

Manchester Water Works
148th Annual Report
2019

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Board of Water Commissioners

Hon. Joyce Craig, Mayor
Ex-Officio

William R. Trombly, Jr., President
Term Expires December 2020

Linda L. Miccio, Clerk
Term Expires December 2020

Harold Sullivan
Term Expires December 2021

Judy Reardon
Term Expires December 2021

Omer Beaudoin
Term Expires December 2022

Danielle York
Term Expires December 2022

Senior Staff

Philip W. Croasdale, CPA
Director

Guy Chabot, P.E.
Deputy Director, Water Distribution

Sarah Demos, CPA
Deputy Director, Finance and Administration

David G. Miller, P.E.
Deputy Director, Water Treatment and Supply

John O'Neil
Manager, Watershed Land and Property

*Manchester Water Works
281 Lincoln Street
Manchester, N.H.*

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Presidents of Board of Water Commissioners

Ezekiel A. Straw	1871 - 1875
Alpheus Gay	1876 - 1902
Charles H. Manning	1902 - 1918
Charles M. Floyd	1919 - 1922
Walter G. Africa	1923 - 1925
J. Brodie Smith	1926 - 1947
Albert J. Precourt	1947 - 1950
D. Frank Shea	1950 - 1954
Murray A. Towle	1954 - 1959
Arthur H. St. Germaine	1959 - 1981
J. Leo Dery	1981 - 1989
Thomas J. Tessier	1989 - 1998
C. Arthur Soucy	1998 - 2008
Louis C. D'Allesandro	2009 - 2010
Paul G. Lessard	2011 - 2014
Kimberley L. Griswold	2015 - 2016
William R. Trombly, Jr.	2017 -

Chairman of Board of Water Commissioners

Thomas J. Tessier	1985 - 1989
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Mayors Who Have Served Ex-Officio

James A. Weston	1871
Person C. Cheney	1872
Charles H. Bartlett	Jan 1873 - Feb 1873
John P. Newell	1873
James A. Weston	1874 - 1875
Alpheus Gay	1875 - 1876
Ira Cross	Mar 1876 - Aug 1877
Patrick A. Devine, as Chairman, Board of Mayor and Aldermen	Aug 1877 - Sep 1877
John C. Kelley	1877 - 1880
Horace B. Putnam	1881 - 1884
George H. Sterns	1885 - 1886
John Hosley	1887 - 1888
David B. Varney	1889 - 1890
Edgar J. Knowlton	1891 - 1894

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Mayors Who Have Served Ex-Officio (Continued)

David B. Varney	May 1894 - Jun 1894
Byron Worthen, as Chairman, Board of Mayor and Aldermen	Jul 1894 - Dec 1894
William C. Clarke	1895 - 1902
Eugene E. Reed	1903 - 1910
Edward C. Smith	1911 - 1912
Charles C. Hayes	1913 - 1914
Harry W. Spaulding	1915 - 1917
Moise Verrette	1918 - 1921
George E. Trudel	1922 - 1925
Arthur E. Moreau	1926 - 1931
Damase Caron	1932 - 1941
Wilfred A. Laflamme	1942 - 1943
Josaphat T. Benoit	1944 - 1961
John C. Mongan	1962 - 1963
Roland S. Vallee	1964 - 1966
John C. Mongan	1967 - 1969
Henry J. Pariseau	Jan 1970 - May 1970
Thomas J. Enright, as Chairman, Board of Mayor and Aldermen	May 1970 - Jul 1970
Charles R. Stanton	1970 - 1971
Sylvio L. Dupuis	1972 - 1975
Andre A. Verville	Jan 1975
Charles R. Stanton	Jan 1975
Andre A. Verville, as Chairman, Board of Mayor and Aldermen	Jan 1975 - Mar 1975
Charles R. Stanton	1975 - 1981
Emile D. Beaulieu	1982 - 1983
Robert F. Shaw	1984 - 1987
Emile D. Beaulieu	1988 - 1989
Raymond J. Wiczorek	1990 - 1999
Robert A. Baines	2000 - 2005
Frank C. Guinta	2006 - 2009
Theodore L. Gatsas	2010 - 2017
Joyce Craig	2018 -

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Superintendents of Manchester Water Works

Charles K. Walker	Mar 1875 - May 1912
James H. Mendell	May 1912 - Apr 1925
Frank A. Gay, P.E.	Apr 1925 - Jan 1933
Percy A. Shaw, P.E.	Jan 1933 - Mar 1954
James A. Sweeney	Apr 1954 - Dec 1965
Clarence L. Ahlgren, P.E.	Jan 1966 - May 1974
Clarence E. Ferry, P.E.	Jun 1974 - Jun 1975
Frederick H. Elwell, P.E.	Jun 1975 - Jun 1987
David Kittredge, P.E.	Jul 1987 - Oct 1992
Thomas M. Bowen, P.E.	Nov 1992 - Jan 2013
David B. Paris	Feb 2013 - May 2015
Philip W. Croasdale, CPA	Jun 2015 -

***Manchester Water Board
Service Members to Date***

Ezekiel A. Straw (President 1871 to 1875)	1871 - 1875
Edward W. Harrington	1871 - 1876
William P. Newell	1871 - 1885
Aretas Blood	1871 - 1880
Alpheus Gay (President 1876 to 1902)	1871 - 1902
Andrew C. Wallace	1871 - 1899
James A. Weston	1875 - 1895
John Q.A. Sargent	1876 - 1880
Eben T. James	1880 - 1886
Edward H. Hobbs	1880 - 1890
Joseph F. Kennard	1885 - 1892
Henry Chandler	1896 - 1900
Charles H. Manning (President 1902 to 1918)	1890 - 1919
Charles T. Means	1892 - 1902
Harry E. Parker	1895 - 1906
Frank Dowst	1899 - 1905
Edgar J. Knowlton (Resigned 5/5/39)	1900 - 1939
William Corey	1902 - 1912
Charles M. Floyd (President 1919 to 1922)	1902 - 1922
Robert E. Mckean (Resigned 5/4/15)	1905 - 1915
Perry H. Dow (Resigned 1/18)	1906 - 1918
Walter G. Africa (President 1923 to 1925)	1912 - 1925

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Manchester Water Board
Service of Members to Date (Continued)

Arthur M. Heard	1915 - 1918
Benjamin F. Worcester	1918 - 1920
Gedeon Lariviere	1918 - 1923
J. Brodie Smith (President 1926 to 1947)	1919 - 1947
Patrick B. Maloney	1921 - 1932
Albert J. Precourt (President 1947 to 1950)	1923 - 1950
Joseph A. Boivin	1924 - 1930
Arthur M. Heard	1925 - 1934
Odilon Demers (Term ended 12/1/36)	1930 - 1936
D. Frank Shea (President 1950 to 1954)	1933 - 1954
Murray H. Towle (President 1954 to 1959)	1935 - 1959
Roland R. Tessier (Term started 5/17/50)	1950 - 1968
Roger J. Crowley (Term 12/7/54 to 8/5/61)	1954 - 1961
Martin F. Loughlin	1961 - 1963
(Term started 9/5/61) (Resigned 12/17/63)	
George J. Baker (12/6/63 to 4/11/71)	1963 - 1971
Charles A. Burke (5/5/39 to 6/13/74)	1939 - 1974
Charles B. McLaughlin (5/20/47 to 2/14/75)	1947 - 1975
Marcel H. Leclerc (4/20/71 to 11/14/77)	1971 - 1977
Arthur H. St. Germain (12/1/36)	1936 - 1981
(President 1959 to 2/20/81)	
Gilbert L. Tuson (Term started 1/19/60)	1960 - 1982
J. Leo Dery (Term started 1/1/68)	1968 - 1989
(President 3/2/81 to 3/7/89)	
Thomas J. Tessier (Term started 7/16/74)	1974 - 1998
(Chairman 2/28/85 to 3/27/89)	
(President 3/28/89 to 1/5/98)	
Fred L. Johnson (Term started 3/4/75)	1975 - 1985
Chris A. Pappas (Term started 11/14/77)	1977 - 1992
Emile A. Marcoux (Term 3/17/81 to 1/27/83)	1981 - 1983
George H. Morrissette (Term started 1/1/83)	1983 - 1988
Georges D. Croteau (Term started 3/15/83)	1983 - 1989
C. Arthur Soucy (Term started 1/1/85)	1985 - 2008
(President 1/6/1998 to 12/31/2008)	
David D. Beaulieu	1989 - 1994
Andre L. Dery (Term 3/7/89 to 2/3/98)	1989 - 1998
Donald P. Perkins	1990 - 2001
Raymond W. Provencher	1993 - 2004

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Service of Members to Date (Continued)***

Theodore L. Gatsas	1995 - 1999
Thomas M. Robert (Term started 2/3/98)	1998 - 2002
Robert A. Cruess (Term 2/3/98 to 7/6/01)	1998 - 2001
Donald P. Couturier	2000 - 2006
James W. Craig (Term started 10/2/01)	2001 - 2006
Patricia Cornell	2002 - 2007
Richard Bunker	2003 - 2008
Louis C. D'Allesandro (President 2009 to 2010)	2005 - 2010
Dylan R. Cruess	2007 - 2013
William A. Beaton	2007 - 2013
Patrick Jordan (Resigned 11/19/08)	2008 - 2008
Bernard G. Garrity	2009 - 2014
Phillip Sapienza	2009 - 2016
Paul G. Lessard (President 2011 to 2014)	2009 - 2014
Kimberley L. Griswold (President 2015 to 2016)	2011 - 2016
Matthew Greenwood (Resigned 1/26/17)	2013 - 2017
Cliff Hurst	2013 - 2018
Will Infantine	2017 - 2019
Linda Miccio	2015 -
William Trombly Jr (President 2017 -)	2015 -
Danielle York	2017 -
Omer Beaudoin	2017 -
Judy Reardon	2019 -

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***City of Manchester - Manchester Water Works
General Information
Hillsborough County, New Hampshire
Incorporated 1846***

Location: On the Merrimack River, 17 miles north of Nashua and 18 miles south of Concord, the State Capital.

Estimated population served in Manchester	111,000
Estimated population served in Auburn, Bedford, Goffstown, Hooksett, Derry, Londonderry, and Litchfield	54,000
Total estimated population served	165,000

Ownership: A proprietary fund of the City of Manchester, NH (the City)

Construction: 1871-74, supply developed via Low Service Station
1893-94, further supply via High Service Station
1972-74, 40-MGD Water Treatment Plant constructed
2003-06, Water Treatment Plant upgraded to 50-MGD
2015-16, 7.2-MGD Merrimack River Radial Collector Well constructed

