



**DEPARTMENT OF WATER MANAGEMENT  
CITY OF CHICAGO**

December 11, 2014

Illinois Department of Natural Resources  
Office of Water Resources  
160 N. LaSalle Street, Suite S-700  
Chicago, Illinois 60601-3117

Enclosed is the completed yearly Pumpage Report LMO-2 for the 2014 water accounting year.

A supplemental sheet, attached to the report, details the average daily supply of water transferred to other entities.

A report detailing the activities of the Chicago Water System in regard to water conservation and accountability during the 2014 water accounting year is also attached.

Very truly yours,



Thomas H. Powers, P.E.  
Commissioner



# Illinois Department of Natural Resources

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

Pat Quinn, Governor  
Marc Miller, Director

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## 2014 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, 2013 through September 30, 2014. This form must be submitted to the Department by January 5, 2015.

### 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:

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: 12/11/14

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

Population: 2,718,782

Number of existing households:

1,061,928

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	755.150 mgd
2. Shallow Aquifer Pumpage	mgd
3. Deep Aquifer Pumpage	mgd
4. Total Pumpage (add lines 1, 2 & 3)	755.150 mgd
5. Water Treatment Use	1.787 mgd
6. Gross Annual Pumpage (subtract line 5 from line 4)	753.363 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	277.789 mgd
8	mgd
9	mgd
10	mgd
11	mgd
12	mgd
13. Total (add lines 7-12 and any additional amounts)	277.789 mgd
14. Net Annual Pumpage (subtract line 13 from line 6)	475.574 mgd

### B. Uses

	Metered	Unmetered	Total
15. Residential	74.615	205.891	280.506 mgd
16. Commercial and Manufacturing	116.322	1.106	117.428 mgd
17. Municipal	19.333	0.420	19.753 mgd
18. Construction	0	0	0 mgd
19. Total Uses (add Total lines 15 through 18)	210.270	207.417	417.687 mgd
20. Percentage of Total Use to Net Annual Pumpage (divide line 19 by line 14 and multiply by 100)			87.83 %

### C. Hydrant Uses

21. Firefighting and Training	2.378 mgd
22. Water Main Flushing	3.312 mgd
23. Sewer Cleaning	0.100 mgd
24. Street Cleaning	0.100 mgd
25. Construction	2.378 mgd
26. Other (attach explanation) Unauthorized and illegal open hydrants	2.400 mgd
27. Total Hydrant Use (add lines 21 through 26)	10.668 mgd

**Section II - Water Use Audit (continued)**

<b>28. Percentage of Hydrant Use to Net Annual Pumpage</b> (divide line 27 by line 14 and multiply by 100)	<u>2.24 %</u>
<b>29. Department allowed maximum for Hydrant Use</b>	<u>1.0 %</u>
<b>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)]</b> ( See Attachment 2 )	<u>1.24 %</u>
<b>D. Unavoidable Leakage and Unaccounted for Flow</b>	
<b>31. Maximum Unavoidable Leakage (Do worksheet in Section III; enter amount from line 10 of the worksheet)</b>	<u>9.966 mgd</u>
<b>32. Percentage of Maximum Unavoidable Leakage to Net Annual Pumpage</b> (divide line 31 by line 14 and multiply by 100)	<u>2.10 %</u>
<b>33. Total Accounted for Flow (add lines 19, 27 and 31)</b>	<u>438.321 mgd</u>
<b>34. Percentage of Total Accounted for Flow to Net Annual Pumpage</b> (divide line 33 by line 14 and multiply by 100)	<u>92.17 %</u>
<b>35. Total Unaccounted for Flow (subtract amount on line 33 from line 14)</b>	<u>37.253 mgd</u>
<b>36. Percentage of Total Unaccounted for Flow to Net Annual Pumpage</b> (divide line 35 by line 14 and multiply by 100)	<u>7.83 %</u>
<b>37. Total Unaccounted for Flow and Maximum Unavoidable Leakage</b> (add lines 31 and 35 and multiply by 365,000,000 )	<u>17,234,935,000 gal/yr</u>
<b>38. Wholesale Water Rate (the rate payed by the permittee to purchase Lake Michigan in \$/1,000 gallons)</b>	<u>2.88 \$/1,000 gal</u>
<b>39. Wholesale Value of Water Lost for Water Year 2013</b> (multiply lines 37, 38 and divide by 1,000)	<u>49,636,613 \$/yr</u>

**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	2,428.54	x 3,000 g/d/mi =	7,285,620	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	1,042.54	x 1,000 g/d/mi =	1,042,540	g/d
9. Total Miles	<u>4,236.69</u>	Total Leakage	<u>9,966,415</u>	g/d
10. Total Maximum Unavoidable Leakage, in mgd			<u>9.966</u>	mgd

