

2019 ANNUAL REPORT OF
WATER USE,
WATER DIVERSION AND
RETURN FLOW
FOR THE CITY OF
NEW BERLIN, WISCONSIN

CITY OF NEW BERLIN
WAUKESHA COUNTY, WISCONSIN
MARCH 2020



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2019 ANNUAL REPORT OF WATER USE, WATER DIVERSION AND RETURN FLOW FOR THE CITY OF NEW BERLIN, WISCONSIN

INTRODUCTION

The information contained in this document provides the needed data and related explanations of the data required to satisfy the conditions of the WATER SUPPLY SERVICE AREA PLAN AND DIVERSION APPROVAL issued by the Wisconsin Department of Natural Resources (DNR) dated May 21, 2009. In particular, the data and explanations report the following information for calendar year 2019 for the City of New Berlin (CITY):

1. The total amount of water purchased from Milwaukee on a monthly basis. Note: All water used by New Berlin Utility customers is purchased from the City of Milwaukee. **ALL City of New Berlin Wells are out of service.**
2. The amount of water sold to each category and the subcategory of customer on a quarterly basis within the City limits.
3. The amount of water sold to each category and the subcategory of customer on a quarterly basis within the approved diversion area.
4. Average residential per capita use.
5. There is currently NO water pumped from City of New Berlin wells. All wells are out of service.
6. Average residential per capita use.
7. A description of the efforts made by the City to improve water conservation and efficiency and minimize the infiltration and inflow into the sanitary system.
8. Estimates of the total monthly sewerage flow within the City.
9. Estimates of the monthly sewerage return flow from within the approved water supply service area and approved diversion area.

The information is presented in 9 sections with titles identical to those above. Data is presented in a tabular format preceded by explanation of each table, how the data was obtained and how the data was interpreted using estimating techniques, engineering judgment and data analysis. Table titles first contain the section number they refer to then the number of the table.

SECTION 1 - THE TOTAL AMOUNT OF WATER PURCHASED FROM THE CITY OF MILWAUKEE

The City of Milwaukee provides all of the water used by the CITY. In 2009, the CITY still used groundwater until July for some of their water needs. In July 2009, the improvements needed to allow the entire CITY to be served with Lake Michigan water via the City of Milwaukee were completed, thus allowing for discontinuance of groundwater supplies. These projects were completed following the Diversion Approval. All City of New Berlin groundwater wells are abandoned. (Appendix E)

Table 1-1 provides the "Total Amount of Water Purchased from the City of Milwaukee" as measured by Milwaukee and billed to the CITY. Table 1-1 contains 4 columns, the

first listing the month, the second representing the cubic feet of water purchased and the third the number of gallons purchased from the City of Milwaukee and the average daily use. All of these totals are determined by the amount of water purchased (and measured) from the City of Milwaukee Water Works. Note: Milwaukee water had an inaccurate meter in 2014.

SECTION 2 - THE AMOUNT OF WATER SOLD TO EACH CATEGORY AND SUBCATEGORY OF CUSTOMER ON A QUARTERLY BASIS WITHIN THE CITY LIMITS

The CITY records and reports all water sold in a report to the Wisconsin Public Service Commission (PSC) by customer class each year. The four customer classes are Residential, Commercial, Industrial and Public. The CITY can further break these water sales records down by geographic location east and west of the sub continental divide and by residential units comprised of condominiums and apartments that are tracked as commercial establishments. Table 2-1 provides a breakdown of these water sales on a quarterly basis for the entire City and by the standard PSC customer classes and the subcategories tracked by the CITY.

SECTION 3 - THE AMOUNT OF WATER SOLD TO EACH CATEGORY AND SUBCATEGORY OF CUSTOMER ON A QUARTERLY BASIS WITHIN THE APPROVED DIVERSION AREA

Table 3-1 reports only water used in the Mississippi river basin on a quarterly basis and also provides a breakdown of residential use by condominiums and apartments in the Mississippi Basin.

SECTION 4 - THE AMOUNT OF WATER DIVERTED TO THE APPROVED DIVERSION AREA ON A MONTHLY BASIS (TO BE ESTIMATED BY THE CITY)

Table 4-1 provides the estimates of the diversion amounts. The estimates are based upon actual percentages of total water use determined by applying an average factor of 57.3 percent groundwater pumpage and 42.7 percent Lake Michigan water usage in 2009. This approximates the water use patterns where the groundwater pumpage was Mississippi River basin pumpage and the Lake Michigan pumping stations was Great Lakes basin pumpage. For the year, the total usage was multiplied by .573 to estimate the diverted amount. The CITY previously maximized the area where Lake Michigan Water was provided to customers so this method provides a reliable estimate of diverted water pumpage.

SECTION 5 - THE AMOUNT OF WATER PUMPED FROM EACH MUNICIPAL WELL WITHIN THE CITY LIMITS ON A QUARTERLY BASIS, NOTING THE BASIN IN WHICH EACH WELL IS LOCATED

Table 5-1 provides a list of all City of New Berlin wells were disconnected in 2009 per the DNR after the diversion request was approved. All City of New Berlin groundwater wells have been abandoned. (Appendix E)

SECTION 6 – AVERAGE RESIDENTIAL PER CAPITA USE

Table 6-1 provides a calculation of average residential per capita use. That calculation shows residential per capita use to be 50.85 gallons per capita per day City wide. The calculation takes into account single family residential, condominium residential, and apartment residential and also breaks the information down by basin. The per capita residency occupation rate of 2.62 in 2019 is from the MMSD Operating Manual. The calculation method used in Table 6-1 to determine the population served by the water system has been added at the bottom of the page. Information from the MMSD Cost Recovery Manual is found in Appendix E.

SECTION 7 – A DESCRIPTION OF THE EFFORTS MADE BY THE CITY TO IMPROVE WATER CONSERVATION AND EFFICIENCY AND MINIMIZE INFILTRATION AND INFLOW TO THE SANITARY SEWER SYSTEM

Water Conservation

The CITY adopted a Water Conservation Plan on December 8, 2009. A copy of the plan is attached to this document in appendix A and includes the revisions made in 2013. The Plan has six distinct goals to promote water conservation.

- Reduce per capita residential water consumption from January 1, 2008 by not less than ten (10) percent by the year 2020 for utility customers as per an agreement between the City of New Berlin and the Wisconsin Department of Natural resources (WDNR).
- Enable the City to meet future needs of our growing population.
- Protect Ground and Surface water supplies from unsustainable depletion. Since acquiring Milwaukee water, the Utility was able to reduce hydrant flushing to once per year. This practice alone has saved substantial water each year (Appendix E).
- Eliminate unnecessary waste in water use practices. The Water Conservation Plan provides the necessary authority to limit lawn sprinkling on an odd/even day and time of day schedule. The dry conditions during summer in 2012 prompted a Press Release limiting water sprinkling (Appendix E). The summer of 2015 provided adequate rainfall to assist our water conservation efforts. The Utility posts information on the website, newsletter and Utility bill in an effort to educate customers in water conservation measures (Appendix E)
- Reduce wastewater treatment volume and associated municipal expenditures.

- Promote the increased use of harvested and recycled water for irrigation needs through the use of cisterns where appropriate for commercial and industrial development. The City has had a Rain Garden display at the recycling center for several years. This display includes a working rain barrel. Information on the various native plants, where to obtain rain barrels and lists of classes are included on the City's website (<http://www.newberlin.org/index.aspx?nid=422>). The Water Resources Management Utility has also used rain gardens and bioretention in several of their projects (Appendix E)

In 2017, the City of New Berlin has eliminated the Third Quarter Sewer Credit to residential customers.

Specific accomplishments include the preparation of the plan near the end of the reporting year. That plan includes a savings projected of 9.4 million gallons of water per year by not using water softeners in the diversion area and a savings of 8.7 million gallons by reducing hydrant flushing from twice per year to once per year for a total estimated annual savings of 18.1 million gallons. Hydrant flushing is performed in spring and fall. Every other hydrant is flushed in spring and the remaining ones in the fall. This ensures that each hydrant is flushed annually on a scheduled basis for maximum efficiency. The CITY also adopted sprinkling restrictions for residents to follow year round. Per capita residential water use decreased city wide from 68.03 in 2007 down to 50.85 in 2019. Adequate rainfall this summer assisted water conservation efforts. (Appendix E)

Beginning in April of 2010, the CITY has a toilet rebate program designed to provide incentives for utility customers to abandon 5 gallon per use toilets and install a water sense 1.3 gallon per flush toilets. The amount of the rebate is \$100 per toilet.

