



Illinois Department of Natural Resources

One Natural Resources Way Springfield, Illinois 62702-1271
<http://dnr.state.il.us>

Pat Quinn, Governor
Marc Miller, Director

Office of Water Resources, Michael A. Bilandic Building, 160 N. LaSalle St., S-703, Chicago, IL 60601
Office: 312/793-3123 Fax: 312/793-5968

2012 Annual Water Use Audit Form (LMO-2)

This form must be completed by all Category IA and IIB Permittees for each annual water use accounting year running from October 1, 2011 through September 30, 2012. This form must be submitted to the Department by January 7, 2013.

Section I - General Information

Name, address and phone number of Permittee:

The City of Chicago
Department of Water Management
1000 East Ohio Street
Chicago, Illinois 60611

County: Cook

Name, address and phone number of the contact person for the Permittee:

Thomas H. Powers, P.E.
312-744-7001

e-mail address _____

Authorized Official



Title: Commissioner

Date: 3/11/2013

Please provide leak survey information and population estimates for the last year.

Population: 2,707,120 Number of existing households: 1,033,022

The Illinois Department of Natural Resources is requesting disclosure of information that is necessary to accomplish the statutory purpose as outlined under Chapter 19, Section 120.2 of the Illinois Revised Statutes. Disclosure of this information is required. Failure to provide any information will result in this form not being processed. This form has been approved by the Forms Management Center, CMS.

Section II - Water Use Audit

Enter the amount of water pumped and utilized for each item shown below. All amounts entered in this section must be in units of million gallons per day (mgd) rounded off to three decimal places. Conversion calculations are provided for your use in Section IV.

A. Pumpage Data

Water bought or received from the following distribution systems:

1. Lake Michigan Pumpage	794.956	mgd
2. Shallow Aquifer Pumpage		mgd
3. Deep Aquifer Pumpage		mgd
4. Total Pumpage (add lines 1, 2 & 3)	794.956	mgd
5. Water Treatment Use	3.047	mgd
6. Gross Annual Pumpage (subtract line 5 from line 4)	791.909	mgd

Water sold or provided to any other distribution systems (enter the name of each system and the amount sold or provided to that system on lines 7 through 12). If additional lines are required, attach an additional sheet listing each system and amount.

7	294.352	mgd
8		mgd
9		mgd
10		mgd
11		mgd
12		mgd
13. Total (add lines 7-12 and any additional amounts)	294.352	mgd
14. Net Annual Pumpage (subtract line 13 from line 6)	497.557	mgd

B. Uses

	Metered	Unmetered	Total
15. Residential	73.749	217.084	290.833 mgd
16. Commercial and Manufacturing	127.168	1.555	128.723 mgd
17. Municipal	19.168	0.628	19.796 mgd
18. Construction	0	0	0 mgd
19. Total Uses (add Total lines 15 through 18)	220.085	219.267	439.352 mgd
20. Percentage of Total Use to Net Annual Pumpage (divide line 19 by line 14 and multiply by 100)			88.30%

C. Hydrant Uses

21. Firefighting and Training	2.488	mgd
22. Water Main Flushing	0.200	mgd
23. Sewer Cleaning	0.100	mgd
24. Street Cleaning	0.100	mgd
25. Construction	2.488	mgd
26. Other (attach explanation) (Explanation Note *)	4.976	mgd
27. Total Hydrant Use (add lines 21 through 26)	10.352	mgd

* Excessive hydrant use due to unauthorized and illegal open hydrants.

