WATER

Astronauts have told us we live on a beautiful blue water-covered planet. That water allows us to exist**;** and its plentitude has allowed us to take of its gifts for drink, food, beauty, cleanliness, transport, and play. That abundance has also led us to take it for granted, becoming careless of how we use and abuse it. This study considers the issues confronting us as we consider how to balance our sometimes conflicting needs.

How much water do we really have on Earth?
http://www.ruralurbanresources.org/all_water_on_earth.htm

- Only 3% of Earth's water is fresh water. 97% of the water on Earth is salt water.
- The water found at the Earth's surface in lakes, rivers, streams, ponds, and swamps makes up only 0.3% of the world's fresh water.
- 68.7% of the fresh water on Earth is trapped in glaciers.
- 30% of fresh water is in the ground.
- 1.7% of the world's water is frozen and therefore unusable.

http://water.epa.gov/learn/kids/drinkingwater/water_trivia_facts.cfm

Who uses this fresh water? According to the Climate Institute water was used as follows in 2005.
http://www.climate.org/topics/water.html

- 67% Agriculture
- 9% Households
- 8% Water Supply
- 7% Electricity and Gas
- 4% Manufacturing
- 2% Mining
- 3% Other

There are 4 main factors aggravating water scarcity: Population growth in the last century has tripled; increased urbanization focuses demand among a more concentrated population; high level of consumption as the world becomes more developed; and climate change will shrink the resources of fresh water.

****** *Hydrologists and agronomists warn that Peak Water is fast approaching, when the already limited availability of water from underground aquifers (a body of permeable rock that can contain or transmit groundwater) for crop irrigation exponentially decreases. Others say we reached it 30 years ago.*
http://arstechnica.com/science/news/2010/05/not-just-oil-us-hit-peak-water-in-1970-and-nobody-noticed.ars

Water in the Greater Cincinnati area.
Greater Cincinnati is richly endowed with water. The Ohio River lies at its southern doorstep. Lake Erie lies on the northern boundary of the State. The Great and Little Miami River Aquifers contain trillions of gallons of water. The Mill Creek aquifer is a much smaller but important source of water for communities located in the Mill Creek Valley.

These abundant waters provide resources for drinking water, industry, waste removal, recreation, transportation and aesthetic appeal. They also share a common vulnerability to pollution and mismanagement, and measures taken to protect them are frequently challenged.

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- *The average faucet flows at a rate of 2 gallons per minute. You can save up to 4 gallons of water every morning by turning off the faucet while you brush your teeth.*
- *Taking a bath requires up to 70 gallons of water. A five-minute shower uses only 10 to 25 gallons.*

- *A running toilet can waste up to 200 gallons of water per day.*
- *Every gallon you don't use is 1 gallon that doesn't have to be purified and pumped to your house, and 1 gallon that remains in the aquifer or river.*

Drinking Water. Greater Cincinnati Water Works (GCWW) has been a municipally owned and operated utility since it was purchased by the City of Cincinnati in 1839. Its mission is to provide its customers with a plentiful supply of the highest quality water and outstanding services in a financially responsible manner. http://www.cincinnati-oh.gov/water/pages/-3028-/

****** In 1900, 25,000 Americans died of typhoid. By 1960, thanks to the use of chlorine in water treatment, that number dropped to 20.* http://water.epa.gov/learn/kids/drinkingwater/water_trivia_facts.cfm

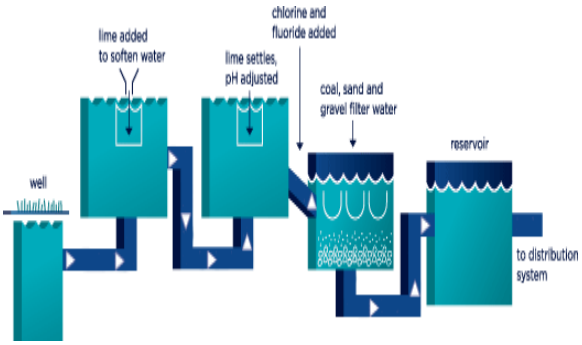
Water is tested more than 600 times a day from the source through treatment, and in the distribution system. GCWW supplies more than 48 billion gallons of water a year (131 million gallons each day) through 3,000 miles of water mains to about 1.2 million people. GCWW's service area has grown to include the entire City of Cincinnati, most of Hamilton County, and parts of Butler and Warren Counties in Ohio. In 2003, GCWW started selling water to Boone County and Florence, KY via a pipeline installed under the Ohio River.