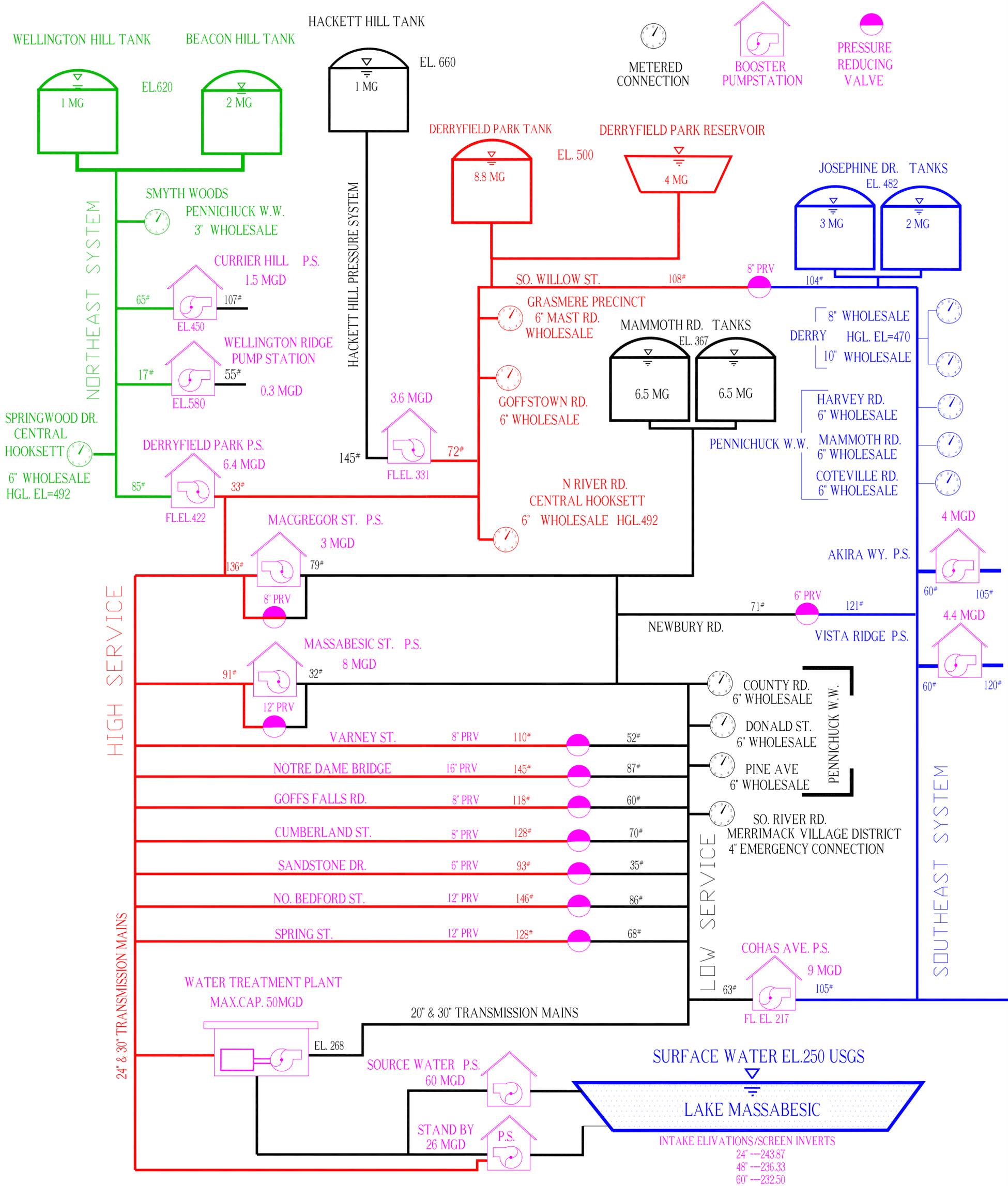
Mode of Supply: Pumping water into five (5) primary pressure systems; High Service reservoir/tank (4 MG & 8.8 MG); Low Service tanks (two 6.5 MG); Wellington Hill and Beacon Hill tanks (1 MG & 2 MG); Hackett Hill Tank (1 MG), and Londonderry tanks (2 MG & 3 MG); all of which then flow by gravity into the distribution system.

Source of Supply: Lake Massabesic, a natural surface water supply 3-1/2 miles east of the City.

Area of watershed	42 sq. miles
Area of lake	4 sq. miles
Total area including lake surface	46 sq. miles
Full elevation of Lake Massabesic	250 USGS
Full elevation of Low Service Tanks	367 USGS
Full elevation of High Service Reservoir	500 USGS

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MANCHESTER WATER WORKS SYSTEM SCHEMATIC



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Water Treatment Plant & Pump Stations Equipment

Water Treatment Plant – *Constructed in 1974*

Source Water Pumps:

- * Two (2) Ingersoll Dresser 29 MGD vertical turbine pumps driven by 200 HP induction motor. Installed in 1997.
- * Ruhrpumpen 15 MGD vertical turbine pump driven by existing rebuilt 200 HP induction motor. Installed in 2014.
- * Variable speed Peerless 29 MGD vertical turbine pump driven by 250 HP induction motor. Installed in 1974. Back-up pump.

High Service Pumps: *Installed in 2005.*

- * Three (3) Flowserve 10 MGD vertical turbine pumps driven by 700 HP induction motor.
- * Flowserve 5 MGD vertical turbine pump driven by 300 HP induction motor.

Low Service Pumps: *Installed in 2005.*

- * Two (2) Flowserve 10 MGD vertical turbine pumps driven by 350 HP induction motor.
- * Flowserve 5 MGD vertical turbine pump driven by 200 HP induction motor.

Back-up Generator: *Installed in 2004.*

- * Caterpillar 2000 KW diesel driven electric generator with auto-start and transfer switch.

Cohas Avenue Pump Station – *Constructed in 1874*

- * Two (2) Peerless 5.8 MGD centrifugal pumps driven by 250 HP synchronous motors. Installed in 2019.
- * One (1) Peerless 7.2 MGD centrifugal pump driven by a 300 HP electric motor. Installed in 2019.
- * Hydroelectric Generator - S. Morgan Smith water turbine, 668 HP directly connected to 375 KW General Electric Company A.C. Generator. Installed in 1915. Turbine rebuilt in 1993, 2006, and 2019.

Massabesic Street Pump Station – *Constructed in 1941*

- * Peerless 8 MGD centrifugal pump driven by a 350 HP electric motor. Installed in 1998.
- * Twelve-inch (12”) Ross pressure reducing valve.

Derryfield Hill Pump Station – *Constructed in 1964*

- * Two (2) Peerless 2.2 MGD centrifugal pumps driven by 75 HP electric motor. Installed in 1986.
- * Worthington 3.8 MGD centrifugal pump driven by 150 HP induction motor. Installed in 1997.
- * Caterpillar 225 KW trailer-mounted diesel driven electric generator with auto-start and transfer switch. Installed in 2001.

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MacGregor Street Pump Station – *Constructed in 1971*

- * Peerless 3 MGD variable speed centrifugal pump driven by 100 HP electric motor.
- * Twelve-inch (12”) Ross pressure reducing valve.

Hackett Hill Pump Station – *Constructed in 1991*

- * Peerless variable speed centrifugal Service pump driven by a 50 HP motor and rated at 650 GPM.
- * Two (2) Aurora variable speed centrifugal Service/Fire pumps driven by 150 HP motors and rated at 1,750 GPM each.
- * 250 KW Katolight diesel driven electric generator set with auto start and automatic transfer switch capability.

Currier Hill Pump Station – *Constructed in 1993*

- * Three (3) variable speed Synchro-flow centrifugal pumps (Jockey, 1 @ 5HP, Service Pumps, 2 @ 7.5 HP), and one (1) Fire Pump @ 30 HP. Maximum station capacity is 1,000 GPM.

Wellington Ridge Pump Station – *Constructed in 1996*

- * Two (2) Berkley 5 HP jockey pumps, (2nd pump installed ~ 2003+/-).
- * Two (2) Berkley 7.5 HP service pumps.

Akira Way Pump Station – *Constructed in 2001*

- * Grundfos 60 GPM jockey pump driven by a 3 HP VFD electric motor.
- * Two (2) Berkeley 220 GPM booster pumps driven by 10 HP VFD electric motors.
- * Berkeley 2,500 GPM fire pump driven by a 100 HP VFD electric motor.
- * 150 KW diesel driven electric generator with auto start and transfer switch.

Vista Ridge Pump Station – *Constructed in 2004*

- * Two (2) Goulds 50 GPM jockey pumps driven by 5 HP VFD electric motors.
- * Two (2) Goulds 225 GPM booster pumps driven by 7.5 HP VFD electric motors.
- * Reddy-Buffaloes 2,500 GPM fire pump driven by a 241 HP diesel engine.
- * 30.4 KW diesel driven electric generator with auto start and transfer switch.

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Range of Water Service Pressure

	PSI
Low Service Pressure System	27-95
High Service Pressure System	24-147
Northeast Pressure System	50-130
Southeast Pressure System	45-122
Hackett Hill Pressure System	90-145
Currier Hill Pressure System	50-90
Akira Way Pressure System	60-105
Vista Ridge Pressure System	60-120

Finished Water Storage Facilities

Low Service Pressure System	Two (2) 6.5 MG (Mammoth Rd.) Tanks
High Service Pressure System	8.8 MG (Derryfield) Tank & 4 MG (Derryfield) Reservoir
Northeast Pressure System	1 MG (Wellington) Tank & 2 MG (Beacon Hill) Tank
Hackett Hill Pressure System	1 MG (Hackett Hill) Tank
Southeast Pressure System	2 MG & 3 MG (Josephine Dr.) Tanks
Total System Storage	34.8 MG

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Pressure Reducing Valves in Distribution System

	Valve size	PSI from:	PSI to:
High Service to Low Service Pressure Systems:			
Notre Dame Bridge	16"	145	87
North Bedford Street	12"	146	86
Spring Street	12"	128	68
Massabesic Pump Station	12"	91	32
MacGregor Street Pump Station	8"	136	79
Varney Street	8"	110	52
Goffs Falls Road	8"	118	60
Cumberland Street	8"	128	70
Sandstone Drive	6"	93	35
High Service to Southeast Pressure Systems:			
South Willow Street	8"	108	104
Southeast to Low Service Pressure Systems:			
Newbury Road	6"	121	71

Wholesale Water Connections in Distribution System

	Meter size	Pressure System	Year service began:
Grasmere Village Water Precinct:			1949
Mast Road	6"	High	
Goffstown Road	6"	High	
Central Hooksett Water Precinct:			1982
Springwood Drive, Hooksett	6"	Northeast	
North River Road, Hooksett	6"	High	
Town of Derry:			1983
Rockingham Road	10"	Southeast	
Rockingham Road	8"	Southeast	
Pennichuck East Utilities, Inc.:			1997
County Road, Bedford	6"	Low	
Donald Street, Bedford	6"	Low	
Pine Avenue, Litchfield	6"	Low	
Harvey Road, Londonderry	6"	Southeast	
Mammoth Road, Londonderry	6"	Southeast	
Coteville Road, Londonderry	6"	Southeast	
Smyth Woods, Hooksett	3"	Northeast	

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Pressure Systems - Consumption & Pumping Statistics

High and Low Pressure Systems - Combined

Total Pumping for the Year ¹		6,349,435,000
Total Consumption for the Year		5,475,016,668
Highest Monthly Consumption	July	720,542,000
Lowest Monthly Consumption	February	386,130,000
Highest Daily Consumption	July 29	25,504,000
Lowest Daily Consumption	November 9	11,428,000
Average Daily Consumption		16,658,000

Low Service Pressure System

Includes Southeast Pressure System

Total Pumping for the Year		3,171,758,000
Total Consumption for the Year		2,950,700,000
Highest Monthly Consumption	July	346,413,000
Lowest Monthly Consumption	February	186,878,000
Highest Daily Consumption	July 29	12,313,000
Lowest Daily Consumption	November 30	4,469,000
Average Daily Consumption for the Year		8,074,000
Average Daily Pumping for the Year		8,679,000

Southeast Pressure System

Sub-system of Low Service System

Includes Vista Ridge and Akira Way Pressure Systems

Total Pumping for the Year		1,275,882,000
Total Consumption for the Year		1,275,753,000
Highest Monthly Consumption	July	149,220,000
Lowest Monthly Consumption	February	82,968,000
Highest Daily Consumption	July 23	6,325,000
Lowest Daily Consumption	November 30	1,263,000
Average Daily Consumption for the Year		3,491,000
Average Daily Pumping for the Year		3,492,000

¹ Figures over one half million are rounded off to the nearest thousand unless otherwise specified.

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Vista Ridge Pressure System

Sub-system of Southeast Pressure System

Total Pumping for the Year	10,509,290
Average Daily Pumping for the Year	28,727

Akira Way Pressure System

Sub-system of Southeast Pressure System

Total Pumping for the Year	3,885,290
Average Daily Pumping for the Year	10,619

High Service Pressure System

Includes Northeast Pressure System and Hackett Hill Pressure System

Total Pumping for the Year		3,177,677,000
Total Consumption for the Year		3,137,375,000
Highest Monthly Consumption	July	374,129,000
Lowest Monthly Consumption	November	199,252,000
Highest Daily Consumption	July 21	14,005,000
Lowest Daily Consumption	January 1	6,273,000
Average Daily Consumption for the year		8,585,000
Average Daily Pumping for the Year		8,695,000

Northeast Pressure System

Sub-system of High Service System

Includes Currier Hill Pressure System and Wellington Ridge Pressure System

Total Pumping for the Year		472,531,000
Total Consumption for the Year		472,556,000
Highest Monthly Consumption	July	69,172,000
Lowest Monthly Consumption	February	23,424,000
Highest Daily Consumption	July 21	2,894,000
Lowest Daily Consumption	December 27	415,000
Average Daily Consumption for the Year		1,292,000
Average Daily Pumping for the Year		1,292,000

Currier Hill Pressure System

Sub-system of Northeast Pressure System

Total Pumping for the Year	12,304,570
Average Daily Pumping for the Year	33,570

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Wellington Ridge Pressure System

Sub-system of Northeast Pressure System

Total Pumping for the Year	19,273,504
Average Daily Pumping for the Year	52,729

Hackett Hill Pressure System

Sub-system of High Service Pressure System

Total pumping for the Year	75,881,630
Average Daily Pumping for the Year	207,383

Pumping and Consumption Accountability

Daily per capita consumption ¹	93.34 gallons
Percent of water accounted for ²	92.34%

¹ Based on an estimated population of 165,000. Daily per capita consumption represents metered consumption.

