximately 141,000 new water body ID codes were added to the Register of Waterbodies (ROW) and the hydro layer. These codes have been used historically as links to tabular data about surface water.

**Register of Waterbodies (ROW)**

The Register of Waterbodies is the database that manages inventory information about our state's surface water. Unique numeric identifiers called waterbody ID codes (WBICs) are assigned to each stream/river, lake, pond, reservoir etc. as it is defined by users. WBICs are an important piece of information used by monitoring databases for linking data across tabular datasets. WBICs are also encoded into the statewide hydro layer.

**Water Assessment Tracking and Electronic Reporting System (WATERS)**

WATERS (previously called "WADRS") supports water quality standards and assessment work, the **Water Division's Goals Reporting System**, and **Electronic Watershed Planning**. WATERS holds decisions and information regarding the status of rivers, steams, and lakes, as well as Great Lakes shoreline miles including a variety of use designation, assessment, and management uses, and linkages to documents or reports supporting decisions about a waterbody.

WATERS, an intranet-based tabular and spatial assessment database created in 2002, supports implementation and reporting under the Federal Clean Water Act. This database holds Clean Water Act Section 305(b) and 303(d) data, designated uses, codified uses, and other data describing the quality of Wisconsin's rivers, lakes, and Great Lakes shoreline. WATERS uses the table structure and the reporting requirements identified in USEPA's integrated reporting strategy and programmed into the ADB V 2.0 and also includes additional enhancements specific to the state's water management needs. Data from this system is sent to EPA periodically in fulfillment of our Clean Water Act 305(b), 303(d), and 314 grant reporting requirements. WATERS can be accessed internally at http://intranet.dnr.state.wi.us/int/water/wm/wadrs/.

**UW-Stevens Point Aquatic Entomology Laboratory/SWIMS**

WDNR macroinvertebrate results analyzed at the UW Stevens Point Aquatic Entomology Laboratory are stored in the Surface Water Integrated Monitoring System (SWIMS). Data include listings of aquatic macroinvertebrate presence and their known associated tolerance values, and calculation of 15 commonly used macroinvertebrate community metrics. This database is supported by *The Macroinvertebrate Data Interpretation Guidance Manual*, which is designed to assist WDNR staff in interpreting macroinvertebrate data. Macroinvertebrate summary scores are now also available by station in the Surface Water Data Viewer (internal) and WATERS as the assessment unit level.

**Fisheries Management Database (FMDB)**

Created in 2000, the Fisheries Management Database stores information on Great lakes and inland fish stocking, inland fisheries assessments, creel surveys, tournaments, fish kills, and small stream habitat surveys. Maintained and developed at the USGS Water Resources Offices in Middleton WI under contract with the WDNR, the Fisheries Management Database is an Internet data entry and reporting system. All WDNR staff (e.g. field biologists, technicians, hatchery staff, and fisheries research scientists) have unlimited access to the system for entering and downloading raw data as well as standardized summary reports (http://infotrek.er.usgs.gov/wdnr_bio). Selected data are also available to the general public at the following address (http://infotrek.er.usgs.gov/wdnr_public/). Data currently not available through the public website are available upon request or through standardized reports available at each field office.

**USGS National Water Information System (NWIS) and related websites**

As part of the U.S. Geological Survey's (USGS) program of disseminating water data to the public, the USGS maintains a distributed network of computers and fileservers for the storage and retrieval of water data collected through its activities at approximately 1.5 million sites around the country. This system is called the National Water Information System (NWIS). Many types of data are stored in this NWIS network, including: site information, time-series (flow, stage, precipitation, chemical), peak flow, ground water, and water quality.