Section II - Water Use Audit (continued)

28. Percentage of Hydrant Use to Net Annual Pumpage (divide line 27 by line 14 and multiply by 100)	<u>2.08 %</u>
29. Department allowed maximum for Hydrant Use	<u>1.0 %</u>
30. Excessive hydrant use (subtract line 29 from line 28). If the percentage is greater than 0.0, attach an explanation. [see Rule 730.307 (e)]	<u>1.08 %</u>
D. Unavoidable Leakage and Unaccounted for Flow	
31. Maximum Unavoidable Leakage (Do worksheet in Section III; enter amount from line 10 of the worksheet)	<u>10.276 mgd</u>
32. Percentage of Maximum Unavoidable Leakage to Net Annual Pumpage (divide line 31 by line 14 and multiply by 100)	<u>2.07 %</u>
33. Total Accounted for Flow (add lines 19, 27 and 31)	<u>459.980 mgd</u>
34. Percentage of Total Accounted for Flow to Net Annual Pumpage (divide line 33 by line 14 and multiply by 100)	<u>92.45 %</u>
35. Total Unaccounted for Flow (subtract amount on line 33 from line 14)	<u>37.577 mgd</u>
36. Percentage of Total Unaccounted for Flow to Net Annual Pumpage (divide line 35 by line 14 and multiply by 100)	<u>7.55 %</u>

Please Check Your Calculations

The sum of lines 33 and 35 should equal line 14. If they do not equal, recheck your calculations.
The sum of lines 34 and 36 should equal approximately 100%. If not, check calculations.

Section III - Maximum Unavoidable Leakage Worksheet

Complete the following calculations to determine your maximum unavoidable leakage.
Enter the appropriate amounts in the space provided.

A. Cast Iron Pipes With Lead Joints

Age of Pipes	Miles of Pipe	Leakage Rate	Maximum Unavoidable Leakage	
1. 60 yrs. or greater	2583.54	x 3,000 g/d/mi =	7,750,620	g/d
2. 40-60 yrs.	426.41	x 2,500 g/d/mi =	1,066,025	g/d
3. 20-40 yrs.		x 2,000 g/d/mi =	0	g/d
4. 20 yrs. or less		x 1,500 g/d/mi =	0	g/d

B. All Other Types of Pipes and Joints

Age of Pipes	Miles of Pipe	Leakage Rate	Maximum Unavoidable Leakage	
5. 60 yrs. or greater		x 2,500 g/d/mi =	0	g/d
6. 40-60 yrs.	126.86	x 2,000 g/d/mi =	253,720	g/d
7. 20-40 yrs.	212.34	x 1,500 g/d/mi =	318,510	g/d
8. 20 yrs. or less	887.54	x 1,000 g/d/mi =	887,540	g/d
9. Total Miles	<u>4,236.69</u>	Total Leakage	<u>10,276,415</u>	g/d
10. Total Maximum Unavoidable Leakage, in mgd (divide total leakage on line 9 by 1,000,000) (Enter this amount on line 31 of "Section II - Water Use Audit")			<u>10.276</u>	mgd

Section IV - Conversion Table

Below are conversion calculations to convert the most commonly used units to units of million gallons per day (mgd).

To convert cubic feet per year (cf) to (mgd) use:

$$(cf \times 7.48) / 1,000,000 / 365 = \text{mgd}$$

To convert gallons per year (g) to (mgd) use:

$$g / 1,000,000 / 365$$

To convert gallons per day (g/d) to (mgd) use:

$$(g/d) / 1,000,000$$

To convert million gallons per year (mg) to (mgd) use:

$$mg / 365 = \text{mgd}$$

CITY OF CHICAGO
DEPARTMENT OF WATER
SUPPLEMENT TO FORM LMO-2

WATER METERED AND BILLED DIRECTLY BY CHICAGO WATER DEPARTMENT
OCTOBER 1, 20011 TO SEPTEMBER 30, 2012

ENTITY	MGD
ALSIP *	6.566
BEDFORD PARK	23.244
BERWYN	5.062
BLUE ISLAND	2.275
BRIDGEVIEW	2.146
BROOKFIELD-N. RIVERSIDE W.C. *	3.973
BURNHAM	0.101
CALUMET CITY	0.080
CALUMET PARK	0.720
CENT. STICKNEY SD	0.161
CICERO	7.250
DES PLAINES	7.046
DOLTON	2.638
DUPAGE W.C.	81.431
ELMWOOD PARK	1.953
EVERGREEN PARK	1.939
FOREST PARK	3.055
FOREST VIEW	0.142
FRANKLIN PARK	3.489
GARDEN HOMES S.D.	0.072
HARVEY *	8.986
HARWOOD HEIGHTS	0.811
HILLSIDE-BERKELEY W.C. *	1.656
HOMETOWN	0.339
JUSTICE-WILLOW SPRINGS W.C. *	2.995
LINCOLNWOOD	1.802
MAYWOOD	2.954
McCOOK *	5.480
MELROSE PARK *	8.755
MERRIONETTE PARK	0.187
MIDLOTHIAN-MARKHAM W.C. *	2.791
MORTON GROVE *	2.943
NILES	5.219
NORRIDGE	1.454
NORTHWEST SUB JOINT ACTION W. A. *	31.159
NORTHLAKE (Partial)	0.137
OAK LAWN *	33.031
OAK PARK	5.151
PARK RIDGE	4.344
RIVER FOREST	1.291
RIVER GROVE	1.104
RIVERDALE	1.491
ROBBINS	1.379
ROSEMONT	1.399
SCHILLER PARK	1.575
SOUTH HOLLAND *	2.429
SOUTH STICKNEY S.D.	2.786
STICKNEY	1.578
SUMMIT	1.143
WESTCHESTER-BROADVIEW W.C. *	3.609
WORTH	1.038
TOTAL	294.352

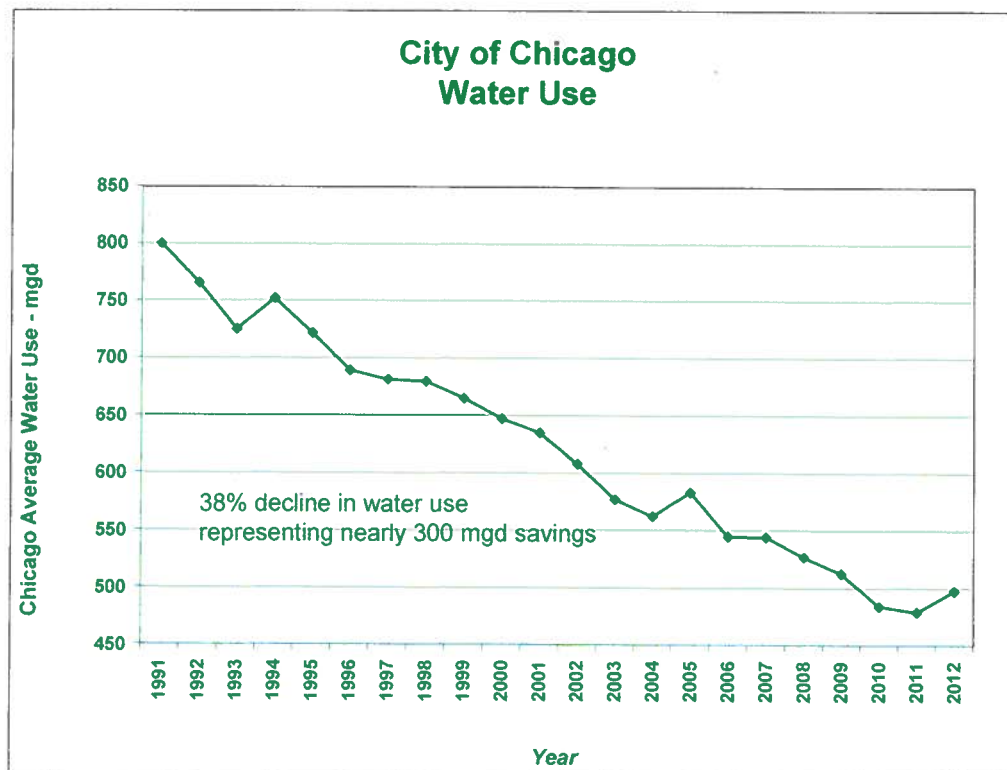
* INCLUDES OTHER MUNICIPALITIES
ALL METERS ARE READ BETWEEN THE 20TH AND 30TH DAY OF EACH MONTH