² Figure reflects metered usage, or other than metered usage, for readings taken between Jan. 1, 2019 through Dec. 31, 2019 inclusive that can be substantiated only.

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Water Treatment Plant - Pumping Statistics

Source Water Pumps	RW#3	RW #4	RW #5
Total Run Time (Hours)	3,788	12,660	4,356

Source Water Pump (High Service)	RW #2
Total Run Time (Hours)	9

Intermediate Lift Pumps	IPS #1	IPS #2	IPS #3	IPS #4
Total Run Time (Hours)	5,406	2,881	5,219	3,202

Low Service Pumps	LS #1	LS #2	LS #3
Total Run Time (Hours)	3,860	2,604	2,895
Total Power Used by Unit (KWH x 1000)	414	596	689
Approximate Annual Flow* (Million Gallons)	804	1,085	1,206
Approximate Gallons Pumped Per KWH	1,944	1,820	1,750
Average Dynamic Head (Feet)	130	140	140
Average Static Head (Feet)	97	97	97

High Service Pumps	HS #1	HS #2	HS #3	HS #4
Total Run Time (Hours)	4,035	879	2,567	1,724
Total Power Used by Unit (KWH x 1000)	924	422	1,227	832
Approximate Annual Flow* (Million Gallons)	841	366	1070	718
Approximate Gallons Pumped Per KWH	910	868	872	863
Average Dynamic Head (Feet)	285	291	291	291
Average Static Head (Feet)	230	230	230	230

* Flow based on nominal capacity of individual pumps

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Pumping Stations Statistics

Cohas Avenue Pump Station

Total Pumping	1,275,882,000
Average Daily Pumping	3,492,000

Derryfield Park Pump Station

Total Pumping	472,531,000
Average Daily Pumping	1,292,000

Hackett Hill Pump Station

Total Pumping	75,881,630
Average Daily Pumping	207,383

Currier Hill Pump Station

Total Pumping	12,304,570
Average Daily Pumping	33,570

Wellington Ridge Pump Station

Total Pumping	19,273,504
Average Daily Pumping	52,729

Vista Ridge Pump Station

Total Pumping	10,509,290
Average Daily Pumping	28,272

Akira Way Pump Station

Total Pumping	3,885,290
Average Daily Pumping	10,619

Massabesic Street Pump Station

Total Run Time (Hrs:Min)	0:20
Total Flow (Gallons)	111,120

MacGregor Street Pump Station

Total Run Time (Hrs:Min)	0:25
Total Flow (Gallons)	41,671

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Annual Production and Consumption of Water

Water Consumption is based upon metered consumption and does not include system losses, fire protection or water department uses.

Per capita consumption is based upon estimated population of 165,000.

Percent of metered consumption	89.93%
Percent of accounted for non-metered consumption	2.41%
Total percent of accounted for water consumption	92.34%
Per capital consumption	93.34 gallons

Water Production (In Gallons)

2019	High Service Pressure System	Low Service Pressure System	Northeast Pressure System	Southeast Pressure System	Total Production	MGD
Jan.	188,648,000	118,287,000	28,708,000	93,705,000	429,348,000	13.85
Feb.	175,768,000	104,009,000	23,484,000	82,869,000	386,130,000	13.79
Mar.	192,827,000	116,234,000	24,692,000	90,401,000	424,154,000	13.68
Apr.	191,538,000	114,088,000	25,330,000	93,776,000	424,732,000	14.16
May	213,790,000	143,278,000	35,946,000	103,604,000	496,618,000	16.02
June	248,628,000	166,406,000	51,311,000	121,697,000	588,042,000	19.60
July	305,055,000	197,286,000	69,074,000	149,127,000	720,542,000	23.24
Aug.	297,411,000	194,443,000	65,686,000	144,790,000	702,330,000	22.66
Sept.	262,576,000	171,888,000	54,861,000	122,318,000	611,643,000	20.39
Oct.	214,171,000	134,169,000	33,735,000	102,117,000	484,192,000	15.62
Nov.	182,834,000	104,215,000	28,996,000	85,668,000	401,713,000	13.39
Dec.	191,598,000	110,515,000	30,708,000	85,810,000	418,631,000	13.50
Total	<u>2,664,844,000</u>	<u>1,674,818,000</u>	<u>472,531,000</u>	<u>1,275,882,000</u>	<u>6,088,075,000</u>	16.68
% of Total	43.77%	27.51%	7.76%	20.96%	100.00%	

Water Consumption Metered (In Gallons)

2019	Residential	Commercial	Industrial	Wholesale	City	Total Consumption	MGD
Jan.	98,403,140	159,692,016	16,496,392	64,789,516	1,487,772	340,868,836	11.00
Feb.	121,929,236	155,833,832	18,592,288	71,170,704	1,604,460	369,130,520	13.18
Mar.	120,686,808	139,602,232	19,497,368	64,208,320	15,675,836	359,670,564	11.60
Apr.	110,550,660	181,761,008	18,972,272	71,431,008	2,216,324	384,931,272	12.83
May	122,072,852	134,232,340	21,968,012	75,270,492	2,682,328	356,226,024	11.49
June	140,222,324	147,190,692	25,702,028	102,259,828	17,438,872	432,813,744	14.43
July	188,359,864	255,524,280	24,145,440	128,149,604	11,015,796	607,194,984	19.59
Aug.	230,740,796	181,309,964	27,664,032	114,663,912	14,288,296	568,667,000	18.34
Sept.	268,249,256	196,050,800	23,751,244	102,044,404	23,050,368	613,146,072	20.44
Oct.	185,111,300	247,997,156	20,173,560	84,929,416	10,943,240	549,154,672	17.71
Nov.	182,283,112	160,830,472	25,632,464	75,544,260	12,086,184	456,376,492	15.21
Dec.	166,659,636	163,798,536	19,079,984	71,009,136	16,289,196	436,836,488	14.09
Total	<u>1,935,268,984</u>	<u>2,123,823,328</u>	<u>261,675,084</u>	<u>1,025,470,600</u>	<u>128,778,672</u>	<u>5,475,016,668</u>	15.00
% of Total	35.35%	38.79%	4.78%	18.73%	2.35%	100.00%	

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25 Year History Annual Production of Water

Water Production (In Gallons)						
Yr.	High Service Pressure System	Low Service Pressure System	Northeast Pressure System	Southeast Pressure System	Total Production	MGD
2019	2,664,844,000	1,674,818,000	472,531,000	1,275,882,000	6,088,075,000	16.68
2018	2,632,925,000	1,699,039,000	512,135,000	1,387,862,000	6,231,961,000	17.07
2017	2,584,877,000	1,605,222,000	503,972,000	1,420,158,000	6,114,229,000	16.75
2016	2,881,769,000	1,640,082,000	455,990,000	1,549,402,000	6,527,243,000	17.88
2015	2,874,662,220	1,516,902,000	466,932,000	1,482,392,000	6,340,888,220	17.37
2014	2,740,265,170	1,449,624,000	418,472,000	1,333,072,000	5,941,433,170	16.28
2013	2,749,394,000	1,581,986,000	460,294,000	1,506,540,000	6,298,214,000	17.26
2012	2,834,495,000	1,644,552,000	449,416,000	1,368,876,000	6,297,339,000	17.25
2011	2,727,642,000	1,635,158,000	468,669,000	1,434,489,000	6,265,958,000	17.17
2010	2,786,871,000	1,678,800,000	520,246,000	1,420,754,000	6,406,671,000	17.55
2009	2,512,207,000	1,667,411,000	429,464,000	1,245,364,000	5,854,446,000	16.00
2008	2,648,671,000	1,810,623,000	422,268,000	1,307,472,000	6,189,034,000	16.96
2007	2,878,952,000	1,862,406,000	434,898,000	1,354,600,000	6,530,856,000	17.89
2006	2,841,645,000	1,647,760,000	379,382,000	1,315,991,000	6,184,778,000	16.94
2005	2,840,510,000	1,638,783,000	406,729,000	1,344,074,000	6,230,096,000	17.07
2004	2,790,353,000	1,579,827,000	400,174,000	1,319,123,000	6,089,477,000	16.64
2003	2,832,824,000	1,519,503,000	427,271,000	1,238,476,000	6,018,074,000	16.49
2002	2,902,744,000	1,540,109,000	447,626,000	1,381,439,000	6,271,918,000	17.18
2001	2,907,037,000	1,580,231,000	425,461,000	1,436,150,000	6,348,879,000	17.39
2000	2,798,615,000	1,504,963,000	644,104,000	1,220,602,000	6,168,284,000	16.85
1999	2,880,146,000	1,473,934,000	567,823,000	1,345,794,000	6,267,697,000	17.17
1998	2,778,999,000	1,273,664,000	485,832,000	1,286,776,000	5,825,271,000	15.96
1997	2,658,539,000	1,460,728,000	493,994,000	1,211,456,000	5,824,717,000	15.96
1996	2,696,294,000	1,363,472,000	435,372,000	1,128,310,000	5,623,448,000	15.36
1995	2,923,925,000	1,237,278,000	373,141,000	1,113,039,000	5,647,383,000	15.47

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25 Year History Annual Consumption of Water

Water Consumption Metered (In Gallons)

Yr	Residential	Commercial	Industrial	Wholesale	City	Total Consumption	MGD
2019	1,935,268,984	2,123,823,328	261,675,084	1,025,740,600	128,778,672	5,475,286,668	15.00
2018	2,009,714,432	2,225,905,880	248,209,588	1,109,793,388	143,636,196	5,737,259,484	15.72
2017	1,916,430,604	2,082,243,504	253,743,292	1,001,116,468	194,954,232	5,448,488,100	14.93
2016	2,120,137,184	2,147,680,788	241,763,324	1,069,273,480	106,111,280	5,684,966,056	15.58
2015	1,969,112,244	2,104,509,968	232,600,324	1,063,435,340	117,756,892	5,487,414,768	15.03
2014	1,919,936,480	2,082,279,408	236,783,140	984,867,664	94,294,376	5,318,161,068	14.57
2013	1,932,788,616	2,172,005,000	244,673,792	1,003,531,760	142,301,764	5,495,300,932	15.06
2012	2,037,935,724	2,178,501,380	273,215,976	1,009,845,628	384,542,312	5,884,041,020	16.12
2011	1,948,715,780	2,102,945,900	239,914,268	969,570,316	144,509,860	5,405,656,124	14.81
2010	2,185,685,920	2,254,653,764	281,878,564	955,216,944	176,976,052	5,854,411,244	16.04
2009	1,876,905,536	2,079,487,124	246,573,712	841,841,836	140,523,020	5,185,331,228	14.17
2008	2,053,768,640	2,233,928,180	302,530,844	873,353,580	134,349,776	5,597,931,020	15.34
2007	2,159,131,172	2,280,081,276	308,884,608	841,017,867	224,271,344	5,813,386,267	15.93
2006	2,034,712,592	2,101,411,752	319,405,615	874,955,048	155,454,596	5,485,939,603	15.03
2005	2,152,551,764	2,217,223,844	354,148,080	921,933,936	158,792,920	5,804,650,544	15.90
2004	2,124,993,948	2,182,134,416	367,817,780	911,399,104	138,321,656	5,724,666,904	15.64
2003	2,140,903,500	2,177,229,780	396,573,892	911,479,888	153,664,632	5,779,851,692	15.84
2002	2,261,147,152	2,159,975,664	380,656,452	972,925,096	173,829,964	5,948,534,328	16.30
2001	2,301,218,260	2,162,343,832	424,803,564	1,009,826,928	185,002,092	6,083,194,676	16.67
2000	2,037,029,896	2,064,678,220	423,806,328	946,006,072	183,843,440	5,655,363,956	15.45
1999	2,322,780,856	2,192,139,664	382,328,980	944,481,648	208,374,848	6,050,105,996	16.58
1998	2,152,953,440	2,122,617,552	347,092,196	880,600,204	176,078,452	5,679,341,844	15.56
1997	2,154,519,752	2,067,389,208	356,073,432	865,407,576	185,293,064	5,628,683,032	15.42
1996	2,057,671,704	1,993,475,352	340,072,216	812,552,400	205,738,896	5,409,510,568	14.78
1995	4,107,475,944		1,345,269,772		N/A	5,452,745,716	14.94