Toilet Replacements By Year			
2010	78	2015	10
2011	45	2016	7
2012	12	2017	9
2013	6	2018	6
2014	7	2019	3

The PSC approved the program to continue in 2019. (For Examples of reduced water consumption after low flow toilet installation, Appendix E)The Utility also performed 43 leak detection tests in 2019 and provides this service free of charge to utility customers. In addition, the Badger Meter RTR/Neptune meter system that we now use can verify whether a customer has a leak. This allows us to notify the customer to set up an appointment to perform a free leak inspection to help reduce the amount of water that is wasted. (Appendix E)

In 2013 the Utility began offering customers free toilet leak dye tablets available at City Hall and the Library. This continued in 2019 and will be offered in 2020. The City's website advertised the EPA's WaterSense "Fix A Leak Week" which gives tips on checking for and fixing leaks.(Appendix D)

The Utility has implemented the cross connection inspection program that was mandated by the DNR for commercial and industrial customers and has been inspecting residential customers since 2012 when meters are replaced or when answering a customer service call. In 2019 there were 579 residential inspections were conducted. (Appendix E) The Utility began documenting if customers are operating water softeners or have removed or disconnected the unit. Since March 2012 Utility personnel that perform meter pulls have documented whether softeners have been disconnected or removed from residences. They have found over 90% of softeners were not in use. (Appendix E) In 2005 and also in 2009 when Milwaukee water was delivered to Utility customers on various sides of the continental divide, letters were sent to customers that provided information regarding the changes in water, including water hardness data and encouraged customers to disconnect their softeners. (Appendix E) Based on estimates and an average softener regeneration of once a week, the average residential customer would save over 2,600 gallons per year. (Appendix E). Because of variables such as weather, occupancy rates, economic conditions and the fact that meters are read quarterly in thousand gallon increments, it is difficult to provide an actual water savings realized in 2011 through disconnection of water softeners. Hydrant flushing water usage has reduced since we began this program. (Appendix E). A 5 Year Water Use Analysis is also listed (see Appendix E).

The City of New Berlin began a member of the Alliance for Water Efficiency in 2013 and began using the AWE Tracking tool to monitor conservation efforts. The Utility teamed with the Energy Efficiency Program's Focus on Energy, sponsored by WE Energies to provide residential citizens with a no-cost energy savings program that provided high efficiency faucet aerators, showerheads, kitchen flip aerators, insulation of hot and cold water heater pipes and water heater temperature setback assistance. The results were impressive with 943 homes responding to the program for a total water savings of 5,772,429 gallons.

In 2015 Kaempfer and Associates conducted a new water study of the entire Utility area. The Utility has a 20 year project schedule to improve reliability and conservation.

The Utility repaired 7 water main breaks, repaired 2 leaking service lines, performed 5 valve replacement and repairs, and replaced 2 hydrants. During road projects the Utility removed 17 valves, replaced those 17 and added 5 new valves for added reliability, 11 hydrants and valves were replaced, 78 service lines from water main to property line, and replaced 4,825; of 6" ductile water main with 8" PVC water main.

With the completion of the conservation plan and use of the CITY web site to provide public education on the need for water conservation, New Berlin is committed to continuing to educate the public. Along with the Water Conservation Plan, Utility personnel use a "Residential Demand Management Program" to monitor high consumption, show customers the amount of water caused by leaks, and provide informational material on water conservation. (Appendix E) Many studies have shown the value of public education is an important component of water conservation efforts. The City's website contains educational information with kid's pages for water conservation activities and links to a drip calculator and other resources to provide

helpful information to utility customers. The Utility also provides classes to schools and businesses and hands out coloring books and water usage wheels to promote water conservation and information on Water Smart Landscape Designs on the website (see Appendix D)

Infiltration and Inflow (I/I)

The City has an annual I/I program that has been in place since 1997. The City spent \$175,945.00 in 2019 on I/I reduction. Table 7-1 lists the I/I reduction projects from 2009. (Appendix B) Private I & I investigation and implementation began in 2013.

Infiltration and Inflow (I/I) occurs in all sanitary sewerage systems. Infiltration refers to rainwater and groundwater that seeps into the system through defective pipes and joints. Inflow refers to storm water and surface water that enters the sewer directly. Both cause "clear water" to enter the system and increase treatment costs, cause sewer backups, bypassing and overflows.

Wastewater systems all have differing designs, construction, ages and are located in varying climates. With this in mind, there are not national standards for allowable I/I. Rather, EPA has required through the NPDES permit program that all wastewater overflows be eliminated. This requirement has prompted many sewerage systems to take active measures to reduce I/I. The MMSD is one of these.

<p>MMSD addresses I/I reduction by placing limits on peak hourly flow rates. If a metered area exceeds the limits, I/I reduction is required. The requirements for these metered areas, also called "meter sheds" as listed in the MMSD 2035 Facility Plan are:</p> <p>Sanitary Meter Shed Area (acres)</p>	<p>Maximum Allowable Peak Hourly Flow Rate (gallons per acre per day)</p>
Less than 250	18,400
250 to 499	17,700
500 to 999	16,400
1,000 to 2,499	13,700
2,500 to 4,999	9,400
Greater than 5,000	4,000

Based upon the MMSD Facility Plan sewer flows for New Berlin, all areas of the City are currently in compliance with the above limits.

The City of New Berlin annually contracts with a consultant to monitor sewer flows during wet periods and prepare a report quantifying I/I. Preliminary results of the 2009

flow monitoring plan and analysis of flows by the city's consultant and 2010-2019 results are provided in Appendix C.

Precise quantification of I/I is impossible with today's technology. Area and velocity flow meters are used annually by the City to derive estimates of I/I by basin and sub-basin. These meters replace older style "level only" meters and are considered to be more accurate. Still, the environment in which they are placed has flooding, toxic gases, high levels of solids and other impairments which readily affect the meters performance. Data that is collected must be collated and suspect data discarded. The remaining reliable data is then professionally analyzed and reasonable professional estimates of I/I can then be made. This is the program used by New Berlin.

The most current estimates of I/I by the City's consultant indicate that total average daily sewer flows are 6.63 MGD. The attached email correspondence from the City and R.A. Smith indicates how they arrived at this figure. Using basin monitors this flow can be divided into flow east and west of the sub continental divide. This was determined by using all of the flow from basins 5 and 6 (Meter 5A) and 50 percent of the flow from basin 7 (Meter 7B). Based upon 2015 metered water use and estimates of sewerage flow the following average daily flows and I/I estimates can be derived:

These are the most current and accurate estimates of I/I available for the City of New Berlin. These volumes change regularly and there will be differing estimates each year depending on a number of factors including groundwater levels and precipitation amounts and severity of precipitation events.

The City has spent over \$20 million since 1997 on I/I reduction efforts. This includes all capital projects for manhole rehabilitation, studies and sanitary sewer replacement or relining. They received only 1 of 2 awards given by MMSD for their I/I reduction efforts in 2003. Listings of past projects are attached. Future projects will focus on higher I/I areas as identified by annual studies.

New Berlin continues to allocate money for I/I reduction. This places them well ahead of many larger and older communities with more I/I.

It is important to realize that the I/I will occur and transmit some quantity of water across the basin divide. It is more important to realize that approval of the diversion has eliminated about 2.0 MGD of pumped water from outside the basin flowing into the basin on a daily basis. This, coupled with the strong commitment to reducing I/I by New Berlin, as evidenced above, absolutely minimizes the amount of water entering the basin from outside the basin.

Going forward, New Berlin proposes to monitor the amount of water used inside and outside the basin by customer water meter. Further, they propose to continue with the annual I/I quantification studies and will use the results of those studies to estimate I/I on both sides of the divide. This information will be available on an annual basis for the previous year.

SECTION 8 – ESTIMATES OF TOTAL MONTHLY SEWERAGE FLOW WITHIN THE CITY

Appendix C contains excerpts from an email provided by R.A. Smith to the City on Sewerage flows. These estimates were developed based upon metering performed by that firm and by MMSD during 2011-2019.