****** American residents use about 100 gallons of water per day. At 50 gallons per day, residential Europeans use about half of the water that residential Americans use. Residents of sub-Saharan Africa use only 2-5 gallons of water per day.*

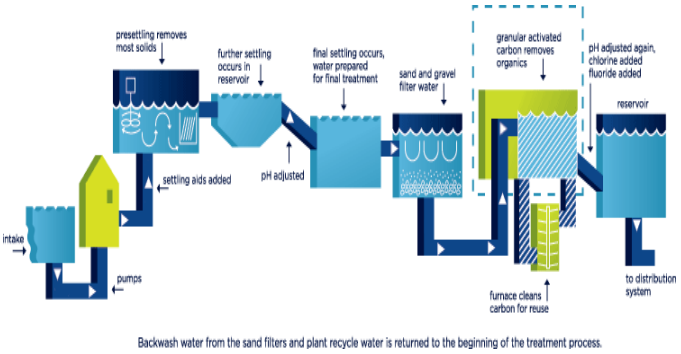
http://water.epa.gov/learn/kids/drinkingwater/water_trivia_facts.cfm

Sources of Greater Cincinnati Water. http://www.cincinnati-oh.gov/water/pages/-3283-/

The Bolton Treatment Plant in southern Butler County treats groundwater from ten wells in the **Great Miami Aquifer**. The aquifer (buried sand and gravel filled with water) is 150-200 feet deep and two miles wide. Bolton Plant supplies about 12% of GCWW water.



The Miller Treatment Plant in the California suburb of Cincinnati treats surface water from the **Ohio River** and supplies 88% of drinking water to GCWW's customers, including most of the City of Cincinnati.



The quality of drinking water is continuously monitored as the Greater Cincinnati Water Works uses the latest treatment techniques in its state-of-the-art

facilities to remove harmful contaminants. Cincinnati has been recognized nationally for its excellent drinking water. GCWW has always met or exceeded all state and federal health standards for drinking water.

***** Fluoride is added to the water to protect teeth, as required by state law passed in 1969. According to the American Dental Association, persons who drink fluoridated water have a 20% to 40% reduction in the number of cavities that would have occurred without fluoride. Some home filtration devices remove fluoride. Bottled water may not contain fluoride. http://www.cincinnati-oh.gov/water/pages/-3312-/#q7 Addition of fluoride to Cincinnati's drinking water was disputed at the time http://fluidlaw.org/caselaw/crotty-v-city-cincinnati and continues to be controversial with some today. http://en.wikipedia.org/wiki/Water_fluoridation_controversy*

Granular Activated Carbon (GAC) is one step in the GCWW water treatment process. It is considered the best way to remove organic materials from water. After settling and filtration, water at the Miller Plant is filtered through beds of GAC. Millions of pores in GAC capture (or "adsorb") the organic substances, removing them from the water. Most spills in the Ohio River are organics. GCWW "reactivates" carbon by burning off contaminants in two giant 1500-degree Fahrenheit furnaces.

***** One cup of GAC has the adsorptive surface area of about 25 football fields (approximately 1,300,000 square feet). Since water treated by GAC needs about 2/3 less chlorine than without GAC, it tastes better to many.*

An ultraviolet (UV) disinfection treatment facility is under construction now at the Miller Plant and slated to be operational at the end of 2013 (due to a rainy 2011 which delayed construction). UV disinfection uses low doses of ultraviolet light to inactivate disease carrying organisms such as Cryptosporidium. This extra step following the GAC process is being added since some organisms are resistant to chlorine. http://www.cincinnati-oh.gov/water/pages/-36456-/

****** In an effort to reduce GCWW's carbon footprint, the new UV facility will include 160 solar panels. When coupled with a second solar installation on an existing GCWW facility, significant environmental impacts and costs will be achieved annually by saving $151,000 of electricity.*

Protecting Cincinnati water. The first step in providing the highest quality water in Cincinnati is to protect our source waters.