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Water Treatment Plant Statistics

Finished Water

Gallons

Total pumping	6,349,435,000
Flow by purchased and hydro power	6,309,570,197
Flow by diesel generator power	39,864,803
Percent raw water pumped for filter backwashing, sedimentation basin cleaning, etc.	3.26

Raw Water

Total pumping	6,563,163,000
Flow by purchased and hydro power	6,522,000,008
Flow by diesel generator power	41,162,992

Cohas Avenue Pump Station

Total pumping	1,275,882,000
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High and Low Service Pumping

Average daily pumping	6,349,435,000
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Kilowatt hours (KWH)

KWH

Total generated hydro power	496,830
Total generated diesel power	47,633
Total generated hydro and diesel (standby) power	<u>544,463</u>

Kilowatt Hours Purchased

KWH

January	565,749
February	514,522
March	581,824
April	572,523
May	639,356
June	759,276
July	925,287
August	914,417
September	792,823
October	633,033
November	560,141
December	579,617
Total for the Year	<u>8,038,568</u>

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***Water Treatment Plant & Pumping Stations
Chemical Usage, Fuel Oil Consumption, and Electrical Power Usage***

Chemical Usage	Pounds
Finished Water Sodium Hypochlorite (as Cl ₂)	119,410
Pre-Sodium Hydroxide (NaOH)	403,918
Pre & Post Sodium Carbonate (Soda Ash, Na ₂ CO ₃)	1,217,113
Aluminum Sulfate (Al ₂ (SO ₄) ₃)	1,876,675
Poly Aluminum Chloride (PACl)	1,765
Filter Aid & Sludge Conditioning Polymer	3,199
Phosphoric Acid	107,153
Fluoride (as F)	35,796
Liquid Oxygen	786,512

Diesel Fuel Consumed	Gallons
Water Treatment Plant diesel fuel for generator	4,063

Natural Gas Consumed	Therms
Water Treatment Plant for heat	16,631
Ozone/Filter Building for heat	5,393
New Raw Water Station for heat	662
Old Raw Water Station for heat	3,204
Total Natural Gas Consumed	25,890

Electrical Power Usage	KWH
Total purchased KWH for Low and High Service Pumping, Raw Water Pumping, and Water Treatment Plant	8,038,568
KWH generated by Hydro & Standby Power	544,463

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Chemical Usage and Dosages

Total Monthly Chemical Usage (per pound)

Pre-Filtration							
Month	PACl	Alum	NaOH	Soda Ash	LOX	Ozone	Filter Aid Polymer
January	1,260	168,890	189	91,868	1,958	148	39
February	-	131,260	18,031	32,008	23,693	1,710	19
March	-	148,186	38,801	-	80,538	6,381	21
April	-	189,978	57,988	-	81,538	6,416	18
May	505	218,956	70,473	1,178	81,977	6,477	22
June	-	204,835	58,506	1	90,508	8,337	-
July	-	220,213	48,005	-	100,303	10,414	14
August	-	190,930	38,335	-	77,985	9,276	11
September	-	157,512	30,168	-	61,834	6,543	11
October	-	90,672	13,327	-	57,795	5,158	12
November	-	78,370	15,354	-	59,808	4,170	21
December	-	76,873	14,741	-	68,574	4,762	21
Total	1,765	1,876,675	403,918	125,054	786,512	69,793	209
Maximum	1,260	220,213	70,473	91,868	100,303	10,414	39
Average	147	156,390	33,660	10,421	65,543	5,816	17
Minimum	-	76,873	189	-	1,958	148	-

Post-Filtration							
Month	Soda Ash	NaOH	NaOCl	Pure Fluoride	Phos Acid	Dewater Polymer	Ammonia
January	84,456	148	8,680	2,429	7,973	240	1,820
February	69,908	220	7,553	2,352	7,342	240	1,723
March	82,879	516	6,740	2,603	7,898	330	1,633
April	62,436	43	6,759	2,519	7,182	320	1,589
May	69,297	5,336	8,083	3,078	8,389	260	2,127
June	63,687	16,121	10,947	3,533	9,731	260	2,589
July	164,319	1,038	15,248	4,095	11,921	330	3,732
August	161,998	2,476	15,735	4,101	12,894	240	4,053
September	121,983	2,569	13,971	3,506	10,725	270	3,414
October	88,375	139	11,031	2,868	8,379	320	2,411
November	60,973	-	7,663	2,272	7,310	160	2,049
December	61,749	-	7,002	2,439	7,412	260	1,810
Total	1,092,059	28,606	119,410	35,796	107,153	3,230	28,951
Maximum	164,319	16,121	15,735	4,101	12,894	330	4,053
Average	91,005	2,384	9,951	2,983	8,929	269	2,413
Minimum	60,973	-	6,740	2,272	7,182	160	1,589

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Chemical Usage and Dosages

Average Monthly Chemical Dosages

Pre - Filtration							
Month	PaCl PPM	Alum PPM	NaOH PPM	Soda Ash PPM	Ozone PPM	Sodium Bisulfite PPM	Filter Aid Polymer PPM
January	0.30	41.70	0.10	23.14	0.04	0.02	0.01
February	-	37.70	5.30	9.05	0.49	0.31	0.01
March	-	38.60	10.10	-	1.63	1.24	0.01
April	-	50.50	15.40	-	1.70	1.49	-
May	-	49.50	16.00	0.25	1.47	0.84	-
June	-	39.00	11.10	-	1.57	0.47	-
July	-	34.90	7.60	-	1.62	0.46	-
August	-	30.40	6.10	-	1.47	0.42	-
September	-	28.70	5.50	-	1.19	0.46	-
October	-	20.60	3.10	-	1.17	0.60	-
November	-	21.70	4.20	-	1.14	0.75	0.01
December	-	20.30	3.90	-	1.26	1.07	0.01
Summation	0.30	413.60	88.40	32.44	14.75	8.13	0.05
Maximum	0.30	50.50	16.00	23.14	1.70	1.49	0.01
Average	0.03	34.47	7.37	2.70	1.23	0.68	0.004
Minimum	-	20.30	0.10	-	0.04	0.02	-

Post - Filtration						
Month	NaOH PPM	Soda Ash PPM	NaOCl PPM	Fluoro-silicic Acid PPM	Phos Acid PPM	Ammonia PPM
January	0.04	22.19	2.27	0.64	2.10	0.48
February	0.07	20.71	2.23	0.70	2.18	0.51
March	0.14	22.39	1.82	0.70	2.15	0.44
April	0.01	16.94	1.84	0.68	1.96	0.43
May	1.25	15.94	1.87	0.71	1.94	0.49
June	3.11	12.60	2.14	0.69	1.90	0.51
July	0.17	26.50	2.46	0.66	1.94	0.60
August	0.40	26.67	2.59	0.67	2.12	0.67
September	0.47	23.04	2.63	0.66	2.02	0.64
October	0.03	20.76	2.59	0.68	1.98	0.57
November	-	17.39	2.19	0.65	2.08	0.58
December	-	16.99	1.93	0.67	2.04	0.50
Summation	5.69	242.12	26.56	8.11	24.41	6.42
Maximum	3.11	26.67	2.63	0.71	2.18	0.67
Average	0.47	20.18	2.21	0.68	2.03	0.54
Minimum	-	12.60	1.82	0.64	1.90	0.43

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Ozone System Performance

Month	Ozone Contactors								
	Combined Transfer Efficiency (%)	Contactor 1		Contactor 2		Contactor 3		Contactor 4	
		Virus Credit (Log)	Virus PR*	Virus Credit (Log)	Virus PR	Virus Credit (Log)	Virus PR	Virus Credit (Log)	Virus PR
Jan	99	2.8	1.4	NIS	NIS	NIS	NIS	15.5	7.8
Feb	99	5.5	2.7	NIS	NIS	5.3	2.7	6.7	3.3
Mar	98	8.1	4.1	3.2	1.6	6.9	3.5	8.4	4.2
Apr	97	10.7	5.4	12.4	6.2	9.9	5.0	10.8	5.4
May	98	11.8	5.9	12.9	6.5	12.2	6.1	11.3	5.6
Jun	97	15.6	7.8	11.2	5.6	11.4	5.7	9.9	5.0
Jul	96	11.9	6.0	11.7	5.9	10.7	5.4	10.8	5.4
Aug	97	10.4	5.2	11.0	5.5	9.9	4.9	10.6	5.3
Sep	98	8.3	4.1	9.4	4.7	9.2	4.6	7.4	3.7
Oct	98	7.9	3.9	8.6	4.3	9.3	4.6	7.5	3.8
Nov	98	6.7	3.4	8.1	4.1	7.6	3.8	6.4	3.2
Dec	98	5.5	2.8	6.6	3.3	5.9	2.9	5.8	2.9
Avg	97.8	8.8	4.4	9.5	4.8	8.9	4.5	9.3	4.6

* Performance Ratio

NIS - Contactor not in service during this month

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Ozone System Performance

Month	Ozone Generators												
	Ozone Production (lb/Day)	Operating Concentration (% wt)	Unit Cost		Generator 1			Generator 2			Generator 3		
			\$/lb	\$/MG	Measured Specific Energy (kWh/lb)	Expected Specific Energy (kWh/lb)	% Variance	Measured Specific Energy (kWh/lb)	Expected Specific Energy (kWh/lb)	% Variance	Measured Specific Energy (kWh/lb)	Expected Specific Energy (kWh/lb)	% Variance
Jan	179	8.00	\$0.90	\$10.79	3.28	3.75	-12.70	NIS	NIS	NIS	NIS	NIS	NIS
Feb	189	7.72	0.92	12.06	3.24	3.69	-12.00	3.38	3.79	-10.70	3.36	3.76	-10.50
Mar	225	7.99	0.91	14.14	3.28	3.75	-12.40	3.41	3.77	-9.40	3.36	3.76	-10.60
Apr	235	8.02	0.91	14.21	3.18	3.75	-15.20	3.52	3.79	-6.70	3.38	3.77	-10.40
May	231	7.98	0.92	12.42	3.31	3.75	-11.70	3.56	3.75	-5.00	3.45	3.75	-8.10
Jun	303	9.33	0.88	12.86	3.85	4.32	-10.80	4.13	4.42	-6.60	3.78	4.15	-8.60
Jul	370	10.55	0.88	13.29	4.34	4.74	-8.20	NIS	NIS	NIS	4.37	5.01	-12.20
Aug	328	11.96	0.87	11.90	4.88	5.61	-13.10	NIS	NIS	NIS	4.61	5.62	-18.00
Sep	237	10.62	0.84	9.34	3.84	4.51	-14.80	NIS	NIS	NIS	4.01	4.85	-16.90
Oct	182	9.49	0.87	9.57	3.70	4.53	-18.00	3.60	4.24	-14.60	3.57	4.02	-10.40
Nov	152	6.99	1.07	11.41	NIS	NIS	NIS	3.18	3.53	-10.10	3.27	3.53	-7.40
Dec	167	6.99	1.06	12.53	NIS	NIS	NIS	3.16	3.53	-10.50	3.22	3.53	-8.80
Avg	233	8.80	\$0.92	\$12.04	3.69	4.24	-12.89	3.49	3.85	-9.20	3.67	4.16	-11.08

NIS - Generator not in service during this month

**Water Treatment Plant
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Operational, Maintenance & Depreciation Costs¹

	2019 Cost	Cost/MG
Chemicals & Supplies <i>Aluminum Sulfate, Soda Ash, Polyaluminum Chloride, Liquid Oxygen, Sodium Hypochlorite, Ammonia, Fluorosilic Acid, Phosphoric Acid, Polymer, Supplies</i>	\$988,026	\$156
Purchased Power ² <i>Equipment, Lighting, Electric Heat</i>	1,006,757	159
Labor <i>Deputy Director/Plant Manager, Operators, Lab Technicians</i>	1,131,233	178
Fuel <i>Heat and Standby Power</i>	18,077	3
Building & Equipment Maintenance	254,061	40
Depreciation	393,831	62
Total Cost	<u>\$3,791,985</u>	<u>\$598</u>

¹ Items are based on total pumping for the year of 6,349,435,000 gallons, see page 13.