SECTION 9 – ESTIMATES OF THE MONTHLY SEWERAGE RETURN FLOW FROM WITHIN THE APPROVED WATER SUPPLY SERVICE AREA AND DIVERSION AREA

Table 9-1 provided by R.A. Smith estimated flows both in the Great Lakes basin and Mississippi basin. The estimates assume all of basin 5 and 6 and 50 percent of basin 7 provide sewerage flows from the Mississippi Basin, and the remaining flow is from the Great Lakes Basin.

Table 1-1

**Total Amount of Water Purchased From the City of Milwaukee
Annual Report of Water Use, Water Diversion and Return Flow - 2019
City of New Berlin, Wisconsin**

Month	Cubic Feet	Monthly Total Amount of Water Purchased From The City of Milwaukee	Average Daily Usage (SCADA)
January	104,881	78,456,442	2,530,853
February	86,976	65,062,571	2,323,663
March	90,946	68,032,337	2,194,592
April	98,869	73,959,153	2,465,305
May	97,837	73,187,164	2,360,876
June	95,153	71,179,392	2,372,646
July	124,994	93,502,012	3,016,194
August	112,322	84,022,697	2,710,410
September	104,525	78,190,135	2,606,338
October	96,999	72,560,296	2,340,655
November	84,163	62,958,309	2,098,610
December	102,605	76,753,875	2,475,931
Total Annual Pumpage	1,200,270	897,864,383	29,496,073

Source: City of Milwaukee, Wisconsin Public Service Commission, and SCADA

Note: ALL of water used by the City of New Berlin Utility customers was purchased from the City of Milwaukee. New Berlin wells are no longer in service

Average: 2.460 million gallons per day
74,822,031 gallons per month

Highest Day: July 15, 2019 4,432,000

Lowest Day: March 21, 2019 1,195,000

Table 2-1

Amount of Water Sold to Each Category and Subcategory of Customer on a Quarterly Basis Within the City Limits 2019
Annual Report of Water Use, Water Diversion and Return Flow - 2019
City of New Berlin, Wisconsin

	Major Category (Gallons Sold in Thousands)				
	Residential	Commercial	Industrial	Public	Total
1st Quarter 2019	97,002	73,892	16,341	1,642	188,877
2nd Quarter 2019	86,388	70,860	18,122	1,915	177,285
3rd Quarter 2019	120,002	86,393	18,303	1,904	226,602
4th Quarter 2019	94,621	80,637	18,376	2,183	195,817
Total	398,013	311,782	71,142	7,644	788,581

	Residential Subcategory (Gallons Sold in Thousands)		
	Great Lakes Basin	Mississippi Basin	Totals
1st Quarter 2019	64,489	32,513	97,002
2nd Quarter 2019	56,969	29,419	86,388
3rd Quarter 2019	80,791	39,211	120,002
4th Quarter 2019	62,939	31,682	94,621
Total	265,188	132,825	398,013

	Condominium and Apartment Subcategory of Commercial Category (Gallons Sold in Thousands)		
	Great Lakes Basin	Mississippi Basin	Totals
1st Quarter 2019	16,396	20,805	37,201
2nd Quarter 2019	14,744	19,747	34,491
3rd Quarter 2019	16,469	23,246	39,715
4th Quarter 2019	15,945	21,576	37,521
Total	63,554	85,374	148,928

Source: City of New Berlin, Wisconsin

Table 3-1

**Amount of Water Sold to Each Category and Subcategory of Customer on a Quarterly Basis Within the Approved Diversion Area
2019**

Annual Report of Water Use, Water Diversion and Return Flow - 2019

City of New Berlin, Wisconsin

	Major Category Mississippi Basin (Gallons Sold in Thousands)				
	Residential	Commercial	Industrial	Public	Total
1st Quarter 2019	32,513	50,388	14,610	1,106	98,617
2nd Quarter 2019	29,419	49,203	16,394	1,229	96,245
3rd Quarter 2019	39,211	59,046	16,030	1,434	115,721
4th Quarter 2019	31,682	56,004	16,387	1,444	105,517
Total	132,825	214,641	63,421	5,213	416,100

Condominium and Apartment Subcategory of Commercial (Gallons Sold in Thousands)	
	Mississippi Basin
1st Quarter 2019	20,805
2nd Quarter 2019	19,747
3rd Quarter 2019	23,246
4th Quarter 2019	21,576
Total	85,374

Source: City of New Berlin, Wisconsin

Table 4-1

Amount of Water Diverted to the Approved Diversion Area on a Monthly Basis

Annual Report of Water Use, Water Diversion and Return Flow - 2019

City of New Berlin, Wisconsin

Month	Estimated Amount Diverted in Gallons
January	44,955,541
February	37,280,853
March	38,982,529
April	42,378,595
May	41,936,245
June	40,785,792
July	53,576,653
August	48,145,005
September	44,802,947
October	41,577,050
November	36,075,006
December	43,979,970
Total	514,476,186

Source: City of New Berlin, Wisconsin and Ruckert & Mielke, inc.

Table 5-1

All water provided to City of New Berlin Utility customers are serviced by City of Milwaukee water.

There are NO New Berlin ground water wells in service.

We have abandoned wells 1, 2, 3, 4, 5, 7, 8, 9, 10 and 11

All wells were disconnected when we received permission for our diversion request and all water is provided by Milwaukee Water.

Table 6-1

**Average Residential Per Capita Use
Annual Report of Water Use, Water Diversion and Return Flow - 2019
City of New Berlin, Wisconsin**

		2019 Quarter (Use in Thousands)				Total	Population	Average Residential Per capita Use in Gallons per Day
Basin	Cust Class	1st Cons	2nd Cons	3rd Cons	4th Cons			
Great Lakes	C-CONDO/APT	16,396	14,744	16,469	15,945	63,554	3,511	
Great Lakes	R Residential	64,489	56,969	80,791	62,939	265,188	13,586	
	TOTALS					328,742	17,097	52.68
Mississippi	C-CONDO/APT	20,805	19,747	23,246	21,576	85,374	4,797	
Mississippi	R Residential	32,513	29,419	39,211	31,682	132,825	7,571	
	TOTALS					218,199	12,368	48.33
Combined City Wide Residential Per Capita Water Use						546,941	29,466	50.85

Source: City of New Berlin, Milwaukee Metropolitan Sewerage District

Calculations: We took the average number of residential connections and multiplied it by the occupancy factor. Then, we broke down the number of bedrooms and multiplied that by the appropriate occupancy factor and finally added the number of condos multiplied by their occupancy factors. We took the occupancy factors out of MMSD's Cost Recovery Manual. The calculation is complicated by two factors; 1) a significant portion of the city is not served by municipal water and 2) the PSC & DNR have different classification methods for residential customers specific to condo and apartment units. (See Table 6-1, P.2)

Table 6-1, P.2

2019 Connections

Basin	Customer Class	Q1	Q2	Q3	Q4	Average	Occupancy Factor	Population
		Count	Count	Count	Count			
MILW	C-CONDO/APT	173	173	173	173			
MILW	R Residential	5176	5178	5191	5197	5,186	2.62	13,586
MISB	C-CONDO/APT	817	817	817	817			
MISB	R Residential	2875	2883	2896	2905	2,890	2.62	7,571

2019 Condo/Apartment Population Calculation

Basin	Bedroom	Units	Factor	Population	Total	
MILW	Apartment	1	458	1.50	687	3,511
MILW	Apartment	2	937	2.50	2,343	
MILW	Apartment	3	79	2.62	207	
MILW	Condo		110	2.50	275	
MISB	Apartment	1	398	1.50	597	4,797
MISB	Apartment	2	897	2.50	2,243	
MISB	Apartment	3	21	2.62	55	
MISB	Condo		761	2.50	1,903	

29,466

Factors are from MMSD Cost Recovery Manual

Table 7-1

**Water Conservation Efforts and I/I Reduction Efforts
Annual Report of Water Use, Water Diversion and Return Flow - 2019
City of New Berlin, Wisconsin**