Potential Sources of Water Contamination. http://www.gwconsortium.org/potential-pollution.php

- Improper storage or disposal of petroleum, chemicals, and hazardous waste
- Improperly managed landfills
- Improperly maintained septic tanks
- Improperly maintained private wells
- Underground storage tanks
- Abandoned gravel pits
- Excessive use of fertilizers or pesticides
- Improper dumping of hazardous household waste, toxic substance, or pharmaceuticals
- Radioactive contamination from uranium enrichment
- Abandoned cars
- Concentrated Animal Feeding Operations runoff
- Hydraulic Fracturing for Natural Gas (definition later in paper)

Ohio River. The Ohio Environmental Protection Agency (OEPA) has classified the Ohio River as highly susceptible to contamination, as with all surface waters. This is because it is open to the environment

and pollution may spread quickly with the flow of the river. To address this, GCWW has several barriers between potential pollution and your tap water.

The first barrier, a source water protection program, is designed to prevent and monitor organic contamination in the Ohio River. This is a coordinated effort by water utilities along the Ohio River in conjunction with ORSANCO (Ohio River Valley Water Sanitation Commission), the first of its type in the U.S. Thirteen monitoring stations test the water as it flows by. http://www.cincinnati-oh.gov/water/pages/-3269-/

If a problem is detected, GCWW has several options to protect the drinking water, ranging from turning off the intake and using stored water until pollution passes, to altering a treatment process to remove contamination.

Great Miami Aquifer. Ohio EPA has classified Bolton Treatment Plant water as having a high susceptibility to contamination because the Great Miami Aquifer does not have a protective clay layer, the water is shallow, there are potential contaminant sources nearby, and there are low levels of nitrates in the aquifer. This classification in itself does not mean that the aquifer is contaminated - only that it is vulnerable to contamination. Gravel is mined from the aquifer, opening it to contamination from multiple sources. http://www.cincinnati-oh.gov/water/pages/-3269-/

The Safe Water Act, as amended in 1986, mandates that each state develop a wellhead protection program to protect public water supplies that use a groundwater source. The State of Ohio's Wellhead Protection Program, approved by U.S. EPA in May 1992, requires local drinking water suppliers to develop and implement wellhead protection plans to prevent contamination of public water supplies, primarily by managing land use activities on or near the well field to avoid such contaminants as mentioned above as sources of pollution. Cincinnati recognized the vulnerability of the aquifer over a decade ago and has worked hard as a member of the Hamilton to New Baltimore Groundwater Consortium (www.gwconsortium.org) to develop an award-winning source water protection program to protect the aquifer. The Consortium's program has been recognized by the American Water Works Association as one of the best in the country.

***** At one time, the Mill Creek aquifer was depleted by over pumping, threatening municipal and industrial water supplies. Private companies cooperated to pipe well water from the Great Miami aquifer to supply their needs, and the Mill Creek Aquifer has since recovered and is near capacity at present.*
http://oh.water.usgs.gov/reports/Abstracts/wrir02-4167.html

Surface and Groundwater Pollution

Water pollution impairs the utility of surface waters, making them unsafe for drinking, recreational uses such as fishing and swimming, and many other uses. Control of pollution is mandated by the Clean Water Act through a permit system for discharges from industrial, municipal, and other facilities where the discharges go directly into surface waters. Individual homes connected to a municipal system, septic system, or that do not have a surface discharge do not need a permit.

Untreated Sewage:

***** *The Board of County Commissioners of Hamilton County, Ohio created the sewer district in 1968. They fund and set policy for the district's operations. On April 10, 1968, they established a 50-year contractual arrangement with the City of Cincinnati, for the management of MSD's daily operations and sustainability.*
http://msdgc.org/aboutmsd/

Cincinnati's raw sewage is carried primarily in two types of sewer systems: sanitary, carrying only waste products, and combined, carrying both waste and storm runoff. Historically, the sanitary sewers received storm water from connected roof and foundation drains and infiltration through aging pipes and joints. The storm water overtaxed the system and caused sewer backups into basements. In response, the County created about 100 sanitary sewer overflows (SSOs) into streams and tributaries to release the stress and prevent basement flooding. Eventually, the SSOs were pouring about 75 million gallons per year of raw sewage into surface waters.