² Item is purchased power of 8,038,568 KWH, see page 21, does not include Hydro or stand-by generated power of 544,463 KWH.

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Operations, Maintenance and Depreciation Costs/MG

Cost	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
Treatment Chemicals	\$ 159.16	\$ 147.38	\$ 145.54	\$ 140.95	\$ 132.41	\$ 110.80	\$ 104.91	\$ 116.52	\$ 127.86	\$ 155.62
Purchased Power	138.24	124.82	127.62	110.88	111.07	134.64	112.93	130.16	120.77	158.57
Labor	149.75	155.65	155.49	155.63	151.96	141.47	144.09	154.48	167.00	178.17
Fuel	4.11	3.59	2.98	2.03	3.55	4.35	2.17	2.94	4.15	2.85
Building & Equipment	30.53	34.26	33.09	28.56	40.79	36.92	18.88	60.55	56.10	40.02
Depreciation	249.80	237.12	246.29	224.23	212.33	211.22	206.40	211.41	275.03	62.03
Total Costs Per MG	\$ 731.59	\$ 702.82	\$ 711.01	\$ 662.28	\$ 702.82	\$ 639.38	\$ 589.39	\$ 676.06	\$ 750.91	\$ 597.26
Average Daily Flow (MG)	17.593	17.147	17.189	17.226	17.214	17.958	17.819	17.325	17.074	16.658

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Hydrological Data

Precipitation		Inches
Total precipitation for 2019		36.24
Highest Monthly precipitation	October	4.51
Lowest Monthly precipitation	August	0.42
Highest Daily precipitation	October 17	2.0
Average Rainfall per Year based on Records Since 1895		40.03

Temperature		°F
Highest Daily Maximum Temperature	July 21	94.0
Lowest Daily Minimum Temperature	March 7	-7.0
Average Mean Temperature for the Year		46.8
Highest Daily Mean Temperature	July 21	84.5
Lowest Daily Mean Temperature	January 22	1.5

Elevation of Water at Mill Pond Dam Relative to Flash Boards		Inches
January 1 st		-3.0
February 1 st		0.5
March 1 st		-13.5
April 1 st		4.5
May 1 st		9.5
June 1 st		-5.0
July 1 st		0.0
August 1 st		-6.5
September 1 st		-17.5
October 1 st		-29.0
November 1 st		-24.0
December 1 st		-20.0
Lowest Lake Level	October 14	-31.5
Highest Lake Level	April 28	+10.5

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Table of Rainfall (in inches)

Averages and totals are based on rainfall records since 1895
Records measured per gauge at H.P. Station

Years 1895 - 2010 (averages by decade)

Years	Jan	Fen	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Avg	Totals	VAR from All Time AVG
1895 - 1900	3.37	3.65	4.24	2.88	3.19	2.88	3.50	3.54	4.51	3.60	5.09	3.13	3.63	43.59	4.74
1901 - 1910	3.02	2.68	3.52	3.83	3.27	3.91	3.21	3.39	3.98	2.81	2.15	3.82	3.30	39.59	0.73
1911 - 1920	2.42	2.74	3.48	2.94	3.22	2.74	3.81	4.45	3.34	2.72	3.09	3.17	3.18	38.11	-0.74
1921 - 1930	2.79	2.72	2.88	3.38	2.54	3.30	4.00	3.18	2.56	3.04	3.68	2.82	3.07	36.88	-1.97
1931 - 1940	3.63	2.53	3.86	3.77	2.78	3.92	2.99	4.03	4.58	2.93	3.08	3.11	3.43	41.21	2.36
1941 - 1950	3.07	2.18	2.39	2.59	3.61	3.41	4.56	2.67	2.61	2.39	3.87	2.66	3.00	36.00	-2.86
1951 - 1960	3.44	2.77	3.48	3.70	3.70	2.88	3.13	4.19	3.50	3.66	4.14	3.40	3.50	41.98	3.12
1961 - 1970	1.99	2.52	2.51	2.87	2.92	3.10	3.74	2.94	3.02	2.91	4.31	3.64	3.04	36.46	-2.39
1971 - 1980	3.85	2.36	3.45	3.29	3.52	3.68	3.38	3.56	3.39	3.91	3.47	4.13	3.50	41.99	3.13
1981 - 1990	2.29	2.63	2.24	3.63	4.08	4.00	4.06	4.07	2.79	3.77	4.15	2.55	3.36	40.26	1.41
1991 - 2000	3.03	1.94	3.07	3.13	2.92	2.93	3.34	3.08	3.99	3.90	3.76	3.16	3.19	38.24	-0.61
2001 - 2010	2.62	2.96	3.56	4.00	4.55	5.40	3.67	3.75	3.71	4.95	3.42	3.46	3.84	46.05	7.19

Years 2011 - 2019 (by year)

Year	Jan	Fen	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Avg	Totals	
2011	2.21	2.25	4.79	3.64	3.41	4.69	1.98	6.65	6.15	7.70	3.31	3.61	4.20	50.39	11.54
2012	2.40	1.12	1.55	2.51	3.59	3.94	1.53	6.40	4.14	7.18	0.71	3.36	3.20	38.43	-0.42
2013	1.84	3.02	1.57	2.48	4.76	6.34	5.53	3.05	8.11	0.76	2.83	2.85	3.60	43.14	4.29
2014	2.61	3.18	4.70	2.22	3.15	2.40	6.50	3.26	1.39	3.75	3.55	4.73	3.45	41.44	2.59
2015	3.10	2.01	1.38	2.44	0.11	5.48	2.38	2.15	3.63	2.98	2.00	4.84	2.71	32.50	-6.35
2016	1.23	3.60	2.84	2.28	1.84	2.16	2.61	2.69	3.42	5.05	2.11	3.69	2.79	33.52	-5.33
2017	2.03	1.90	2.10	4.21	5.80	3.25	3.91	4.21	4.74	6.03	1.35	2.55	3.51	42.08	3.23
2018	2.47	3.92	2.29	4.64	1.33	5.36	6.10	7.57	8.04	3.47	8.75	2.74	4.72	56.68	17.83
2019	4.16	3.04	0.92	4.50	2.47	4.17	3.25	0.42	1.25	4.51	2.01	5.54	3.02	36.24	-2.61

Minimum, average, and maximum rainfall 1895 - 2019

MIN	1.23	1.12	0.92	2.22	0.11	2.16	1.53	0.42	1.25	0.76	0.71	2.55	2.71	32.50
AVG	2.62	2.53	2.76	3.13	3.03	3.63	3.51	3.60	3.77	3.73	3.22	3.32	3.24	38.85
MAX	4.16	3.92	4.79	4.64	5.80	6.34	6.50	7.57	8.11	7.70	8.75	5.54	4.72	56.68

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Bacteria and Water Temperature Data

Month	Raw Water TC/EC	High Service TC/EC	Low Service TC/EC	Avg. Temp Degrees F
January	5/1	ABSENT	ABSENT	42.1
February	4/<1	ABSENT	ABSENT	46.4
March	3/<1	ABSENT	ABSENT	46.4
April	23/<1	ABSENT	ABSENT	49.8
May	97/14	ABSENT	ABSENT	57.2
June	727/10	TC=1P:57A EC ABSENT	ABSENT	69.1
July	2203/14	TC=1P:57A EC ABSENT	ABSENT	78.4
August	2419/6	ABSENT	ABSENT	77.4
September	1860/5	TC=3P:70A EC ABSENT	ABSENT	70.2
October	2133/3	ABSENT	ABSENT	59.4
November	86/2	ABSENT	ABSENT	51.3
December	17/<1	ABSENT	ABSENT	36.9
Average	798/5	TC=10P:690A EC all ABSENT	TC=6P:799A EC all ABSENT	57.1

*TC = Total Coliform

* EC = E-Coli

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***Finished Water Quality
Year-End Average Results for Point Of Entry and System Samples***

Regulated Health Related Contaminants

Contaminant	Maximum Contaminant Level	MWW Level	Units
<i>Microbiological</i>			
Total Coliform	A	A	P/A
Fecal Coliform	A	A	P/A
Giardia	0.29*	ND	Cysts/100L
Cryptosporidium	0.29*	ND	
Heterotrophic Plate Count	>200	6	CFU
<i>Clarity</i>			
Turbidity (POE)	0.5	0.04	NTU
Turbidity (Avg. system values)	0.5	0.18	NTU
<i>Inorganic</i>			
Arsenic	0.01	ND	mg/L
Antimony	0.006	ND	mg/L
Barium	2	0.011	mg/L
Beryllium	0.004	ND	mg/L
Cadmium	0.005	ND	mg/L
Chlorine (total)	4	2.36	mg/L
Monochloramine	4	2.24	mg/L
Chromium	0.1	ND	mg/L
Copper	1.3*	0.0429	mg/L
Cyanide (as Free)	0.2	ND	mg/L
Cyanide, Total	0.2	ND	
Fluoride	4	0.80	mg/L
Lead	0.015*	<0.001	mg/L
Mercury	0.002	ND	mg/L
Nitrate (as N)	10	ND	mg/L
Nitrite (as N)	1	ND	mg/L
Nitrate + Nitrite (as N)		ND	mg/L
Selenium	0.05	ND	mg/L
Thallium	0.002	ND	mg/L
<i>Volatile Organics</i>			
Benzene	0.005	ND	mg/L
Carbon tetrachloride	0.005	ND	mg/L
1,2 dichloroethane	0.005	ND	mg/L

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Regulated Health Related Contaminants, continued

Contaminant	Maximum Contaminant Level	MWW Level	Units
Trichloroethene	0.005	ND	mg/L
1,4 dichlorobenzene	0.075	ND	mg/L
1,1 dichloroethene	0.007	ND	mg/L
1,1,1 trichloroethane	0.2	ND	mg/L
Vinyl chloride	0.002	ND	mg/L
Cis 1,2 dichloroethene	0.07	ND	mg/L
1,2 dichloropropane	0.005	ND	mg/L
Ethylbenzene	0.7	ND	mg/L
Chlorobenzene	0.1	ND	mg/L
1,2 dichlorobenzene	0.6	ND	mg/L
Styrene	0.1	ND	mg/L
Tetrachloroethene	0.005	ND	mg/L
Toluene	1	ND	mg/L
Trans 1,2 dichloroethene	0.1	ND	mg/L
Xylene, Total	10	ND	mg/L
Methyl-t-butylether (MtBE)	0.013	ND	mg/L
<i>Radionuclides</i>			
Gross Alpha	15	<3	pCi/L
Gross Beta	4 mrem/yr	<3.0	pCi/L
Uranium	0.03	<0.67	pCi/L
Radium 226 & 228	5	<1	pCi/L
<i>Disinfection By-Products</i>			
Total Trihalomethanes	0.08	0.0076	mg/L
Haloacetic Acid	0.06	0.0059	mg/L
Bromate	10 ppb	1.9	ug/L
<i>Synthetic Organics</i>			
Endrin	0.002	ND	mg/L
Lindane	0.0002	ND	mg/L
Methoxychlor	0.04	ND	mg/L
Pentachlorophenol	0.001	ND	mg/L
Polychlorinated Biphenyls	0.0005	ND	mg/L
Toxaphene	0.003	ND	mg/L
2,4,5 TP (Silvex)	0.05	ND	mg/L
2,4 D	0.07	ND	mg/L

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Regulated Health Related Contaminants, continued