Year	Project Title	Work Involved	Project Expenditures
2009	Glendale Road	Sewer Rehabilitation, Relining and Manhole Repairs to Reduce I/I	\$711,000.00
2009	Deer Creek Interceptor	Sewer Rehabilitation, Relining and Manhole Repairs to Reduce I/I	\$247,945.00
2010	Various Areas	Sewer Rehabilitation, Relining and Manhole Repairs to Reduce I/I	\$352,785.00
2011	Greenridge/various	Sewer Rehabilitation, Relining and Manhole Repairs to Reduce I/I	\$283,000.00
2012	124th & Greenfield	Relay Section of sewer main, Relining and Manhole Repairs to Reduce I/I	\$73,000.00
2013	Various Areas	Dye Testing/Leak Inspection for PPI/I	\$460,000.00
2013	Citywide	Manhole Grouting (areas identified from dye testing results)	\$2,400.00
2013	Citywide	Manhole Grouting (areas identified from dye testing results)	\$36,056.00
2014	Citywide	Grant Work	\$5,000.00
2015	Citywide	Manhole Grouting	\$15,212.00
2015	Calhoun Road	Boot Installation	\$846.00
2015	Various Areas	Dye Testing/Leak inspection for PPI/I	\$233,258.00
2016	Citywide	Manhole & Lateral Grouting	\$13,740.00
2016	Citywide	Boot Installation	\$24,586.00
2016	Citywide	Manhole Lid Replacement	\$10,287.00
2017	Hearthridge Drive	Sewer Relining	\$24,890.00
2017	124th & Cleveland	Sewer Obstruction Removal & Lining	\$22,523.00
2018	Citywide	Manhole Grouting	\$4,000.00
2018	Rogers Drive	Sectional Relining	\$21,400.00
2018	124th & Howard	Sanitary Frame Replacement	\$7,500.00
2018	Linnie Lac Lift Station	MH Deck Replacement	\$7,500.00
2018		PPI/I Program Lateral Lining	\$937,419.35
2019	Moorland Rd	Sewer Relining	\$78,979.00
2019	124th Cleveland	Sewer Relining	\$16,165.00
2019	Citywide	Manhole Grouting	\$48,500.00
2019	Citywide	Grant Work	\$32,301.00
	Total		\$3,670,292.35

Source: City of New Berlin Utility Department

Table 8- 1 & 9-1

**Estimates of the Monthly sewerage return Flow From Within the Approved Water Supply
Service Area and approved Diversion Area
Annual Report of Water Use, Water Diversion and Return Flow - 2019
City of New Berlin, Wisconsin**

Basin	Average Daily Flow (MGD)	Monthly (30-Day Flow Gallons)	Annual Flow (Gallons)
Great Lakes Basin	4.29	128,700,000	1,565,850,000
Mississippi River Basin	2.34	70,200,000	854,100,000
Total	6.630	198,900,000	2,419,950,000

Source:

R.A. Smith and Milwaukee Metropolitan Sewerage District

2019 RA Smith Report

See below for the flows across the divide. The average daily flow for the Great Lakes Basin has increased by about 24% from the 2018 value (3.24 MGD). The average daily flow for the Mississippi River Basin has decreased by about 4% from the 2018 value (2.43 MGD) . The table is what needs to be submitted, but feel free to review the rest of the information, which we've always just used to justify the data we present.

Below is Table 9-1, which has been used in past reporting by the City, which estimates the monthly sewage return flow across the divide. As in past years, I've also included the methodology used to arrive at the numbers below for your reference later in this email.

Basin	Average Daily Flow (MGD)	Monthly (30-Day Flow Gallons)	Annual Flow (Gallons)
Great Lakes Basin	4.29	128,700,000	1,565,850,000
Mississippi River Basin	2.34	70,200,000	854,100,000
Total	6.63	198,900,000	2,419,950,000

Here is the formula and information for first calculating the total sewer flows and then once again across the divide...

The following information is a summary of metered information from the MMSD, City-wide flow monitoring, and lift station pumping data. The information below gives a conservative estimate of the flows from the City to MMSD in 2019.

Because MMSD has only two meters monitoring flows from the City, we needed to rely more heavily on Utility-Owned meters to estimate the flows below. The following are the average flows for the City during 2019.

MMSD Meter DC0306 (This is an area-velocity meter similar to what the utility uses. I trust the accuracy of this data. The average flow below is from March 2019 through October 2019.)

(New Berlin Basins 1, 4, 5, and 6) = 2.47 MGD (2.812 MGD in 2009, 2.766 in 2010, 2.430 in 2011, 2.292 in 2012, 2.479 in 2013, 2.00 in 2014, 1.66 in 2015, 2.05 in 2016, 2.21 in 2017 and 2.06 in 2018)

MMSD Meter MS0213 (This is an area-velocity meter similar to what the utility uses. I trust the accuracy of this data. The average flow below is from March 2019 through November 2019.)

(New Berlin Basin 9) = 1.23 MGD (0.403 MGD in 2009, 0.452 in 2010, 0.369 in 2011, 0.65 in 2012, 0.982 in 2013, 0.474 in 2014, 0.967 in 2015, 1.17 in 2016, 1.04 in 2017 and 1.07 in 2018)

(New Berlin Basin 2, utility owned meter 2002-A) = 0.158 MGD (0.084 MGD in 2013, .095 in 2014, 0.141 in 2015, .075 in 2016, 0.146 in 2017 and 0.14 in 2018)

2019 RA Smith Report

(New Berlin Basin 3, utility owned meters 2003-B and 2003-C) = 0.749 MGD (0.503 in 2009, 0.551 in 2014, 0.327 in 2015, 0.41 in 2016, 0.45 in 2017 and 0.49 in 2018)

(New Berlin Basins 7 and 10, utility owned meters 2007-B and 2010-A) = 2.01 MGD (2.292 MGD in 2009, 2.530 in 2010, 2.083 in 2011, 1.420 in 2012, 2.527 in 2013, 1.834 in 2014, 1.55 in 2016, 1.88 in 2017 and 1.89 in 2018)

(New Berlin Basin 8, utility owned meter 2008-C and lift station 6) = 0.016 MGD (0.041 MGD in 2015, 0.058 in 2016, 0.026 in 2017 and 0.02 in 2018)

Total 2019 Average Daily Flow = 6.63 MGD → * 365 = 2.42 Billion Gallons
(about a 16.9% increase from 2018 numbers and about a 15.2% increase from 2017 numbers)

Total 2018 Average Daily Flow = 5.67 MGD → * 365 = 2.07 Billion Gallons
(about a 1.4% decrease from 2017 numbers and about a 6.78% increase from 2016 numbers)

Total 2017 Average Daily Flow = 5.75 MGD → * 365 = 2.10 Billion Gallons
(about a 8% increase from 2016 numbers and about a 16.2% increase from 2015 numbers)

Total 2016 Average Daily Flow = 5.31 MGD → * 365 = 1.94 Billion Gallons
(about a 8.6% increase from 2015 numbers and about a 6.9% increase from 2014 numbers)

Total 2015 Average Daily Flow = 4.89 MGD → * 365 = 1.785 Billion Gallons
(about a 1.5% decrease from 2014 numbers and about a 25.75% decrease from 2013 numbers)

Total 2014 Average Daily Flow = 4.966 MGD → * 365 = 1.813 Billion Gallons
(about a 25% decrease from 2013 numbers and about a 2% increase from 2012 numbers)

Total 2013 Average Daily Flow = 6.586 MGD → * 365 = 2.404 Billion Gallons
(about a 35% increase from 2012 numbers)

Total 2012 Average Daily Flow = 4.874 MGD → * 365 = 1.780 Billion Gallons
(about a 10% decrease from 2011 numbers)

Total 2011 Average Daily Flow = 5.397 MGD → * 365 = 1.970 Billion Gallons

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(about a 10% decrease from 2010 numbers)

Total 2010 Average Daily Flow = 5.979 MGD → $5.979 * 365 = 2.182$ Billion Gallons
(about a 1% decrease from 2009 numbers)

Total 2009 Average Daily Flow = 6.025 MGD → $6.025 * 365 = 2.199$ Billion Gallons
(about a 10% increase from 2006 numbers)

Since the above indicates total flow from the City, we need to estimate what it is on each side of the divide... here is how we do it...

One MMSD meter measured flows from all of New Berlin Basins 1, 4, 5, and 6. Since we only wanted the flows from 5 and 6, I subtracted the flows recorded for 1 and 4 from the flow monitoring data that we have been collecting for the City every year. The result should give us a good idea of what flows basins 5 and 6 are contributing.