In the 1860s, combined sewers were constructed to carry sewage to treatment plants during dry weather and to carry both storm water and sewage during storms with overflows (CSOs) designed into the system. These resulted in approximately 6 billion gallons of sewage-contaminated water being discharged without treatment annually.

In 1972, the Clean Water Act was passed which prohibited the discharge of pollutants including raw sewage into waters unless authorized by a National Pollutant Discharge Elimination System Permit. The Act gave responsibility for enforcement to states, federal government, and private citizens; the latter to serve to ensure that governments are diligent in prosecuting violations. The discharges of raw sewage from Cincinnati and Hamilton County's SSOs and CSOs were and are in violation of the Clean Water Act.

After 20 years, in 1992, Ohio EPA issued an order compelling the city and county to remedy its illegal SSOs. In the next 10 years, Hamilton County and Cincinnati spent $174 million and eliminated 63 SSOs. but other SSOs remained and violations continued. On December 18, 2001 the Sierra Club filed a citizen suit notice of its intent "...to enforce and seek elimination of all SSOs into the Mill Creek and Little Miami River...." After two years of negotiations and further legal actions, a *Final Consent Decree* was agreed to by the State and Federal agencies and the County and City (for MSD) to provide a comprehensive program to bring all raw sewage overflows and waste treatment violations into compliance by no later than 2022. On June 9, 2004, the U.S. District Court issued a Final Order accepting the Consent Decree as "in compliance with the Clean Water Act" and subject to enforcement by the Court (Ref.: No. 05-4437 Sierra Club and Marilyn Wall V. Hamilton County Board of Commissioners and City of Cincinnati US Court of Appeals for the 6th District).

http://caselaw.findlaw.com/us-6th-circuit/1244672.html

In 2009, MSD submitted a revised plan to federal authorities that included a giant tunnel 300 feet under the lower Mill Creek which would hold overflow for processing through the Gest Street treatment plant. Since 3/4 of CSO volume is storm water, MSD proposed the consideration of a lower cost alternative called Project Groundwork using a watershed retention approach to reduce and eliminate sewer overflows into creeks and rivers. MSD received conditional approval for both proposals from federal agencies and in August 2010 the Federal Court approved MSD's proposal.

****** Runoff from impermeable surfaces such as roofs, parking lots, streets and even lawns is much of what goes into CSO's. Keeping or restoring natural streams means that huge quantities of water are not contaminated with sewage and do not require treatment. It also refills our aquifers and provides pleasant recreation locations for citizens.*

Project Groundwork: The 2004 agreement requiring MSD to fix SSO and CSO problems required revenue from industrial and residential users to support expenditures of up to $1.5 billion by 2022. Details are available at www.msdgc.org. MSD has sought to reduce costs in order to avoid prohibitive rate increases for customers. The average user pays 90 % more today than in 2004, and rates will go up another 8% next year. Savings of over $10 million per year in operating costs have been achieved through reduced labor costs, but major capital savings in addressing the inadequacies of the ancient infrastructure is of critical importance.

The deep tunnel would cost $244 million (in 2006 dollars) to build and an extra $1.7 million a year just to pump the sewage through the tunnel and enhanced treatment plant. Running rainwater and runoff through streams would cost only one-tenth the operating cost, in part because there are no pumping or treatment costs for the diverted storm water.

****** Default Solution -- The U.S. EPA is requiring MSD to design a deep storage tunnel and enhanced high rate treatment (EHRT) facility to eliminate 1.6 billion gallons of annual overflows within the Lower Mill Creek watershed. This solution will cost more than $244 million to construct and additional funds to operate and maintain.*

Evaluation Project in South Fairmont -- The Project Groundwork approach is being evaluated in the 2700-acre Lick Run watershed on Cincinnati's west side. Each year, 1.6 billion gallons of raw sewage and storm water from communities in that watershed flow from a huge CSO into Mill Creek. 75% of the overflow is from storm water that used to flow via natural streams but was diverted into underground pipes when combined sewers were constructed. Project Groundwater proposes to let rain water flow through a newly constructed stream while the sewage is conducted only through underground pipes to the treatment facility.