Contaminant	Maximum Contaminant Level	MWW Level	Units
<i>Other Synthetic Organics</i>			
Benzo(a)pyrene	0.0002	ND	mg/L
Di(ethylhexyl)phthalate	0.006	ND	mg/L
Hexachlorobenzene	0.001	ND	mg/L
Hexachlorocyclopentadiene	0.05	ND	mg/L
Ethylene Dibromide (EDB)	0.00005	ND	mg/L
Chlorodane	0.0002	ND	mg/L
Dicamba	0.0004	ND	mg/L
Dinoseb	0.0007	ND	mg/L
Picloram	0.5	ND	mg/L
Alachlor	0.0002	ND	mg/L
Aldrin	0.0001	ND	mg/L
Atrazine	0.0003	ND	mg/L
Butachlor	0.0002	ND	mg/L
Di(2-ethylhexyl)adipate	0.4	ND	mg/L
Dieldrin	0.007	ND	mg/L
Heptachlor	0.00004	ND	mg/L
Metoachlor		ND	mg/L
Metribuzin		ND	mg/L
Propachlor		ND	mg/L
Simazine	0.004	ND	mg/L
3-Hydroxycarbofuran		ND	mg/L
Aldicarb Sulfone		ND	mg/L
Aldicarb Sulfoxide		ND	mg/L
Aldicarb		ND	mg/L
Carbaryl		ND	mg/L
Carbofuran	0.04	ND	mg/L
Methiocarb		ND	mg/L
Methomyl		ND	mg/L
Oxamyl (Vydate)	0.2	ND	mg/L
Propoxur (Baygon)		ND	mg/L
Glyphosate	0.7	ND	mg/L

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Regulated Secondary Contaminants Aesthetic Qualities

Contaminant	Maximum Contaminant Level	MWW Level	Units
Aluminum	0.05	0.022	mg/L
Chloride	250	46.5	mg/L
Color	15	0	mg/L
Iron	0.3	<0.1	mg/L
Manganese	0.05	0.0121	mg/L
pH	6.5 - 8.5	7.71	mg/L
Silver	0.01	ND	mg/L
Sulfate	500	22.75	mg/L
Zinc	5	0.001	mg/L
Sodium	100 - 250	42.9	mg/L
UV-254		0.03	cm

Unregulated Contaminants

Contaminant	Maximum Contaminant Level	MWW Level	Units
<i>Organics</i>			
Chloroform		0.65	ug/L
Bromobenzene		ND	ug/L
Bromodichloromethane		1.625	ug/L
Bromoform		ND	ug/L
Bromomethane		ND	ug/L
Chlorobenzene		ND	ug/L
Chloroethane		ND	ug/L
Chloromethane		ND	ug/L
2-Chlorotoluene		ND	ug/L
4-Chlorotoluene		ND	ug/L
Dibromochloromethane		0.675	ug/L
1,2-Dibromo-3-Chloropropane		ND	ug/L
1,3 Dichlorobenzene		ND	ug/L
1,1-Dichloroethane		ND	ug/L
Trans 1,3-Dichloropropane		ND	ug/L
1,1,2,2-Tetrachloroethane		ND	ug/L
1,1,1,2-Trichloroethane		ND	ug/L
1,1,2-Trichloropropane		ND	ug/L
Dichlorodifluoromethane		ND	ug/L

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Unregulated Contaminants, continued

Contaminant	Maximum Contaminant Level	MWW Level	Units
Bromomethane		ND	ug/L
Trichlorofluoromethane		ND	ug/L
Diethyl Ether		ND	ug/L
Acetone		ND	ug/L
Tert-Butyl-Alcohol (TBA)		ND	ug/L
Methylene chloride		ND	ug/L
Carbon disulfide		ND	ug/L
Ethyl-t-butyl ether (ETBE)		ND	ug/L
Isopropyl ether (DIPE)		ND	ug/L
Tert-amyl methyl ether (TAME)		ND	ug/L
Vinyl acetate		ND	ug/L
2-Butanone (MEK)		ND	ug/L
Bromochloromethane		ND	ug/L
Tetrahydrofuran (THF)		ND	ug/L
Bromodichloromethane		ND	ug/L
4-Methyl-2-pentanone (MIBK)		ND	ug/L
Cis-1,3-Dichloropropene		ND	ug/L
2-Hexanone		ND	ug/L
1 Dibromochloromethane		ND	ug/L
1,2-Dibromoethane (EDB)		ND	ug/L
IsoPropylbenzene		ND	ug/L
n-Propylbenzene		ND	ug/L
1,3,5-Trimethylbenzene		ND	ug/L
tert-Butylbenzene		ND	ug/L
1,2,4-Trimethylbenzene		ND	ug/L
sec-Butylbenzene		ND	ug/L
p-Isopropyltoluene		ND	ug/L
n-Butylbenzene		ND	ug/L
1,2-Dibromo-3-chloropropane		ND	ug/L
1,3,5-Trichlorobenzene		ND	ug/L
1,2,4-Trichlorobenzene		ND	ug/L
Hexachlorbutadiene		ND	ug/L
Naphthalene		ND	ug/L
1,2,3-Trichlorobenzene		ND	ug/L

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Unregulated Contaminants, continued

Contaminant	Maximum Contaminant Level	MWW Level	Units
<i>Radionuclides</i>			
Radon		Not Tested	pCi/L
Uranium	0.03	<0.67	pCi/L
<i>Secondary Contaminants</i>			
Alkalinity		23.3	mg/L
Free Ammonia		0.058	mg/L
Calcium Hardness		4.5	mg/L
Total Hardness		15.4	mg/L
Orthophosphate		1.46	mg/L
Specific Conductance		265.5	uS/cm
TOC		1.83	mg/L
Magnesium		1.02	mg/L
Nickel		ND	mg/L

* *Denotes Action Level*

Key to Abbreviations

<i>Maximum Contaminant Level (MCL)</i>	<i>State of NH Department of Environmental Services</i>
<i>MWW Level</i>	<i>Typical level of contaminant in Manchester Water Works drinking water</i>
<i>Units</i>	<i>The scientific unit of measure</i>
<i>ND</i>	<i>Not detected</i>
<i>ug/L</i>	<i>Micrograms per liter or parts per billion</i>
<i>mg/L</i>	<i>Milligrams per liter or parts per million</i>
<i>NTU</i>	<i>Nephelometric Turbidity Units, a measure of clarity</i>
<i>pCi/L</i>	<i>Picocuries per liter, a measure of radioactivity</i>
<i>uS/cm</i>	<i>Microsimens per centimeter, a measure of electrical conductivity</i>
<i>A or P</i>	<i>Absence or presence of bacteria with no more than 5% of samples being positive</i>
<i>Mfl</i>	<i>Million asbestos fibers per liter</i>

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Major Distribution Projects

Manchester:

Street Relayed:	From:	To:	Linear Feet	Pipe Diameter (inches)
Slade Ave.	Purchase St.	Dead End	160	4
Rose Ave.	Purchase St.	Dead End	200	4
Reynolds Ave.	Massabesic St.	Dead End	228	4
Amoskeag Bridge (Slip Lined)			900	14
Therrien Ln.	Wellington Rd.	Dead End	785	6

Bedford:

Merry St.	Donald St.	Darling St.	246	4
Woodlawn Ave.	Donald St.	Dead End	490	6
Cedarwood Dr.	S River Rd.	Dead End	528	8
S. River Rd.	N of Hawthorne Dr.	Everett Tpk. Overpass	555	12
Route 101	Bedford Center Rd.	Westerly	419	16

Auburn:

Neal Ave.	Manchester Rd.	Brookside Dr.	485	6
Rockingham Rd.	254 Northeasterly	Across King St.	404	8
Orchard St.	Manchester Rd.	Westerly	675	8
Reading St.	Sparrow Ln.	Northeasterly	236	8

Hooksett:

K Ave.	Hale Ave.	Southerly	252	4
Elmer Ave.	Alice Ave.	Northerly	221	4
Coaker Ave.	Alice Ave.	Northerly	575	6
K Ave.	Alice Ave.	Southerly	177	6
Brookview Dr.	Existing E.O.P.	Westerly	1,756	12
Sophie Cir.	Brookview Dr.	Northerly	520	8

Goffstown:

Orchard St.	Existing E.O.P.	Southerly	204	6
Laurier St.	Cross St.	Southerly	347	6

Londonderry:

Sanborn Rd.	Existing E.O.P.	Easterly	1,634	12
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Distribution System Summary

Main Pipe		
Main pipe laid	pg 40, 41	13,225 ft
Mile equivalent	pg 41	2.5 mi
Main pipe discontinued	pg 42	4,915 ft
Main pipe in distribution system	pg 43, 44	2,676,500 ft
Mile equivalent	pg 44	506.9 mi
Main Gates		
Main gates installed (1" and larger)	pg 45	79
Main gates discontinued	pg 45	7
Main gates in distribution system	pg 46	11,671
Hydrants		
Municipal hydrants installed	pg 47	9
Municipal hydrants discontinued	pg 47	0
Municipal hydrants in distribution system	pg 48	3,456
Private hydrants in distribution system	pg 49	1,053
Domestic Services		
New domestic services laid	pg 50	65
Length of new services laid	pg 50	1,017
Domestic services discontinued	pg 50	11
Domestic services relaid	pg 50	2
Length of services relaid	pg 50	58
Domestic services in distribution system	pg 51	31,395
Fire Services		
Fire services installed	pg 52	21
Fire services discontinued	pg 52	1
Fire services in distribution system	pg 53	1,774
Meters		
Meters in distribution system	pg 54	30,635
Meters equipped with radio reading devices	N/A	30,624
Backflow Devices		
Backflow device tests performed	pg 55	7,493
Backflow devices in distribution system	pg 56	6,440

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***Main Pipe Laid During Year
by Town***

Pipe Diameter (Inches)	Auburn	Bedford	Goffstown	Hooksett	Londonderry	Manchester	Total Linear Feet
1	-	-	-	-	-	15	15
2	-	-	-	31	-	225	256
4	-	243	-	473	-	368	1,084
6	485	508	550	1,112	19	1,113	3,787
8	1,318	528	2	557	-	-	2,405
12	-	555	-	2,115	1,615	-	4,285
14	-	-	-	-	-	900	900
16	-	419	-	-	-	-	419
24	-	-	-	-	-	74	74
Totals	<u>1,803</u>	<u>2,253</u>	<u>552</u>	<u>4,288</u>	<u>1,634</u>	<u>2,695</u>	<u>13,225</u>

***Main Pipe Laid During Year
by Type***

Pipe Diameter (Inches)	Copper	Ductile	Plastic	Total Linear Feet
1	15	-	-	15
2	31	-	225	256
4	-	1,084	-	1,084
6	-	3,787	-	3,787
8	-	2,405	-	2,405
12	-	4,285	-	4,285
14	-	-	900	900
16	-	419	-	419
24	-	74	-	74
Totals	<u>46</u>	<u>12,054</u>	<u>1,125</u>	<u>13,225</u>

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***Main Pipe Laid During Year (continued)
by Purpose***

Pipe Diameter (Inches)	Petition	Hydrant Branch	Improvements to System	Relocation	Total Linear Feet
1	-	-	15	-	15
2	-	-	256	-	256
4	-	-	1,084	-	1,084
6	1,353	144	2,291	-	3,787
8	1,087	-	1,318	-	2,405
12	4,285	-	-	-	4,285
14	-	-	900	-	900
16	-	-	-	419	419
24	-	-	74	-	74
Total Feet	<u>6,724</u>	<u>144</u>	<u>5,938</u>	<u>419</u>	<u>13,225</u>

Total 13,225 Feet or 2.5 Miles

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***Main Pipe Discontinued
by Town***

Pipe Diameter (Inches)	Auburn	Bedford	Goffstown	Hooksett	Manchester	Total Linear Feet
1.5	-	-	-	461	196	657
2	-	274	21	-	344	639
6	-	485	-	589	119	1,193
8	2,039	-	-	-	192	2,231
16	-	180	-	-	-	180
24	-	-	-	-	15	15
Total Feet	<u>2,039</u>	<u>939</u>	<u>21</u>	<u>1,050</u>	<u>866</u>	<u>4,915</u>

***Main Pipe Discontinued
by Type***

Pipe Diameter (Inches)	Cast Iron	Copper	Ductile	Lined Cast Iron	Total Linear Feet
1.5	-	19	-	638	657
2	124	95	-	420	639
6	1,021	-	-	172	1,193
8	-	-	227	2,004	2,231
16	-	-	-	180	180
24	15	-	-	-	15
Total Feet	<u>1,160</u>	<u>114</u>	<u>227</u>	<u>3,414</u>	<u>4,915</u>

Total 4,915 Feet or .93 Mile

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***Main Pipe in Distribution System
by Type***