- MMSD Meter DC0306 = 2.47 MGD
 - New Berlin Flow Meter Basin 1 (utility meter 3001-G, 0.77 MGD) and Basin 4 (utility meter 3001-A, 0.336 MGD)
 - Resultant Basin 5 and 6 flows = 1.364 MGD

Assuming that half of flow from Basin 7 and 10 is pumped over the sub-divide line we get:

- New Berlin Basins 7 and 10 (utility owned meters 2007-B and 2010-A) = $2.01 \text{ MGD} / 2 = \underline{1.005}$ MGD

Add Basin 8 (utility owned meter 2008-C and lift station 6), and the above two together and we get our number → $1.364 + 1.005 + 0.016 = \underline{2.34}$ MGD

Thanks and let me know if you have any questions.

Ben G. High, P.E.

Project Manager

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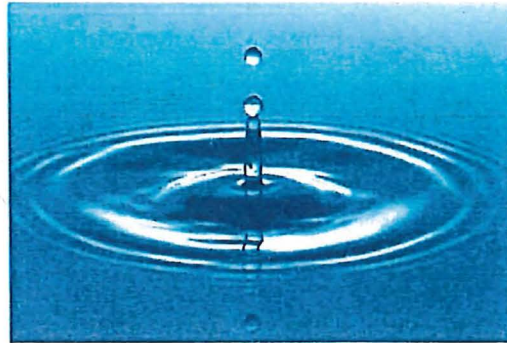
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Appendix A

Water Conservation Plan

City of New Berlin Water Conservation Plan



Adopted by the New Berlin Common Council on 12/8/09

Updated February 2019

WATER CONSERVATION PLAN MISSION STATEMENT

To promote water conservation and protection measures throughout the City of New Berlin to ensure a viable and healthy water supply for future generations.

Goals:

- Reduce overall water consumption.
- Enact water protection / conservation ordinances and codes.
- Protect wellhead recharge areas.
- Provide incentives for water conservation.
- Promote 3-Dimensional (groundwater, stormwater and surface-water) water management.
- Implement good stormwater Best Management Practices ("BMPs") that enhance recharge areas.

INTRODUCTION

This document presents the City of New Berlin's ("City") Water Conservation Plan. Over the years, the City, as well as the Southeastern Wisconsin Regional Planning Commission (SEWRPC) have conducted a number of water supply studies. All of these studies are referenced in one form or another throughout this document.

New Berlin is uniquely positioned within southeast Wisconsin as it straddles the "Sub-Continental Divide", which runs north-south through the eastern part of the City. Nearly 27 square miles in the western part of the City, or about 73 percent of the City's total land area, is located in the Fox River Watershed. This portion is west of the Sub-Continental Divide and part of the Mississippi River Watershed. The remaining City land area is tributary to the Great Lakes / St. Lawrence River drainage basin.

The Utility Service Area is supplied with water from Lake Michigan which is purchased from the Milwaukee Water Works. In this portion of the City wastewater is returned to Lake Michigan via the Milwaukee Metropolitan Sewerage District sewer system. The western portions of the City, outside of the Utility Service Area, use groundwater / private wells as their water supply source.

New Berlin is located within Waukesha County, one of the fastest growing counties within the southeast Wisconsin region. The County's population in 2005 was 377,348. New Berlin is the sixth largest city in terms of land area in the state and the third most populated municipality in the County with a 2005 population of 38,969. Population trends for New Berlin indicate an approximate two to three percent increase in five year increments out to 2020. At that point in time, the estimated New Berlin population is expected to be 42,228. The City has experienced steady, moderate growth over the past 20 years.

City of New Berlin Water Conservation Plan

There are three City entities that are involved with water conservation and water resource protection; they include the Water Utility, Department of Community Development (DCD) and the Water Resources Management Utility (a division of DCD).

The Mission of the Water Utility is to be the responsible custodian for and to provide a good quality, potable water supply at adequate pressures and in sufficient quantity for consumption and fire protection purposes, to all current and future Utility customers consistent with State/Federal Regulations and water industry practices and standards, in the most cost effective manner possible, and to educate the public about the benefits of being a good water use steward.

The Department of Community Development promotes and maintains the careful development of land, and preservation of the natural resources in the City of New Berlin. To accomplish this, the Department is involved in both current and long-range land use planning, engineering, building and capital improvement planning. This Department regulates every aspect of the development/construction process. DCD reviews, documents, permits, regulates and inspects all development/construction activity in the city. These efforts include reviewing and documenting development, economic development, geographic information systems (GIS)/land information systems (LIS), zoning enforcement, building inspection, construction/field inspections for new development, capital planning, mapping and in-house capital project design. It also includes the dissemination of this information to the public, working and coordinating with county, regional, state, and federal officials.

The long-term vision of the Water Resources Management Utility is to "promote a three-dimensional approach to efficiently and effectively manage storm water and to protect the water resource needs of the City of New Berlin". The Utility's Mission is dedicated to the management, construction, maintenance, protections, control, regulation, use, and enhancement of storm & surface water systems, flood protection, water quality, and groundwater recharge through education, coordination, development, maintenance and management of projects & programs in concert with other community development programming in an efficient and cost effective manner that considers the needs for protection of public health, private property, the natural environment, and economic development.

PURPOSE OF THE PLAN

The City has developed a Water Conservation Plan in order to be good stewards of a finite resource. Its loss can impact the quality of life for residents and dramatically affect policy decisions. In order to maintain quality of life and economic activity, a sustainable water supply is needed. To be good stewards, the City should conserve water by working closely with all residents and businesses to promote water conservation, and work with other governmental jurisdictions in the region to effectively manage water resources.

City of New Berlin Water Conservation Plan

To this end, the City views water resource management three-dimensionally. That is the protection & management of our groundwater, surface water and storm water through various means and methods. The City has set the following Plan goals to promote water conservation:

- ⇒ Reduce per capita residential water consumption from January 1, 2008 by not less than ten (10) percent by the Year 2020 for Utility customers as per an agreement between the City of New Berlin and the Wisconsin Department of Natural Resources (WDNR)
- ⇒ Enable the City to meet future needs of our growing population
- ⇒ Protect ground and surface water supplies from unsustainable depletion
- ⇒ Eliminate unnecessary waste in water use practices
- ⇒ Reduce wastewater treatment volume and associated municipal expenditures
- ⇒ Promote the increased use of harvested and recycled water for irrigation needs through the use of cisterns where appropriate for commercial and industrial development

Much of this Plan was developed by referencing the numerous water studies and current, relevant industry materials that are available. According to our Department's records, twenty-two (22) studies at a cost of over \$500,000 have been conducted analyzing and studying water issues in New Berlin. This does not include the current ongoing work related to the redevelopment of the New Valley Sand & Gravel quarry site (Mill Valley Business Park). There will be a geo-technical component to that report. A comprehensive list of recent water studies conducted for New Berlin can be found in Appendix A.

WATER UTILITY ACCOMPLISHMENTS

The Water Utility has worked hard to reduce water usage to help conserve a very valuable resource. We have in place an odd-even sprinkling schedule citywide to reduce water usage to lawns and gardens. In addition, we have a program in place whereby we change out water meters on a 10-year cycle instead of the 20-year program that the Public Service Commission requires. Changing the meters on a 10-year cycle ensures more accurate water consumption usage totals. Now that water utility customers are supplied with Milwaukee Water throughout the entire service area, the Water Utility will see reductions in water usage as follows:

1. 90% of all customers will NOT USE water softeners
 - ⇒ 180 gallons of water passes through every time the softener runs
 - ⇒ 9.4 million gallons of water will be saved by not using softeners
2. 8.7 million gallons will be saved annually due to the reduction of hydrant flushing from twice per year to once per year.

City of New Berlin Water Conservation Plan

A total of 18.1 million gallons of water will be saved annually with just these two changes. Since 2006, the Utility has seen a decrease in the total water usage by approximately 21%.