(divide total leakage on line 9 by 1,000,000)

(Enter this amount on line 31 of "Section II - Water Use Audit")

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

WATER METERED AND BILLED DIRECTLY BY CHICAGO WATER DEPARTMENT  
OCTOBER 1, 2013 TO SEPTEMBER 30, 2014

ENTITY	MGD
ALSIP *	5.769
BEDFORD PARK	21.574
BERWYN	5.106
BLUE ISLAND	2.220
BRIDGEVIEW	2.082
BROOKFIELD-N. RIVERSIDE W.C. *	4.369
BURNHAM	0.081
CALUMET CITY	0.225
CALUMET PARK	0.734
CENT. STICKNEY SD	0.130
CICERO	7.104
DES PLAINES	6.945
DOLTON	3.177
DUPAGE W.C.	75.437
ELMWOOD PARK	2.282
EVERGREEN PARK	1.810
FOREST PARK	3.010
FOREST VIEW	0.128
FRANKLIN PARK	3.112
GARDEN HOMES S.D.	0.066
HARVEY *	9.589
HARWOOD HEIGHTS	0.798
HILLSIDE-BERKELEY W.C. *	1.764
HOMETOWN	0.329
JUSTICE-WILLOW SPRINGS W.C. *	2.877
LINCOLNWOOD	1.529
MAYWOOD	2.853
McCOOK *	5.262
MELROSE PARK *	8.297
MERRIONETTE PARK	0.189
MIDLOTHIAN-MARKHAM W.C. *	2.630
MORTON GROVE *	3.048
NILES	3.727
NORRIDGE	1.433
NORTHWEST SUB JOINT ACTION W. A. *	28.768
NORTHLAKE (Partial)	0.033
OAK LAWN *	29.405
OAK PARK	5.056
PARK RIDGE	4.219
RIVER FOREST	1.187
RIVER GROVE	1.086
RIVERDALE	1.575
ROBBINS	1.301
ROSEMONT	1.505
SCHILLER PARK	1.760
SOUTH HOLLAND *	2.199
SOUTH STICKNEY S.D.	2.284
STICKNEY	1.776
SUMMIT	1.252
WESTCHESTER-BROADVIEW W.C. *	3.732
WORTH	0.967
TOTAL	277.789