Pipe Diameter (Inches)	Cast Iron	Ductile	Plastic	Galvanized C.L.	Copper	Lock Joint Concrete	Galvanized	Total Linear Feet
1	-	-	278	247	505	-	-	1,030
1 1/4	-	-	-	6	73	-	970	1,049
1 1/2	-	-	260	2,416	518	-	303	3,497
2	-	-	10,618	3,058	2,143	-	-	15,819
2 1/4	-	-	-	428	-	-	-	428
2 1/2	-	-	-	236	-	-	-	236
4	10,005	9,840	-	-	-	-	71	19,916
6	467,480	269,899	-	-	-	-	-	737,379
8	357,365	399,807	-	-	-	-	-	757,172
10	104,702	29,029	-	-	-	-	-	133,731
12	201,216	322,116	-	-	-	-	-	523,332
14	24,543	1,742	900	-	-	-	-	27,185
16	58,691	171,504	-	-	-	-	-	230,195
20	83,972	28,988	886	-	-	-	-	113,846
24	37,999	30,750	-	-	-	-	-	68,749
30	3,356	23,142	-	-	-	977	-	27,475
36	-	13,971	-	-	-	-	-	13,971
42	-	96	-	-	-	-	-	96
48	-	-	-	-	-	964	-	964
63	-	-	430	-	-	-	-	430
Total Feet	<u>1,349,329</u>	<u>1,300,884</u>	<u>13,372</u>	<u>6,391</u>	<u>3,239</u>	<u>1,941</u>	<u>1,344</u>	<u>2,676,500</u>

Total 2,676,500 Feet or 506.9 Miles

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***Main Pipe in Distribution System (continued)
by Town***

Pipe Diameter (Inches)	Auburn	Bedford	Goffstown	Hooksett	Litchfield	Londonderry	Manchester	Total Linear Feet
1	-	-	70	193	-	-	767	1,030
1 1/4	-	-	-	-	-	-	1,049	1,049
1 1/2	254	-	-	194	-	-	3,049	3,497
2	61	880	464	2,435	-	-	11,979	15,819
2 1/4	-	-	-	217	-	-	211	428
2 1/2	-	-	-	-	-	-	236	236
4	628	401	803	667	-	522	16,895	19,916
6	1,094	21,254	33,417	11,230	11	4,760	664,522	736,288
8	6,376	52,957	68,299	31,195	291	27,993	570,061	757,172
10	-	52	122	42	-	5,375	128,140	133,731
12	3,833	55,905	16,524	26,151	-	74,807	347,012	524,232
14	-	-	-	-	-	-	27,185	27,185
16	1,722	16,900	9,185	34,773	-	40,582	127,033	230,195
20	-	5,312	-	2,025	-	5,823	100,686	113,846
24	-	-	-	1,961	-	17,884	49,095	68,940
30	-	-	-	-	-	5,503	21,972	27,475
36	-	-	-	-	-	-	13,971	13,971
42	-	-	-	-	-	-	96	96
48	-	-	-	-	-	-	964	964
63	-	-	-	-	-	-	430	430
Total Feet	<u>13,968</u>	<u>153,661</u>	<u>128,884</u>	<u>111,083</u>	<u>302</u>	<u>183,249</u>	<u>2,085,353</u>	<u>2,676,500</u>

Total 2,676,500 Feet or 506.9 Miles

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Main Gates Installed

Diameter (Inches)	Auburn	Bedford	Goffstown	Hooksett	Londonderry	Manchester	Total Gates
1	-	-	-	-	-	1	1
4	-	2	-	2	-	3	7
6	-	3	1	14	6	13	37
8	4	3	1	2	-	7	17
10	-	-	-	-	1	1	2
12	-	1	-	6	3	2	12
20	-	-	-	-	-	2	2
24	-	-	-	-	-	1	1
Total Gates	<u>4</u>	<u>9</u>	<u>2</u>	<u>24</u>	<u>10</u>	<u>30</u>	<u>79</u>

Main Gates Discontinued

Diameter (Inches)	Auburn	Hooksett	Manchester	Total Gates
1.5	-	1	-	1
2	-	1	-	1
6	-	-	4	4
8	1	-	-	1
Total Gates	<u>1</u>	<u>2</u>	<u>4</u>	<u>7</u>

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Main Gates in Distribution System

Diameter (Inches)	Auburn	Bedford	Goffstown	Hooksett	Litchfield	Londonderry	Manchester	Total Gates
3/4	-	-	2	-	-	-	-	2
1	1	-	3	1	-	-	-	5
1 1/2	2	1	-	2	-	-	-	5
2	1	9	10	4	-	-	-	24
4	1	58	9	8	-	5	273	354
6	27	323	259	227	1	363	5,091	6,291
8	25	207	170	118	-	215	1,890	2,625
10	-	2	1	-	-	19	339	361
12	7	122	48	64	-	182	882	1,305
14	-	-	-	-	-	-	83	83
16	2	24	11	53	-	63	198	351
20	-	6	-	3	-	6	141	156
24	-	-	-	5	-	16	70	91
30	-	-	-	-	-	3	9	12
36	-	-	-	-	-	-	5	5
42	-	-	-	-	-	-	1	1
Total Gates	<u>66</u>	<u>752</u>	<u>513</u>	<u>485</u>	<u>1</u>	<u>872</u>	<u>8,982</u>	<u>11,671</u>

Butterfly Valves Included

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Municipal Hydrants Installed

Manufacturer	Bedford	Hooksett	Londonderry	Manchester	Total
Eddy B/F	<u>2</u>	<u>4</u>	<u>2</u>	<u>1</u>	<u>9</u>

No Municipal Hydrants Discontinued

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Municipal Hydrants In Distribution System

Manufacturer	Auburn	Bedford	Goffstown	Hooksett	Litchfield	Londonderry	Manchester	Total Hydrants
AP Smith	-	13	19	7	-	31	106	176
Amoskeag	-	-	-	-	-	-	1	1
Chapman	-	-	-	-	-	-	3	3
Coffin	-	-	-	-	-	-	1	1
Corey	-	-	-	-	-	-	1	1
Eddy	5	22	42	11	-	10	939	1,029
Eddy B/F	10	116	80	122	1	158	1,000	1,487
Holyoke	-	1	1	-	-	-	61	63
Holy Large	-	-	-	-	-	-	1	1
Kennedy	-	-	-	-	-	-	1	1
Ludlow	-	-	-	-	-	-	4	4
Metropolitan	7	37	14	25	-	58	537	678
Mueller	-	-	-	-	-	1	1	2
Pratt & Cady	-	-	-	-	-	-	3	3
Unknown	-	1	-	2	-	-	3	6
Total Hydrants	<u>22</u>	<u>190</u>	<u>156</u>	<u>167</u>	<u>1</u>	<u>258</u>	<u>2,662</u>	<u>3,456</u>

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Private Hydrants In Distribution System

Manufacturer	Auburn	Bedford	Goffstown	Hooksett	Londonderry	Manchester	Total Hydrants
Amoskeag	-	-	-	-	-	3	3
AP Smith	-	1	2	-	-	56	59
Corey	-	-	-	-	-	1	1
Darling	-	3	2	-	-	4	9
Eddy	-	1	12	-	-	24	37
Eddy B/F	2	83	26	64	155	372	702
Kennedy	-	-	-	-	-	5	5
M+H	-	-	-	-	10	-	10
Metropolitan	2	23	10	28	49	95	207
Mueller	-	1	1	-	1	1	4
Unknown	-	1	-	1	7	7	16
Total Hydrants	<u>4</u>	<u>113</u>	<u>53</u>	<u>93</u>	<u>222</u>	<u>568</u>	<u>1,053</u>

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Domestic Services Laid

Diameter (Inches)	Bedford	Goffstown	Hooksett	Londonderry	Manchester	Total Services
3/4	1	-	-	-	-	1
1	2	6	7	3	42	60
2	1	-	-	-	1	2
4	-	-	-	2	-	2
Total Services	<u>4</u>	<u>6</u>	<u>7</u>	<u>5</u>	<u>43</u>	<u>65</u>

Total 1,017 Feet of Domestic Services Laid

Domestic Services Discontinued

Diameter (Inches)	Bedford	Manchester	Total Services
3/4	2	4	6
1 1/4	-	1	1
2	1	1	2
6	-	2	2
Total Services	<u>3</u>	<u>8</u>	<u>11</u>

Domestic Services Relaid

Total 58 Feet (2 Services) of Domestic Services Relaid: 46' of 1" CU and 12' of .75" CU

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Domestic Services in Distribution System

Diameter (Inches)	Auburn	Bedford	Goffstown	Hooksett	Litchfield	Londonderry	Manchester	Total Services
3/4	68	520	1,058	424	-	146	19,924	22,140
1	16	530	267	317	3	352	4,919	6,404
1 1/4	-	6	2	1	-	1	213	223
1 1/2	-	110	37	27	-	62	920	1,156
2	8	123	58	59	-	73	918	1,239
2 1/2	-	-	-	1	-	-	11	12
3	-	11	4	3	-	5	37	60
4	-	12	4	3	-	8	102	129
6	-	1	1	1	-	-	23	26
8	-	-	-	-	-	2	-	2
10	-	-	-	-	-	-	3	3
12	-	-	-	-	-	1	-	1
Total Services	<u>92</u>	<u>1,313</u>	<u>1,431</u>	<u>836</u>	<u>3</u>	<u>650</u>	<u>27,070</u>	<u>31,395</u>

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Fire Services Installed

Diameter (Inches)	Bedford	Hooksett	Londonderry	Manchester	Total Fire Services
2	-	-	-	1	1
4	-	-	-	3	3
6	2	2	2	4	10
8	1	-	-	4	5
12	-	-	-	1	1
16	-	-	1	-	1
Total Fire Services	<u>3</u>	<u>2</u>	<u>3</u>	<u>13</u>	<u>21</u>

Fire Services Discontinued

1 10" Fire Service Discontinued in Manchester

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Fire Services in Distribution System

Diameter (Inches)	Auburn	Bedford	Goffstown	Hooksett	Londonderry	Manchester	Total Fire Services
3/4	-	-	-	-	-	1	1
1	-	-	-	-	-	9	9
1 1/2	-	27	-	-	-	8	35
2	-	1	7	9	-	78	95
2 1/2	-	-	-	-	-	2	2
4	-	42	5	2	2	130	181
6	2	66	16	29	96	574	783
8	9	72	15	31	109	323	559
10	-	1	1	-	4	29	35
12	1	10	4	13	14	27	69
14	-	-	-	-	-	4	4
16	-	1	-	-	-	-	1
Total Fire Services	<u>12</u>	<u>220</u>	<u>48</u>	<u>84</u>	<u>225</u>	<u>1,184</u>	<u>1,774</u>

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Meters in Distribution System

Type/Diameter	Triseal	Trident 8	Trident 10	Trident	Hersey	Total Meters
Discs						
5/8"	2,247	5,784	17,656	-	-	25,687
3/4"	80	253	1,241	-	-	1,574
1"	96	283	1,224	-	-	1,603
1 1/2"	228	85	616	-	-	929
2"	292	127	354	-	-	773
Total Discs	2,943	6,532	21,091	-	-	30,566

Type/Diameter	Triseal	Trident 8	Trident 10	Trident	Hersey	Total Meters
Turbines						
2"	-	-	-	2	-	2
3"	-	-	-	15	3	18
4"	-	-	-	14	4	18
6"	-	-	-	6	1	7
8"	-	-	-	1	-	1
10"	-	-	-	1	-	1
Total Turbines	-	-	-	39	8	47

Type/Diameter	Triseal	Trident 8	Trident 10	Trident	Hersey	Total Meters
Compounds						
3"	-	-	-	9	-	9
4"	-	-	-	5	-	5
6"	-	-	-	8	-	8
Total Compounds	-	-	-	22	-	22

Total Meters	<u>2,943</u>	<u>6,532</u>	<u>21,091</u>	<u>61</u>	<u>8</u>	<u>30,635</u>
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Backflow Device Tests Performed

	DCVA¹	PVB²	RPZ³	Total Devices
January	189	-	447	636
February	94	-	292	386
March	274	1	209	484
April	224	2	260	486
May	128	222	261	611
June	56	960	30	1,046
July	72	1,171	51	1,294
August	186	222	530	938
September	90	7	374	471
October	126	7	317	450
November	88	1	202	291
December	146	-	254	400
Total Devices	<u>1,673</u>	<u>2,593</u>	<u>3,227</u>	<u>7,493</u>

¹ - DCVA = Double Check Valve Assembly

² - PVB = Pressure Vacuum Breaker

³ - RPZ = Reduced Pressure Zone

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Backflow Devices in Distribution System