MSD's plan is to recreate the historic Lick Run in South Fairmont as a green oasis in a blighted, neglected, and declining historic neighborhood. This change could catalyze economic and residential revitalization while eliminating raw sewage discharges, and at less than half the capital cost of the deep tunnel option. Five options are being considered, ranging from traditional underground storm water with little improvement in water quality to an aboveground natural stream with water quality features linked to the Mill Creek. Community input is being solicited as the study proceeds. For further information

about the options being considered, go to http://projectgroundwork.org/lickrun/ .

***** Years ago, Lick Run between Queen City and Westwood Avenues was put underground as a sewer. In dry weather, wastes go to a sewage plant. When it rains, the sewer is beyond capacity and is diverted directly to the Mill Creek, where it discharges a mixture of runoff and sewage.

Pending and Future Water Issues

Pharmaceuticals can enter our waterways through several different pathways:

- Pets and livestock feedlots
- Human waste
- Improper disposal of medicine

Waste from people and animals contains residues of medications. Some are being found in the water. While some are removed by current practices, it is an area of increasing concern in water purification. http://www.gwconsortium.org/Pharmaceuticals-Water.php

You can do your part to reduce this problem by following The White House Office of National Drug Control Policy for disposing of pharmaceuticals.

- Take unused, unneeded, or expired prescription drugs out of their original containers and throw them in the trash.
- Mix prescription drugs with an undesirable substance, such as used coffee grounds or kitty litter, and put them in impermeable, non-descript containers, such as empty cans or sealable bags.
- Don't flush prescription drugs down the toilet unless the label or accompanying patient information so specifies.
- Take advantage of community pharmaceutical take-back programs that allow the public to bring unused drugs to a central location for proper disposal. http://www.cincinnati-oh.gov/water/downloads/water_pdf34872.pdf

Gas Exploration and Fracturing. Eastern Ohio is underlain with an enormous bed of oil-containing Utica Shale. Leasing of private lands is underway with a high likelihood that hydraulic fracturing – or "fracking" – will be used to economically recover oil and gas. This type of oil and gas recovery involves injection of millions of gallons water, sand and chemicals into the shale under high pressure to open cracks through which gas and oil flow into the well. Part of the water returns to the surface laden with drilling chemicals, heavy metals, and radioactive materials from the shale, and must be cleaned and recycled or pumped into deep wells. Chemical wastes removed from the water must be disposed of safely.

***** The League of Women Voters of Pennsylvania has taken a strong position of public protection on fracking. The League supports (in part):
"… the maximum protection of public health and the environment in all aspects of Marcellus Shale natural gas production, site restoration, and delivery to the customer, by requiring the use of best practices, and promoting comprehensive regulation, communication, and adequate staffing across government agencies." See entire position at http://palwv.org/issues/MarcellusShale/Position%20Statement%20Marcellus%20Shale.pdf

Reports of household well water contamination by the drilling industry and the inability of some municipal waste water treatment facilities to remove all the chemicals in drilling waste water have raised issues of concern. The Ohio EPA will soon take comments on standards for pollution limits. http://www.tribune-chronicle.com/page/content.detail/id/145516

/Ohio-EPA-proposes-pollution-limits-for-drilling-.html?isap=1&nav=5031

The Great Lakes Basin Compact. There has been recent concern about over-usage of water from the Great Lakes. State legislation is required as part of the 2008 eight-state Great Lakes Compact, created as the lakes' border states sought measures to protect their abundant fresh waters. The compact requires each state to decide by 2013 how the waters are to be used. The Ohio Legislature passed legislation this summer that was vetoed by Governor Kasich. "Lake Erie is an incredible resource that demands our vigilant stewardship to maximize its environmental, recreational and commercial potential for Ohioans," Kasich said in a statement. "Ohio's legislation lacks clear standards for conservation and withdrawals and does not allow for sufficient evaluation and monitoring of withdrawals or usage." http://www.cleveland.com/open/index.ssf/2011/07/post_28.html