**REPORT BY THE CITY OF CHICAGO
DEPARTMENT OF WATER MANAGEMENT
TO
THE ILLINOIS DEPARTMENT OF NATURAL RESOURCES
FOR THE 2012 WATER ACCOUNTING YEAR**

During Water Year 2012, the City of Chicago has continued to promote water conservation through a number of initiatives and policies to better conserve our fresh water and to wisely manage storm water. Our water conservation plan is a partnership among public and private sectors, and each resident of Chicago. It includes investing in infrastructure upgrades, working with our sister agencies and large industrial customers to promote conservation, and developing a plan to meter all residential water users. With the exception of 2005 and 2012 drought years, the Department continues to see declining water usage due to its continued efforts to reduce water waste by investing in the following programs:

- a.) Water Main Replacement
- b.) Hydrant Custodian Installation
- c.) Education and Public Awareness
- d.) Meter Repair and Replacement
- e.) Elimination of Unused Services
- f.) Underground Leak Detection and Repair
- g.) SCADA System Upgrade
- h.) Installation of Variable Speed Pumps

The chart below demonstrates our progress with a plan that has had significant results in reducing water usage for the City of Chicago.



WATER MAIN REPLACEMENT

The Water Main Replacement Program was designed to address the City's aging water mains which were installed over 100 years ago at the height of Chicago's exponential growth rate. The selection of water mains to be replaced is based primarily from analyzing break history records to determine where replacement would most benefit the water system. The City has placed a high priority on this key component of the Water Conservation Program, and believes it has had a large impact on the reduction of unaccounted for water, and a significant impact on the decline in water pumpage. Prior to 2012, the program had targeted a replacement rate of approximately 1% of the system's 4,350 miles of pipe each year. We are now on a path to target over 2% per year allowing us to mirror the installation rates over 100 years ago. The following table shows the past and current miles of main replaced per year.

We are pleased to report that through the leadership and support of Mayor Rahm Emanuel, the funding to address the needs of our aging infrastructure has become available through a series of water rate increases starting in 2012 with 25% and continuing the next 3 years with 15% each year. Water mains are critical assets to deliver safe potable water to not just Chicago but to its wholesale customers. These unprecedented water rate increases were based on the fact that over 25% of our water mains are over 100 years old and demonstrate our Mayor's vision and commitment to focus on the long term needs of this aging water system. The rate increases will allow us to continue this successful program to reduce water waste as well as fund critical treatment plant and pumping station upgrades. Our long term goals have been set to replace nearly 900 miles of water mains in the next 10 years.

Year	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
Miles of Pipe Laid	42.2	49.5	42.3	38.7	35.9	23.0	33.7	20.7	34.0	32.0	30.0	30.0	70.0	75.0

HYDRANT CUSTODIANS

The City has historically experienced difficulty in deterring people from opening hydrants during hot summer days. The opening of hydrants creates hazardous traffic situations, may damage adjacent property, and wastes water. In addition, open hydrants reduce the pressure and amount of water available for fire fighting.

In order to minimize this problem, the City began installing hydrant custodians in areas where previous experience indicated that open hydrants may be a problem. This program had to be coordinated with the Fire Department to insure that the hydrants would always be available for fighting fires. The installation of hydrant custodians is a repetitive and evolutionary process. The City develops a locking mechanism and the water thieves develop methods of removal. This has occurred multiple times with the City attempting to stay one lock ahead of the thieves.

The City has experimented with various locking devices throughout the years and has developed two types of technologically advanced custodians that are fairly effective. In addition, the City has developed a stem design that makes it difficult to turn the hydrant valve by reaching through the ports and manually turning the stem.

In the 1990's, the City investigated and tried many other deterrents and have found them to be readily defeatable by determined vandals. Over 20,000 of the City's 48,000 hydrants now have custodians. A total of 8,400 of these 19,000 are the newer "NEO" version which operates with a stronger magnet. In areas where repeated open hydrants occur, the City is retrofitting the custodian with an additional spider guard deterrent to prevent damage to the operating mechanism. These retrofits installed since 1998, have demonstrated their effectiveness by a reduction in their frequency of opening. The City has found that the newer "NEO" version of the custodian has had a very significant impact on illegal hydrant openings. The City will still install the additional spider guard retrofits, but only in the areas where the "NEO" has not been successful.