Diameter (Inches)	DCVA	PVB	RPZ	RPZ*	Total Devices
1/2	1	3	-	-	4
3/4	818	1,982	259	168	3,227
1	276	856	214	67	1,413
1 1/4	3	1	51	18	73
1 1/2	216	3	295	65	579
2	351	5	541	106	1,003
2 1/2	7	1	23	5	36
3	9	-	43	2	54
4	5	-	30	-	35
5	-	-	-	-	-
6	1	-	11	-	12
8	3	-	1	-	4
Total Devices	<u>1,690</u>	<u>2,851</u>	<u>1,468</u>	<u>431</u>	<u>6,440</u>

* RPZ Tested as DCVA

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Summary of Work Performed

	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	2019
Main Laid (in feet)	-	74	105	485	1,767	1,057	1,525	2,298	1,925	3,091	826	72	13,225
Hydrants Set	-	-	-	-	2	-	1	2	-	3	1	-	9
Hydrants Moved	-	-	-	-	-	-	-	-	1	2	-	-	3
Hydrants Replaced	1	2	2	2	-	3	-	2	1	2	1	3	19
Hydrants Repaired	9	26	20	79	99	75	47	23	10	19	77	48	532
Hydrants Thawed (frozen)	5	3	-	-	-	-	-	-	-	-	1	3	12
New Services Laid	-	-	3	3	15	3	7	19	6	4	5	-	65
Relaid Service	-	-	-	-	1	-	1	-	-	-	-	-	2
Discontinued Services	-	-	1	-	3	1	-	1	3	2	-	-	11
Leaks on Mains	5	3	1	-	-	1	1	1	-	1	1	-	14
Leaks on Services	5	-	1	2	-	3	-	-	2	3	2	5	23
Meters Taken Out and Retired	23	20	15	13	9	8	14	13	21	9	12	10	167
Meters Taken Out for Test	226	215	253	201	181	145	142	163	285	349	306	261	2,727
Meters Repaired	32	26	29	27	24	22	23	22	48	38	23	18	332
Backflow P.V.B.	-	-	1	2	222	960	1171	222	7	7	1	-	2,593
Devices D.C.V.	189	94	274	224	128	56	72	186	90	126	88	146	1,673
Tested R.P.Z.	447	292	209	260	261	30	51	530	374	317	202	254	3,227

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10 Year History of Work Performed

	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
Main Laid (in feet)	19,748	12,819	11,701	19,210	14,141	15,828	15,732	13,930	11,686	13,225
Hydrants Set	13	14	4	8	12	10	14	12	21	9
Hydrants Relocated	9	4	6	5	2	8	1	1	2	3
Hydrants Replaced	18	20	20	21	17	20	6	15	16	19
Hydrants Repaired	206	235	222	218	297	312	155	417	570	532
Hydrants Thawed (frozen)	2	8	5	37	15	7	17	8	29	12
New Services Laid	96	68	70	100	102	118	131	115	82	65
Relaid Service	24	6	9	9	6	25	1	33	2	2
Discontinued Services	13	33	17	24	16	27	2	3	21	11
Frozen Services	1	-	-	-	1	39	-	-	6	-
Leaks on Mains	27	27	24	47	28	30	24	26	30	14
Leaks on Services	30	31	31	49	54	62	25	37	24	23
Meters Taken Out and Retired	127	114	121	120	160	207	N/A	169	244	167
Meters Taken Out for Test	1,767	1,216	1,261	1,292	930	858	N/A	2,065	2,823	2,727
Meters Repaired	121	87	94	88	69	89	N/A	207	244	332
Backflow P.V.B.	95	114	117	105	89	67	68	36	62	2,593*
Devices D.C.V.	24	31	31	51	29	28	6	8	10	1,673*
Installed R.P.Z.	23	28	44	63	29	32	6	21	16	3,227*

N/A = Not available in 2016 annual report

** = Backflow Devices Tested*

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Metered Municipal Water Usage

Location	CCF	Usage Charges	Meter Service Charges	Hydrant Charges	Fire Service Charges	Total Service Charges	Total Usage and Service Charges
Airport	\$ 1,244	\$ 1,923	\$ 157	\$ -	\$ 222	\$ 379	\$ 2,302
Cemeteries - Public	21,570	33,347	2,968	557	-	3,525	36,872
Enviromental Protection Division	55,848	86,341	2,868	-	192	3,060	89,401
Fire Department	2,785	4,306	2,527	2,226	3,339	8,092	12,398
Highway Department	2,839	4,389	1,718	557	1,670	3,945	8,334
Parks & Recreation	67,831	104,867	13,573	557	1,670	15,800	120,667
Police	963	1,489	721	557	557	1,835	3,324
Public Buildings	3,704	5,726	2,704	557	1,861	5,122	10,848
Schools - Private	877	1,356	1,172	-	1,113	2,285	3,641
Schools - Public	25,505	39,431	11,809	7,235	16,869	35,913	75,344
Total - Municipal Departments	183,166	283,175	40,217	12,246	27,493	79,956	363,131
Manchester Water Works	6,689	10,341	2,832	-	-	2,832	13,173
Municipal Fire Hydrants	-	-	-	1,482,734	-	1,482,734	1,482,734
Grand Total	\$ <u>189,855</u>	\$ <u>293,516</u>	\$ <u>43,049</u>	\$ <u>1,494,980</u>	\$ <u>27,493</u>	\$ <u>1,565,522</u>	\$ <u>1,859,038</u>

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Revenue Summary - 10 year history

	2010 Audited	2011 Audited	2012 Audited	FY 2013* Audited	FY 2014 Audited	FY 2015 Audited	FY 2016 Audited	FY 2017 Audited	FY 2018 Audited	FY 2019 Audited
Water use:										
Residential - Manchester	\$ 3,277,865	\$ 2,945,504	\$ 3,059,389	\$ 1,370,954	\$ 2,959,890	\$ 3,235,277	\$ 3,471,839	\$ 3,368,171	\$ 3,426,923	\$ 3,356,833
Residential - Towns	572,492	516,732	538,491	245,622	537,544	608,504	662,967	658,282	651,981	638,446
Commercial - Manchester	2,939,313	2,758,666	2,792,103	1,328,366	2,794,899	2,961,946	3,031,020	3,101,074	3,202,829	3,297,066
Commercial - Towns	1,062,976	956,000	1,027,157	462,782	1,054,080	1,178,888	1,231,236	1,236,834	1,206,627	1,245,534
Industrial - Manchester	210,694	175,236	204,629	90,546	186,440	205,197	201,504	284,075	218,180	223,441
Industrial - Towns	269,189	267,830	266,200	129,926	248,211	266,994	251,406	262,423	261,052	334,696
Wholesale	1,318,038	1,322,396	1,361,127	675,958	1,429,508	1,488,873	1,600,716	1,621,425	1,619,068	1,594,894
Subtotal	9,650,567	8,942,364	9,249,096	4,304,154	9,210,572	9,945,679	10,450,688	10,532,284	10,586,660	10,690,910
Service Charge:										
Residential - Manchester	1,899,628	1,890,549	1,902,325	979,154	2,009,116	2,106,875	2,118,209	2,195,325	2,260,852	2,316,096
Residential - Towns	328,280	329,997	333,115	172,028	354,372	377,525	380,757	397,202	415,606	428,181
Commercial - Manchester	593,155	588,547	590,724	302,112	616,521	646,295	652,861	665,896	679,163	692,924
Commercial - Towns	141,193	140,105	141,510	73,562	150,753	155,911	161,909	166,318	173,789	181,906
Industrial - Manchester	12,878	13,038	12,940	6,701	13,522	13,605	36,606	14,685	13,985	14,258
Industrial - Towns	4,998	5,084	5,009	2,576	5,269	5,700	5,516	6,073	5,395	5,943
Wholesale	18,108	18,108	18,045	9,235	18,931	19,452	22,795	25,059	20,475	21,359
Subtotal	2,998,240	2,985,428	3,003,668	1,545,368	3,168,484	3,325,363	3,378,653	3,470,558	3,569,265	3,660,667
Private Fire Protection	1,256,316	1,260,071	1,290,062	674,896	1,382,975	1,473,606	1,523,861	1,597,363	1,675,481	1,749,042
Municipal Fire Protection	387,172	387,037	387,711	198,897	403,947	423,467	436,250	452,457	466,014	483,135
Subtotal	1,643,488	1,647,108	1,677,773	873,793	1,786,922	1,897,073	1,960,111	2,049,820	2,141,495	2,232,177
Total	\$ 14,292,295	\$ 13,574,900	\$ 13,930,537	\$ 6,723,315	\$ 14,165,978	\$ 15,168,115	\$ 15,789,452	\$ 16,052,662	\$ 16,297,420	\$ 16,583,754

* 2009-2012 shown in calendar year. FY 2013 is for the six months ended June 30, 2013. FY 2014-2019 are July 1 through June 30.

**Manchester Water Works
148th Annual Report
2019**

Salaries and Wages and Ten Largest Operating and Maintenance Costs - 10 year history

	2010 Audited	2011 Audited	2012 Audited	FY 2013* Audited	FY 2014 Audited	FY 2015 Audited	FY 2016 Audited	FY 2017 Audited	FY 2018 Audited	FY 2019 Audited
Total salaries and wages	\$ 4,725,338	\$ 4,814,624	\$ 4,844,212	\$ 2,245,517	\$ 4,344,839	\$ 4,411,056	\$ 4,352,604	\$ 4,434,123	\$ 4,357,972	4,735,158
% increase over prior year	1.39%	1.89%	0.61%	-53.65%	93.49%	1.52%	-1.33%	1.87%	-1.72%	8.66%
Contributory retirement	854,213	891,958	918,847	474,965	979,062	1,065,906	1,003,827	1,127,855	1,144,828	1,367,921
Net pension liability expense	-	-	-	-	-	148,467	692,015	665,321	580,747	1,138,707
Health insurance	973,686	1,085,091	1,053,908	555,456	1,041,243	994,913	957,408	1,113,697	1,065,350	1,059,850
Chemicals	1,024,003	923,503	911,958	439,416	915,069	735,295	695,061	698,929	779,935	988,026
Repairs and maintenance - distribution	415,014	273,474	243,891	152,932	334,383	417,825	699,669	450,434	603,837	709,828
Purchased power - treatment	741,573	652,268	666,787	252,636	615,797	674,828	680,305	738,313	687,222	676,662
Property taxes	883,934	946,670	843,427	395,313	918,933	583,909	523,101	486,666	436,488	420,529
FICA/Medicare	359,471	365,071	367,318	185,155	361,719	393,651	351,086	356,080	361,639	385,224
Purchased power - pumping	348,242	311,695	308,706	123,638	286,211	307,674	332,775	336,695	332,509	324,696
Data processing	-	-	-	61,294	-	-	-	-	-	228,235
Insurance	139,359	159,472	141,544	-	147,673	-	277,331	-	300,479	-
Professional fees	96,729	-	-	-	-	-	-	-	-	-
Vehicle fuel	-	135,629	123,064	-	-	-	-	-	-	-
Repairs and maintenance - treatment	-	-	-	-	177,076	144,723	-	234,705	-	-
Employee benefits - other	-	-	-	169,155	-	-	-	-	-	-
Total	\$ 5,836,224	\$ 5,744,831	\$ 5,579,450	\$ 2,809,960	\$ 5,777,166	\$ 5,467,191	\$ 6,212,578	\$ 6,208,695	\$ 6,293,034	\$ 7,299,678
% of total	82.91%	83.69%	83.09%	83.32%	82.47%	79.76%	80.83%	81.36%	81.11%	83.00%
All other operating and maintenance costs	1,203,342	1,119,381	1,135,738	562,540	1,228,379	1,387,493	1,473,176	1,422,594	1,465,905	1,494,986
% of total	17.09%	16.31%	16.91%	16.68%	17.53%	20.24%	19.17%	18.64%	18.89%	17.00%
Total operating and maintenance	\$ 7,039,566	\$ 6,864,212	\$ 6,715,188	\$ 3,372,500	\$ 7,005,545	\$ 6,854,684	\$ 7,685,754	\$ 7,631,289	\$ 7,758,939	\$ 8,794,664

* 2010-2012 shown in calendar year. FY 2013 is for the six months ended June 30, 2013. FY 2014-2020 are July 1 through June 30.