***** *More than 25% of bottled water comes from a municipal water supply, the same place that tap water comes from. If you drink your daily recommended 8 glasses of water per day from the tap, it will cost you about 50 cents per year. If you choose to drink it from water bottles, it can cost you up to $1,400.* *http://water.epa.gov/learn/kids/drinkingwater/water_trivia_facts.cfm*

Climate Change Impacts on Water. There are numerous articles about the effects of climate change on water. This excerpt points to the region which includes Cincinnati as an example of what scientists are predicting. **http://www.isse.ucar.edu/water_climate/html_map.html#9**

Region 6: Midwest USA and Canadian Prairies

Regional Characteristics: *Agricultural heartland – mostly rainfed, with some areas relying heavily on irrigation.*

- Annual streamflow decreasing/increasing; possible large declines in summer streamflow.
- Increasing likelihood of severe droughts.
- Possible increasing aridity in semiarid zones.
- Increases or decreases in irrigation demand and water availability – uncertain impacts on farm sector income, groundwater levels, streamflows, and water quality.

Two other links to climate/water information: **http://www.choicesmagazine.org/2008-1/theme/2008-1-04.htm; http://www.climate.org/topics/water.html**

Flooding: Greater Cincinnati has experienced catastrophic flooding on both large and smaller localized scales. Administration of flood control programs is divided among municipalities, county, state, and federal agencies. Construction of large-scale structures have helped to prevent recurrence of the historic 1937 flood, but economic damage and occasional loss of life still happen in local communities. Issues remain over coordination, flood warnings, financing and approach (built barriers vs. improved storm water retention).

Cincinnati barge transport: Bulk commodity transport by barge on the Ohio River is efficient, low cost and climate and energy friendly. It remains economically important to the city and region, and there is interest in expanding docking infrastructure to facilitate cargo handling and transfer to connecting land transport. Recent interest in locating a dock near the junction of the Mill Creek with the Ohio has encountered local community opposition over a competing plan for the site as a riverside park.

Industrial waste. Industrial waste disposal is regulated under the Clean Water Act. However, chemical spills occur and must be captured and cleaned up, subject to effective regulatory oversight. This is not an easy task in moving water, where booms and other equipment must be acquired and put in place promptly to minimize dispersion.

LWVUS Action History on the Water Resources Issue

http://www.lwv.org/AM/Template.cfm?Section=Natural_Resources&CONTENTID=14223&TEMPLATE=/CM/ContentDisplay.cfm

The League actively supported passage of an expanded Safe Drinking Water Act in 1986 and the Clean Water Act of 1987. The LWVEF supported educational forums across the country under the Safe Drinking Water Project. In 1994 and 1995, the League opposed amendments to the Safe Drinking Water Act that would have required EPA to conduct formal cost-benefit analysis for every regulatory action.

Groundwater, the source of half of the nation's drinking water, was largely unprotected at the national level until the Clean Water Act was renewed in 1994. Prior to that time, state and local leagues undertook local educational efforts to promote awareness of risks and corrective action. The League published and distributed *Strategies for Effective Public Involvement in Drinking Water Source Assessment and Protection*, a handbook designed to facilitate public involvement required by the Safe Drinking Water Amendments of 1996.

The League also supported protection of wetlands through education and conferences. It supports a watershed approach to protect streams from pollution and degradation and to restore and protect wetlands. Related to this, the League submitted comments to the Army Corps of Engineers urging revocation of nationwide Permit 26 (NWP 26), which sanctions the loss of thousands of acres of wetlands every year.

Locally, LWVCA has a position in support of the classification of the Little Miami River as a State and National Wild and Scenic River. The Natural Resources Committee participates on the Board of the Mill Creek Watershed Council of Communities.

In 2010 the League of Women Voters unanimously resolved to call for 'stronger regulation and enforcement of rules about mining for energy resources'. Several studies are underway to establish responsible drilling practices.
Believing that it is prudent to wait until these studies are available, the League of Women Voters of Ohio has called for a one-year moratorium on new well permits.
http://www.lwvohio.org/assets/attachments/file/06_14_11%20SubHB133test(1).pdf