CURRENT REGULATIONS AND ACTIVITIES

Current development standards, regulations and activities are already being implemented within in the City. The goal of this plan is to expand on the current City actions and implement additional water conservation strategies. Below is a list of current City initiatives:

- ⇒ Codes/ordinances – numerous City regulations are in place to protect water quality and quantity. These ordinances follow DNR requirements for storm water management.
- ⇒ Sprinkling restrictions – the Utility Department has enacted sprinkling restrictions for residents to follow year-round. The restrictions are as follows: even numbered addresses water on even days of each month and odd numbered addresses water on odd days of each month.
- ⇒ Utility activities – the Utility Department utilizes the City webpage to provide information to residents. The webpage includes information on water conservation, kids activities to learn more about water, a water drip calculator and sprinkling restrictions. The Utility Department has also placed informational articles in the City's "Leaflet" quarterly newsletter, and has included conservation techniques in the City's Annual Water Quality Report. The department also offers free "leak test" for customers to have their toilets or water softeners tested for leaks. New meters that are currently being installed have a "leak detection" feature on them for residential and industrial usages.
- ⇒ Development/land use regulations – The Department of Community Development encourages Low Impact Development (LID) techniques when reviewing projects. The Zoning Code has minimum open space requirements to limit the amount of impervious surface on development sites. Alternative stormwater Best Management Practices ("BMPs") that use vegetation to naturally infiltrate the ground is also encouraged.
- ⇒ Wellhead protection – the City also has a Wellhead Protection Area in the southeast portion of the City. This area is important to groundwater recharge and regulations are in place to protect the groundwater in this area.
- ⇒ 3-D Storm water regulations (groundwater, surface water and storm water) – the City's ordinances and codes are in place to protect the City's water resources. The regulations work to promote protection of groundwater, surface water and storm water. The DNR regulates many activities surrounding these resources and the City's regulations adhere to the DNR requirements. Currently the City has a storm water management ordinance (Ord. #2193) to set storm water management requirements, an erosion control ordinance (Ord. #2268) to prevent erosion from construction sites and a post-construction storm water management ordinance (Ord. #2267) to prevent erosion for the long-term after construction.

City of New Berlin Water Conservation Plan

The City also has an illicit discharge ordinance to prevent and remedy any illegal discharges to the storm drain system.

- ⇒ Public awareness/education – Aside from the Utility Department's activities, the City utilizes the website, "Leaflet" newsletter and mailing inserts to promote water conservation and protection. The Water Resources Management Utility (WRM) has partnered with a number of other communities from Kenosha, Racine, Milwaukee and Waukesha counties (known as the Root-Pike Watershed Initiative Network) to conduct programming to work to protect, restore, and sustain the ecosystems of the Root River and Pike River. The City recently hosted a Rain Garden Workshop that educated participants on ways of keeping storm water runoff from polluting streams, rivers and lakes by learning how to build and maintain a rain garden. The WRM is also involved in a number of other educational initiatives in relation to the City's Wisconsin Pollutant Discharge Elimination System Permit (WPDES) ranging from neighborhood meetings, development reviews to discussing local water resources issues to newsletter articles.

WISCONSIN'S GREAT LAKES COMPACT

The Great Lakes Basin is comprised of Lake Erie, Lake Huron, Lake Michigan, Lake Ontario, Lake Superior and the St. Lawrence River – represented by eight (8) Great Lakes states and two (2) Canadian Provinces (Minnesota, Wisconsin, Illinois, Indiana, Ohio, Michigan, Pennsylvania, New York, Quebec and Ontario). The Compact, in and of itself is significant as it encompasses ten (10) jurisdictions across international boundaries that have collectively agreed to manage the largest surface freshwater resource in the world. This is the first multi-jurisdictional agreement of this type in the world.

Each state and/or province adopted statutes further implementing the Compact within their respective jurisdictions. The Wisconsin Legislature adopted Act 227 in early 2008. Governor Doyle signed the law into effect on May 27, 2008. Wisconsin Act 227 adopts text of the Compact into state statute and provides implementation provisions for both pre and post Compact. In summary, Act 227 now regulates:

- ⇒ "Interbasin Transfers"
- ⇒ New Statewide Water Supply Planning for Public Water Supply Systems
- ⇒ New Statewide Water Use Regulations & Reporting System
- ⇒ New In-basin Water Use Permitting System; and
- ⇒ New Water Conservation and Efficiency Program

As a complimentary document to Wisconsin Act 227, the Southeastern Wisconsin Regional Planning Commission (SEWRPC) has prepared a draft Regional Water Supply Study. The complete study can be referenced on the SEWRPC website via the following link <http://www.sewrpc.org/water/watersupplystudy>. The scope of this study is as follows:

City of New Berlin Water Conservation Plan

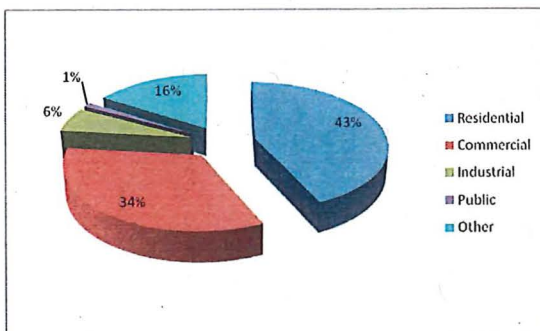
- ⇒ Forecast future water use demand in the Region
- ⇒ Consider potential of water conservation to reduce future demand
- ⇒ Identify groundwater recharge areas which should be protected from development
- ⇒ Assess potential for shallow groundwater recharge through infiltration of storm water runoff
- ⇒ Consider potential alternative sources of supply
 - Shallow groundwater
 - Lake Michigan water replacing groundwater east of the sub-continental divide
 - Lake Michigan water replacing groundwater in "straddling communities" which already have "return flow"
 - Lake Michigan water replacing groundwater in "straddling communities" and "communities in straddling counties" and providing for "return flow"
- ⇒ Estimate costs and impacts of alternatives
 - Groundwater-Surface Water Interdependence and Impacts
- ⇒ Identify any development constraints necessary to assure water supply sustainability
- ⇒ Amend regional land use plan if necessary.

The Regional Water Supply Study has identified and evaluated seven (7) different scenarios for providing adequate and clean water supplies to the region. It is important that this Plan be used as a guide as future water resource planning and conservation policy decisions are made.

EVALUATION OF HISTORICAL WATER USAGE AND PAST & CURRENT CONSERVATION MEASURES

In 2015, the breakdown, by use, for City Water Utility customers is as follows:

⇒ Residential	43%	
⇒ Commercial	34%	
⇒ Industrial	6%	
⇒ Public	1%	
⇒ Other	16%	<i>(Hydrant flushing, equipment malfunction, lost water, meter inaccuracies)</i>



Source: New Berlin Water Utility

According to numbers provided by the City's Water Utility Department, the total yearly usage was as follows:

~2016	1,004,682,932
~2017	940,313,792
~2018	959,770,020
~2019	897,864,383

The maximum usage (in gallons – highest day) for the last four years were:

~2016	4,684,000	07/29/2016
~2017	4,247,000	12/14/2017
~2018	5,929,000	05/28/2018
~2019	4,432,000	07/15/2019

Source: *New Berlin Water Utility*

Water usage is tracked by quarterly billing to show high consumption with a high/low report for residential and industrial usage. The average residential water use per residential customer in New Berlin for 2007 was 70 gallons per customer per day (gpcd). The 2019 average is 50.85 gallons per customer per day.

New Berlin has moved ahead with its water conservation measures whether it be through promoting and/or limiting water usage and loss or through land use planning, storm water management and development review. Utility activities implemented to date include:

- Sprinkling restriction in effect year around
- Notices of sprinkling restrictions on the City's website, quarterly leaflet, utility billings and on the local access cable channel

City of New Berlin Water Conservation Plan

- ⇒ Leaflets available on the City website and references in the annual consumer confidence report
- ⇒ Rain barrels
- ⇒ Fixture replacement rebate program
- ⇒ Conduct annual water audits assessing utility system water losses
- ⇒ Leak detection program
- ⇒ Flag significant quarterly changes in water meter readings
- ⇒ Meter individual multi-family and residential condominium units
- ⇒ Replace water meters on a 10 year cycle
- ⇒ A water rate service charge that includes certain fixed charges but no water use, encouraging even those with lower water use to conserve
- ⇒ Adoption of the Storm water Management Ordinances
- ⇒ Water rate requests to the Public Service Commission reflecting full cost pricing
- ⇒ There are no bulk water sales within the Water Utility service area.

LAND USE PLANNING, STORMWATER MANAGEMENT AND DEVELOPMENT REVIEW MEASURES

The following is a summary of several ways that the Department of Community Development (DCD) furthers water conservation efforts here in New Berlin through the regulation of land use, storm water management and construction activities. Many of these items described below are not directly related to water conservation "per se" but, they do reflect our efforts surrounding water preservation and improving water quality.