EDUCATION AND PUBLIC AWARENESS

The Department of Water Management engages in public education and awareness on a continuing basis. Conservation messages are conveyed through a variety of channels, including community meetings, literature distribution, and extensive use of the World Wide Web. Over the past years, we have included themes from the Chicago Water Agenda. This is a gathering of local initiatives, policies, programs and proposals that address issues of conservation, water quality and storm water management in a coordinated way. The Agenda applies not just to the City of Chicago, but to suburban communities and other cities across the Great Lakes region. We have also ramped up efforts in a promotional campaign to get conservation messages out to the public through various transportation ads and street signage advertising. Our metersave program message is quite visible throughout the city.

Coordinating with other City departments, the Department of Water Management has been including Agenda messages in the annual Consumer Confidence Report, in development of an educational program for schools, in grass roots presentations to community groups and Chambers of Commerce, and in other appropriate settings. Topics range from techniques of conservation to fire hydrant usages to the prospect of universal customer metering.

METER REPAIR AND REPLACEMENT

The City has also continued to make great strides with its volunteer metering program. Accounts which are currently unmetered can have a meter installed free of charge. By the end of 2012, we installed over 22,000 meters under this programs inception in 2009 and plan to install 12,000 meters in 2013. To keep up with the program, we have continued to engage in a contract to allow a private contractor to install meters from the volunteer program and supplement our in-house work force. As this program is continuously promoted and more customers realize the financial and resource benefits, we anticipate a stronger participation and are committed to making this a successful program. The highlights of this program are presented on our promotional website at www.metersave.org.

The City continued to service those meters presently installed on suburban, commercial, industrial, and municipal accounts. The total installed meter base in Chicago is in excess of 190,000 units. As new housing is erected and rehabilitation continues, the number of meters is increasing. Maintenance of this large installed meter base requires a considerable commitment of manpower and equipment. The City is committed to maintaining its meters in conformance with the recommendation of the meter manufacturers and the AWWA.

COMMERCIAL NON-METERED ACCOUNTS

The Department of Water Management has continued its efforts to install meters on all non-metered commercial accounts. To date we have installed 550 meters with another 350 targeted for 2013. We have accomplished this task by efforts of sending letters requesting that meters be installed per Chicago Municipal Ordinance and conducting field visits to assure that all properties requiring meters work toward installing meters. Although most of these accounts require smaller meters, we have found that the larger meters have various circumstances which make this task difficult such as the need to get permits, design plans and the feasibility to construct larger meter vaults to accommodate the some of the larger meters. We are working hard to continue our efforts to have all of these accounts metered by the end of 2013.

ELIMINATION OF UNUSED SERVICES

The City continued its efforts to cut and seal unused services. The following table shows the data for termination of unused services since 1999.

Year	99	00	01	02	03	04	05	06	07	08	09	10	11	12
Number of Services Terminated	1596	1108	1206	1140	650	820	620	422	297	488	510	692	342	476

A major effort has been made to eliminate these potential sources of leakage. These water services were terminated by both City forces and by private contractors. Although the termination of unused water services is very expensive, the continued reduction in the number of unused services should help reduce the amount of unaccounted for water.

LEAK DETECTION AND REPAIR

The Department has maintained a high level of effort in its leak detection program over the past years. The Department employs one TriCorr TM 2001 correlator and in 2009 purchased some of the newer Digicorr correlators from FCS which is considered the product of choice by most professional leak detection firms and consultants, particularly in North America. These models are more sensitive in detecting leaks and have better noise filtering capabilities. In addition to our in house forces, the Department also contracts out services for leak detection. The services include not only an ongoing systematic coverage for leak detection of our distribution system every 3-4 years, but also the monitoring for leak noises while performing an ongoing valve inspection program. Where noise was detected, they returned with electronic correlators equipment to pinpoint the leaks for repair. Through our leak detection consultant, we have been able to employ various technologies use to detect and pinpoint underground leakage. The Radcom SoundSens Leak Noise Correlator system combines sound logging and correlation by installing three or more correlating pods within an area. The units pick up sound during the night and are then analyzed the next day by downloading the sounds to a central correlator. A multipoint correlation can then be performed between the units resulting in higher degrees of accuracy and allowing nighttime sounding without the need to work during the nighttime.