Data are accessible to the public through NWISWeb, at http://waterdata.usgs.gov/nwis. Its goal is to provide both internal and external users of USGS water information with an easy to use, geographically-seamless interface to the large volume of USGS water data maintained on 48 separate NWIS databases nationwide. Data are updated from the NWIS sites on a regularly scheduled basis; real-time data are transmitted to NWISWeb several times a day. NWISWeb provides several output options: real-time

streamflow, water-levels and water quality graphs, data tables and site maps; tabular output in html and ASCII tab delimited files; lists of selected sites as summaries with reselection for details.

Data are retrieved by category of data, such as surface water, ground water, or water quality; and by geographic area. Further refinement is possible by selecting specific information and by defining the output desired. NWIS data comes from all 50 states, selected territories and border stations, from 1896 to present. Of the 1.5M sites with NWIS data, 80% are wells; 350,000 are water quality sites; and 19,000 are streamflow sites, of which over 5,000 are real-time. NWISWeb contains about 4.3 million Water Quality Samples; and 64 million Water Quality Sampling Results.

**USGS Great Lakes Beach Health database and related websites**

Created in 2000, the USGS Great Lakes Beach Health database stores data from WDNR, various local cooperators throughout the state, and the public. It stores data on water quality samples from Great Lakes swimming beaches and other related information. Data are available to the public through the WDNR Beach Health website: http://infotrek.er.usgs.gov/pls/beachhealth.

**System for Wastewater Applications, Monitoring, and Permits (SWAMP)**

The SWAMP is an Oracle-based computer system designed to assist with management of the Wisconsin Pollutant Discharge Elimination System (WPDES) Permit Program. This system has the capability to generate WPDES permit applications, store facility information, generate and issue WPDES permits, determine whole effluent toxicity requirements, generate monitoring forms, store permittee monitoring data and analyze compliance, generate/store permit-related documents, track compliance events, and calculate annual environmental fees based on reported discharges. The database became active in January 1999; permitting capability became active in 2000.

For monitoring purposes, SWAMP has the capability to track sample point and monitoring requirements, display data and documents, compare reported data to reporting requirements and display apparent violations, warnings, and exceedances, and produce reports. Discharge, groundwater, sludge, and land application self-monitoring data are stored and available for downloading. Electronic reporting of discharge data is currently being implemented. Monitoring data that is held in SWAMP is downloaded, manipulated, and displayed as annual loading in the FACTs system, available on the WDNR website. A list of permittees with contact info can be found at http://dnr.wi.gov/org/water/wm/ww/permlists.htm, and location information for groundwater monitoring wells will be available in a WDNR Drinking Water web page soon.

**Drinking Water System (DWS)**

The purpose of the Drinking Water System is to enforce Safe Drinking Water Act regulations covering public water systems. The DWS is a data system created and maintained by the WDNR's Bureau of Drinking Water and Groundwater. It contains the monitoring and reporting requirements for each public water system and their drinking water sampling results. It also includes violations for any missing requirements and exceedances of the maximum contaminant levels (MCLs). This system is used to report public water supply data to USEPA as required by the Safe Drinking Water Act. The DWS also contains information on public and private well construction and high-capacity well approvals. A subset of data is available on the Internet for public access at http://www.dnr.state.wi.us/org/water/dwg/DWS.htm.

**Groundwater Retrieval Network (GRN)**

The Groundwater Retrieval Network acts as a central hub for accessing well information and groundwater quality data from various WDNR program databases. It contains information on public and private drinking water wells and monitoring wells and their associated water quality results. Data covers the period from the early 1970s to present for the Public Water data, 1988 to present for the Private Water Supply, priority watershed and special study data, and from the mid-1970s to present for the GEMS database. Not all

programs that currently generate groundwater-related data are linked into the GRN system. Data from the Bureau of Remediation and Redevelopment (LUST, spills, or remediation sites) as well as data from the Bureau of Watershed Management (wastewater treatment facilities and land spreading sites) is not currently retrievable through the GRN system. A subset of data is available on the Internet for public access at http://prodmtex00.dnr.state.wi.us/pls/inter1/grn$.startup.