The Department of Community Development (DCD) literally aids in the coordination and regulation of all construction activity within the city. The DCD also establishes and coordinates compliance with all storm water regulations. The DCD practices what we call "*three-dimensional water resource planning*". Focusing efforts on protection of groundwater, surface water and storm water resources.

Many of the water studies listed in Appendix A of this report have been utilized over the years in refining the City's Comprehensive Plan and utility needs. This was especially true during the preparation of the Growth and Development Master Plan update to the City's 1987 Comprehensive Plan. Since that time, DCD has been involved in the following initiatives and/or ways of promoting Low Impact Development (LID) in order to preserve our water resources.

- ⇒ The Department promotes the use of alternative "Best Management Practices" ("BMPs") for handling storm water. The encouragement of "green-roofs", bio-retention swales, rain gardens, rain barrels and "prairie restorations", all promote habitat restoration and groundwater recharge. The Department has effectively promoted these ideals over the past two or more years. For example, the Settler's Ridge Subdivision located off of Wehr Road is 15 lots on 75 acres. Our Department required the developer to restore and enhance the open space into a "prairie habitat" that will be forever preserved offering not only visual benefits but

City of New Berlin Water Conservation Plan

functional as well, for overland flow of storm water allowing for groundwater recharge.

- ⇒ The Department has over the past several years, developed a number of ordinances and policies to assist in our efforts to promote *"Three-Dimensional Water Resource Planning"*. This is the protection of groundwater, surface water and managing storm water conveyance. With assistance from Mr. Randall Arendt (one of the nation's foremost experts in conservation subdivision design & development), the City developed a conservation subdivision ordinance requiring that 75% of lands in any given conservation subdivision be set aside for permanent open space preservation for those without public utilities. For those conservation subdivisions with public utilities, our ordinance requires that 65% of the land be set-aside for permanent preservation. To the best of our knowledge, this is one of, if not the strictest conservation requirements within the State in terms of minimum open space requirements. Our ordinance also allows a transfer of density option in order to preserve additional open lands while allowing compensation to the parcels giving away their development rights. In the past, the Department has proposed a purchase of development rights program. However, that program was not funded.
- ⇒ Another example of how "BMPs" have been incorporated into a new development is the recent Living Word Church project. They are installing bio-infiltration swales that will contain engineered soils. These swales will be planted to follow DNR Technical Standards. They will also have temporary diversion swales during construction, which will protect the bio-infiltration swales.
- ⇒ The recently approved Crossroads Community Church is an additional example of the incorporation of "BMPs". This project will include bio-infiltration swales with engineered soils. A portion of the parking that will be used for larger church services will be grass covered with geo-blocks. This will help treat runoff as it comes off the parking lot before it enters the storm water ponds.
- ⇒ A recent project in the New Berlin Industrial Park was a Dog Day Care. This was a new use to the City. In working with the applicant, Staff had some concerns about the amount of animal waste and runoff from chemicals that this site would generate. Working collectively, DCD staff, DNR staff and the applicant worked on incorporating a rain garden and the proper use of environmentally friendly chemicals that do not degrade water quality and do not negatively impact the drainage ways and watershed.
- ⇒ Through continuing education, the Department is beginning to learn more about applying the standards found under the Leadership in Energy Efficient Design (LEED) program. With the recently approved Willowtree Development, an approximately 350,000 square foot building, the developer coordinated with our Department and was able to incorporate storm water "BMPs" into the site design and also various LEED design criteria. Besides incorporating energy efficient elements into the building's construction, the property will also be water efficient in terms of watering its landscaping. Irrigation water will be used from the site's retention pond to reduce water usage by 50% or more. In addition, a portion of the parking lot used for overflow parking will be grass covered with geo-blocks, further allowing infiltration and treating runoff prior to reaching the retention pond.

City of New Berlin Water Conservation Plan

- ⇒ Another project that is promoting groundwater recharge, enhancing aquatic habitat, and helping to protect our water resource assets is the Underwood Creek "Prospect Parkway" project being managed by the City's Water Resources Management Utility. Depending upon funding availability, this project is incorporating rain gardens, bio-retention swales, infiltration basins & trenches, native / prairie plantings and providing for additional wetland plantings that will help absorb additional water & pollutants and detaining additional water from entering the creek causing flooding problems downstream.
- ⇒ The current study underway for the redevelopment of the New Valley Sand & Gravel Quarry (Mill Valley Business Center) is being site designed to support 100% groundwater recharge of all storm water. In addition, LEED standards will also be recommended for new development.
- ⇒ The City's upcoming Comprehensive Plan update will focus on neighborhood planning efforts and identification of significant environmental features in the city and ways to preserve their integrity and further our three-dimensional water resource planning ideals.
- ⇒ In 2001, the Department conducted and prepared an Urban Ecological Analysis report. The project used the CITYgreen software that American Forests utilizes to examine the environmental and economic benefits of trees and green spaces within the City. This information is currently used on various maps within the City including the Map of Potential Conservation Lands and the Departments front counter maps to help staff and others quickly see areas of the City and their associated tree canopy.
- ⇒ The Department promotes water quality management measures to meet the City's WPDES Permit requirements by administering and enforcing the provisions of the City's Storm Water Ordinance No. 2193, the Illicit Discharge Ordinance No. 2269, the Erosion Control Ordinance No. 2268 and the Post Construction Ordinance No. 2267. The intent of this enforcement is to reduce the amount of sediment and other pollutants reaching the waters of the State. Our Department, through the Water Resources Management Utility have implemented a strong code compliance program to monitor all on-site construction activities related to erosion control and storm water management to ensure that all construction sites are in compliance with federal, state and local laws regulating water quality and storm water. All of which ultimately protects our water resources.
- ⇒ In addition, our Department is responsible for inspecting all plumbing devices pursuant to Comm 84.20 regarding flow control and flow restricting devices. Members of our Department also serve on various statewide or regional boards or commissions that focus on improving land use planning and / or improving watershed & water resource management.

Due to increasing and complicated legislation & regulations relating to water resource protection, there needs to be a change in community development programming at all levels of government. Managing water resources is critical in high-quality land use planning and the overall health & integrity of these vital resources.

CONSERVATION MEASURES

Programs or activities to achieve water conservation can be classified into three categories: 1) program actions, 2) voluntary, and 3) mandatory. Program actions are those activities that can be directly taken up by the City. Voluntary activities are those that use education or incentives to promote water conservation. Mandatory activities are those that use regulations and ordinances. These measures can be combined or phased in over time.

Suggested/Recommended "Program" Actions:

- ⇒ Install more rain gardens at public buildings
- ⇒ Install low flow fixtures at City Hall or other City buildings and monitor decrease in water usage
- ⇒ Install a rain barrel at City Hall
- ⇒ Remove obstacles in the zoning and building code to allow for rain harvesting tanks in all zoning districts. Encourage new subdivisions through homeowner association declarations of restrictions to allow them as well.
- ⇒ Encourage all new subdivisions to plant trees and use water harvesting for landscape irrigation.
- ⇒ Reduce hydrant flushing from two times to one time per year
- ⇒ Detect and reduce leakage in the New Berlin water system. Leakage from the water system provides an opportunity to reduce the amount of water that is being used by utility customers. The New Berlin Water Utility should institute a more detailed water audit for the system to identify priority areas for water main replacement. Reducing leaks increases water pressure within the system and reduces energy costs for water pumping.

Suggested/Recommended "Voluntary" Actions:

- ⇒ When brushing your teeth, do not let the water run
- ⇒ Use water conserving shower heads and replace them as necessary
- ⇒ Check every faucet in your home for leaks (just a slow drip can waste 15-20 gallons per day).
- ⇒ Install rain barrels
- ⇒ Use native plantings in landscaping
- ⇒ Install a rain garden
- ⇒ Install low-flow fixtures with rebate assistance from the Utility for installation of water efficient fixtures
- ⇒ Bypass water softener system
- ⇒ Do not water lawns, gardens and landscaping between the hours of 9:00 a.m. and 9:00 p.m.