The Department is also employing the latest technology in the leak detection field for feeder mains also. During 2005 and 2006, we started to survey sections of 36-inch and 60-inch mains with the Sahara® leak detection technology. A tether-controlled Sahara® sensor is deployed inside a pipeline without any disruption to pipeline service. It moves through the pipeline with the flow and pinpoints even the smallest leaks in water mains. More documentation on this technology can be found at

http://www.puretechltd.com/products/sahara/sahara_leak_gas_pocket.shtml . In 2007 we started using another newer technology for large diameter pipeline leak detection. This technology is Echologics and is differs from traditional leak correlators in that it uses the water column inside the

pipeline to transmit the sound wave generated from a leak. This technology allows greater distances to between transmitters and has proven to be worthwhile. More documentation on this technology can be found at http://www.echologics.com/leakfinder_overview.html. Since then, we have been using a similar product, the Primayer leak correlator system and have made an effort to systematically survey our older trunk main systems to assure no leaks are occurring on these mains which could cause catastrophic failures and extensive damage. More documentation on this technology can be found at http://www.primayer.co.uk/wlc_leak_location_eureka_digital.htm

The following table demonstrates the Department's efforts toward leak detection.

Year	01	02	03	04	05	06	07	08	09	10	11	12
Miles of Pipe Surveyed	2364	2390	2310	2200	700	734	1220	1700	1460	1220	1600	1900
Number of Underground Leaks Located	994	809	1050	938	400	320	356	590	477	402	300	660

SCADA SYSTEM

The SCADA system was upgraded during 1996-97 when the five steam stations underwent re-instrumentation. At that time, new well gauges, discharge pressure gauges, and flow meters were replaced. In addition, remote pressure sensors were installed at 36 continuously monitored points in the distribution system. Installation of a total of 48 intermittent pressure monitoring points were also installed. Over the past few years, eight additional continuously monitored points have been added. These points are located mainly in the outlying areas to monitor supply pressure and suburban flow demand patterns. These pressure sensors have proven to aid in pumping station operation by avoiding over pressuring the system and is believed to contribute to significant savings in water use. The upgrade also allowed the SCADA system to monitor in real time the entire pumping station operation. It has also allowed a more complete monitoring and control of pressures and flows in the distribution system on a real time basis. In 2006, the Department started a two year contract to upgrade both the equipment and software to improve the operations and allow even better pressure management. This project finished late in 2009 and has already proven to be a useful tool to improve operations.

VARIABLE SPEED ELECTRIC DRIVES

The Southwest pumping station which supplies nearly 70 percent of its demand to suburban wholesale customers was the first electric pumping station to undergo installation of variable speed drives. Prior to installation there were wide swings in demand and pressures due mainly to the suburban customer loading. These units have proven to be more efficient concerning water use by adding the flexibility of meeting varying demands without the need to start up additional pumps, and thus over pressurizing the water system. The Department has also completed the construction in 2012 of installing variable speed drives for Thomas Jefferson pumping station. This improvement has already demonstrated great improvement in pumping operations on the City's northeast side.

In 2002, the department completed the work at the Roseland pumping station. This station was converted from steam driven turbines to variable speed electric drives. An additional pump was also installed as part of this capital project. The conversion of this station has provided reliability, flexibility and efficiency over steam. The Department completed final design plans for the conversion of the Springfield Pumping Station from steam to variable speed electric drives in 2009 and has awarded and started work in 2011 for this multi-year construction project which is on schedule to be completed in 2015. We are also in the RFQ process to select a design engineering firm to move forward with the conversion of Central Park Pumping Station.