\* INCLUDES OTHER MUNICIPALITIES

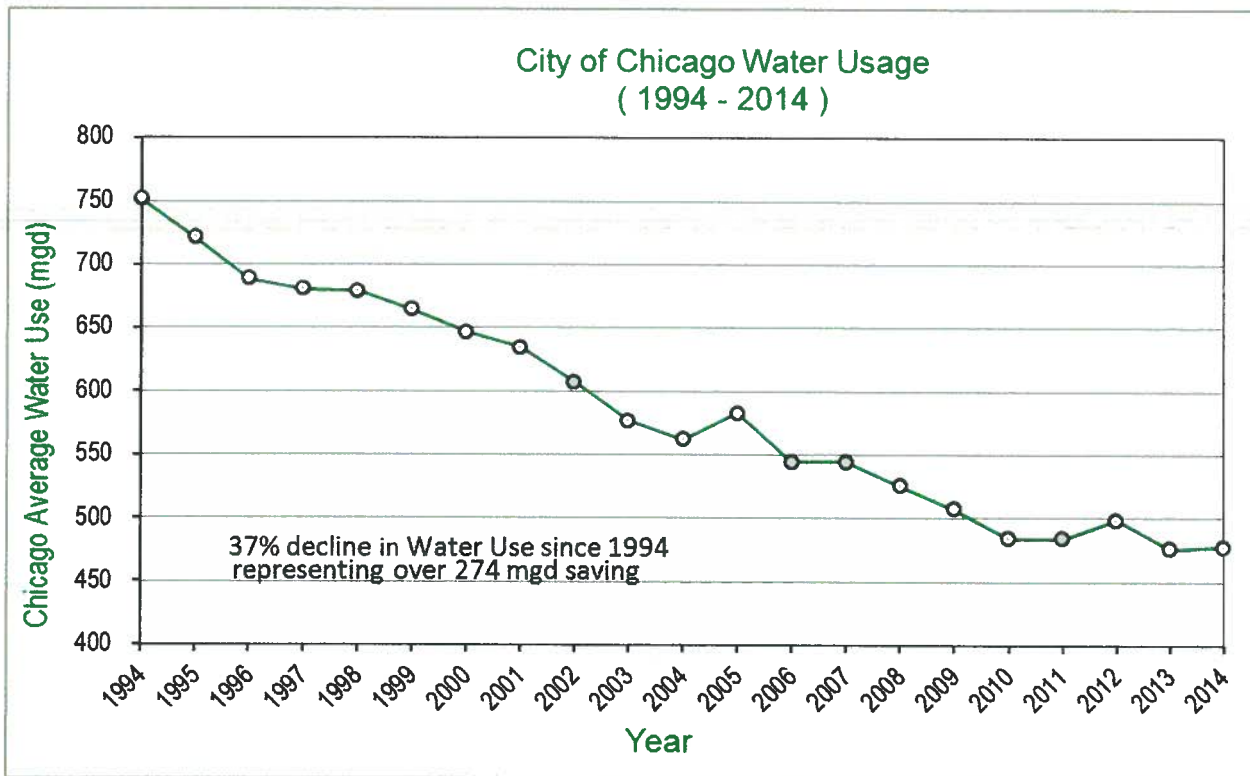
ALL METERS ARE READ BETWEEN THE 20TH AND 30TH DAY OF EACH MONTH

**REPORT BY THE CITY OF CHICAGO  
DEPARTMENT OF WATER MANAGEMENT  
TO  
THE ILLINOIS DEPARTMENT OF NATURAL RESOURCES  
FOR THE 2014 WATER ACCOUNTING YEAR**

During Water Year 2014, 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 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.) Volunteer Metering Program
- 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 10 year period, from 2012 through 2021

Year	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
Miles of Pipe Laid	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	85.0

## **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.

### **VOLUNTEER METERING PROGRAM**

The City has 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 2014, the City has installed over 55,500 meters, under this program, since its inception in 2009, and plan to install additional 15,000 meters in 2015. 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 water resource benefits, we anticipate a stronger participation, in the years to come, from our unmetered customer base. The Department of Water Management is fully committed to making this a successful program. Also, additional highlights of this program are presented on our promotional website at [www.metersave.org](http://www.metersave.org).

### **METER REPAIR AND REPLACEMENT**

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 236,000 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 active non-metered commercial accounts; this effort was completed late in 2014. We have accomplished this task by 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 required smaller meters, we have found that some of 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. Once this task was completed the Department has shifted its efforts to meter all un-metered three flat residential buildings and un-metered charitable accounts, which include churches, hospitals and schools. There are 562 such accounts in the system, the plan is to meter all of them by 2017.

### **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	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14
Number of Services Terminated	1108	1206	1140	650	820	620	422	297	488	510	692	342	476	635	1540



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. Through our leak detection consultant, we have been able to employ various technologies to detect and pinpoint underground leakage. One of these technologies: 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. During 2005 and 2006, we started to survey sections of 36-inch and 60-inch mains with the Sahara® leak detection technology, where 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](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 it 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](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](http://www.primayer.co.uk/wlc_leak_location_eureka_digital.htm)

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

Year	02	03	04	05	06	07	08	09	10	11	12	13	14
Miles of Pipe Surveyed	2390	2310	2200	700	734	1220	1700	1460	1220	1600	1900	1760	1162
Number of Underground Leaks Located	809	1050	938	400	320	356	590	477	402	300	660	637	380

## **SCADA SYSTEM**

The SCADA system was upgraded during 1996-97. At that time new well gauges, discharge pressure gauges, and flow meters were installed. In 2006, the SCADA system was upgraded again with new equipment and software to improve the operations and allow even better pressure management. Today there are 84 remote pressure sensors installed in the distribution system. The sensors are continuously monitoring water pressure in real time for the entire service area of the City of Chicago. Also, there are eight additional continuously monitored points located mainly in the outlying areas to monitor supply pressure and suburban flow demand patterns. These pressure sensors have proven to be a great aid with pumping station operation, by avoiding over pressurizing the system that in turn is believed to contribute to significant savings in water usage. The upgraded SCADA system provided a more complete monitoring and control of pressures and flows in the distribution system on a real time basis.

## **VARIABLE SPEED ELECTRIC DRIVES**

The Chicago water system has 12 pumping stations. Eight of the pumping stations have pumps that are driven by electric motors, and four of these electric stations are equipped with electronically controlled variable speed drives. The variable speed drives allow the operating staff to efficiently adjust water pumpage without over pressurizing the water distribution system, which reduces water main breaks and wasting of water. The remaining four stations are steam powered with manually controlled pumps. The plan is to convert these stations to electrical power with variable speed drives. The Department is currently in the process of converting the Springfield Pumping Station; this multi-year construction project is on schedule and will be completed in 2015. We have also awarded a contract for the engineering design services for the conversion of Central Park Pumping Station, this project will go into construction in 2017. The last steam powered station, Western Ave. Pumping station will follow soon after the start of the Central Park Station construction.

## Attachment 2

Explanation of Excessive Hydrant use. (Report Line No.30)

Excessive hydrant use was due to the following factors:

1. An increase of water main flushing.

An accelerated water main replacement program is in progress.  
More hydrant flow is needed for water main flushing.

2. Unauthorized and illegal open hydrants.