City of New Berlin Water Conservation Plan

- ⇒ Cleaning of sidepaths, driveways, parking areas, tennis courts, patios, decks or other hard-surface areas should be accomplished with brooms – the use of water should be avoided
- ⇒ Limit the outdoor use of any water-play apparatus connected to a water source to one hour per day
- ⇒ The operation of outdoor misting systems used to cool people or areas should be avoided unless their use is necessary to alleviate an immediate threat to a person's health or safety
- ⇒ Water obtained by means of a fire hydrant shall not be used for cleaning equipment of any kind
- ⇒ Pools larger than 500 cubic feet should be supplied with water *obtained* from a source on that property's side of the sub-continental divide
- ⇒ The watering of gardens, trees and landscaping (except invasive species) through the use of a hand-held watering can or other hand-held container or hose is encouraged, provided any such watering device is utilized manually and in conjunction with an automatic hand-held shut-off valve
- ⇒ The watering or irrigation of new landscaping would also be allowed
- ⇒ Avoid showering, doing laundry, or running a dishwasher during a rain storm

Suggested/Recommended "Mandatory" Actions:

- ⇒ Sprinkling Ordinance – impose fines when not followed (odd/even days)
- ⇒ Sprinkling Ordinance – prohibit sprinkling during a significant portion of the mid-day hours when evaporation rates are high
- ⇒ Require an automatic hand-held shut-off valve for all outdoor domestic water hose use
- ⇒ Require rain and moisture sensors on all new lawn irrigation systems
- ⇒ Require low flow fixtures

The simplest application to minimize impact on City residents is to require conservation measures for all new development, so that it is incorporated from the outset. As new technology becomes available, its implementation into our codes and wide spread use should be encouraged.

PROGRAM IMPLEMENTATION

The City designates the Water Utility and the Department of Community Development (including the WRM) as the responsible departments for implementing this Water Conservation Plan. Each department would work cooperatively in administering, educating and implementing the programs and policies identified herein. To further the Plans' implementation, the City should set city-wide and household conservation goals and publicize them.

New Berlin should act as a role model for water conservation. Some of the areas where the City can lead by example are as follows:

City of New Berlin Water Conservation Plan

- ⇒ Continue to promote three-dimensional water resource planning
- ⇒ Implement best management practices ("BMPs") for conservation and utilize public lands as pilot projects
- ⇒ Actively coordinate all land use planning elements thru sound community development; and
- ⇒ Provide water resource utility fee credits to property owners who utilize "BMPs" on their property (ie. pervious paving, rain gardens, bio-swales, etc.).

REDUCING WATER USE

Reduce per capita residential water consumption from January 1, 2008 by not less than (10) percent by the Year 2020 for Utility customers as per an agreement between the City of New Berlin and the Wisconsin Department of Natural Resources (WDNR). This goal is based on prior experience with other municipal water conservation programs. New Berlin is also seeking to reduce peak water demand by 1 MGD through controls in water sprinkling. The city will develop a program that provides monetary and other incentives to water users to reduce water use. Many water utilities use incentive-based programs to encourage water use reductions. This is usually done in tandem with a change in the rate structure that discourages increases in water usage.

INCENTIVE PROGRAM FOR RESIDENTS (Toilet and Fixture Replacements)

Toilet Replacements

The City of New Berlin Water Utility will develop a program to offer rebates of up to \$100 for residential customers who replace their high water using toilets with EPA WaterSense-rated High Efficiency Toilet (HET) models. The program is part of the utility's Water Conservation Plan to reduce per capita residential water usage ten (10) percent by the year 2020.

Toilets eligible for rebate must be HETs (which use an average of 1.28 gallons per flush) and must be on the Environmental Protection Agency's (EPA) WaterSense list. Any toilet that meets the criteria and is purchased after January 1, 2010, will be eligible. Rebates will be in the form of checks sent to the customer's residence of record; the check amount will not exceed the purchase price of the toilet.

To apply for the rebate, an applicant must submit two items: the original, dated sales receipt for the toilet showing the manufacturer's model name and number and the completed application form. These items would be submitted to the City's Water Utility Office.

Eligibility

City of New Berlin Water Conservation Plan

Participants in the program must be residential customers of the New Berlin Water Utility, and the installation address must be in the customer service area of the utility. Qualified customers are those who live in single-family homes, condos, or apartments in buildings no larger than two units. Rebates are for replacement of existing larger-capacity toilets, and are not for new construction. Rebates are first-come, first-served, until funding is exhausted. The program is for only two toilet rebates per household. Eligible replacement toilets must be HETs listed on the EPA WaterSense website (http://epa.gov/watersense/pp/find_het.htm).

Installation

Homeowners may install the toilets themselves, or they may hire a plumber or contractor to do the job. Owners are responsible for proper installation and associated costs. All applicable building and/or plumbing permits shall be obtained from the Department of Community Development – Inspection Services Division and pass all inspections. Installation may also be subject to verification by water utility personnel. Toilets may be purchased at any supplier as long as they are on the WaterSense list of HETs. Where applicable, permit fees will be waived for these installations.

Rebates

Rebate checks of up to \$100/toilet (not to exceed actual purchase price) will be sent to the customer's address four to six weeks after applications are processed and the Utility has received notification that the installation has passed inspection. Rebates are not available for the costs of installation. The program will be based upon a "first come-first served" basis and will be limited to the amount budgeted within a given year.

Fixture Replacement

Greater water savings are achieved when ALL fixtures are replaced with High Efficiency ones. In addition to offering rebates for the installation of HETs, the Water Utility will also offer rebates for the installation of high efficiency showerheads and faucets.

For High Efficiency Showerheads (HES), participants will receive a \$10.00 rebate (not to exceed the purchase price) when they purchase and install 1.5 gallon per minute (gpm) showerheads (maximum of two (2)). Or, participants may exchange their old showerheads for free (maximum of two (2)) for new high efficiency ones at either the City's Utility Office or the Department of Community Development – Permit Application Center. Where applicable, permit fees will be waived for these installations.

Regarding, High Efficiency Faucets (HEF), participants may receive a \$25.00 rebate (not to exceed the purchase price) when they purchase and install 1.5 gallon per minute (gpm) kitchen/bathroom faucet (maximum of two (2)). Faucets must be EPA WaterSense certified.

City of New Berlin Water Conservation Plan

All rebates shall be granted on a first-come, first-served basis until program funds are exhausted. This program is subject to available funds and the City of New Berlin Utility Committee would reserve the right to alter program funding or program requirements at any time without notice. The Water Utility would not guarantee that program funding would be sufficient nor that all persons submitting applications shall receive a rebate.

Only High-Efficiency Toilets labeled as EPA's WaterSense and 1.5 gallons per minute showerheads and/or faucets qualify for a rebate. Proof of WaterSense labeled High Efficiency Faucet and/or proof of 1.5 gpm Showerhead is required to be submitted with application. No substitutions will be accepted under this Program. Original dated sales receipt for new showerhead or faucet must be submitted with the rebate application. New construction is not covered by this rebate. Rebate amount applies to purchase of approved toilets/faucets/showerheads only.

IMPLEMENT CONSERVATION PLAN and CONDUCT PUBLIC OUTREACH & EDUCATION

The New Berlin Water Utility and Department of Community Development will implement the final conservation plan encompassing the information gathered. The City will circulate the plan to local stakeholders, government officials, and utility staff to generate support for and comment on the plan. The Department's will implement the plan's measures and track progress.

The City will actively promote implementation of the conservation plan through public education and outreach in the New Berlin schools and the press. The City will utilize existing educational and outreach materials available through: the California Urban Water Conservation Council – www.h2ouse.org; www.everydrop.org; www.waterwiser.org; and the American Water Works Association at www.awwa.org.

The Utility will also conduct an ongoing monitoring program to assess the effectiveness of water use reduction activities through actual water use savings, customer participation, and costs of device maintenance.

The Water Utility will regularly report on the program effectiveness to the Utility Committee and through annual reports to the public.

APPENDIX A – RECENT NEW BERLIN WATER STUDIES

⇒ City of New Berlin Application for Water Diversion	2006
⇒ Radium Compliance Study	2002
⇒ Lake Michigan Water Study	2001
⇒ Report on the Geophysical Logging Study on Well 8	2001
⇒ Sand and Gravel Test Boring Results	2001
⇒ New Berlin Energy Park Studies & Groundwater Monitoring	2000
⇒ Report on the Geologic Reconnaissance Study for the Siting of Shallow Sand and Gravel Wells	2000

City of New Berlin Water Conservation Plan

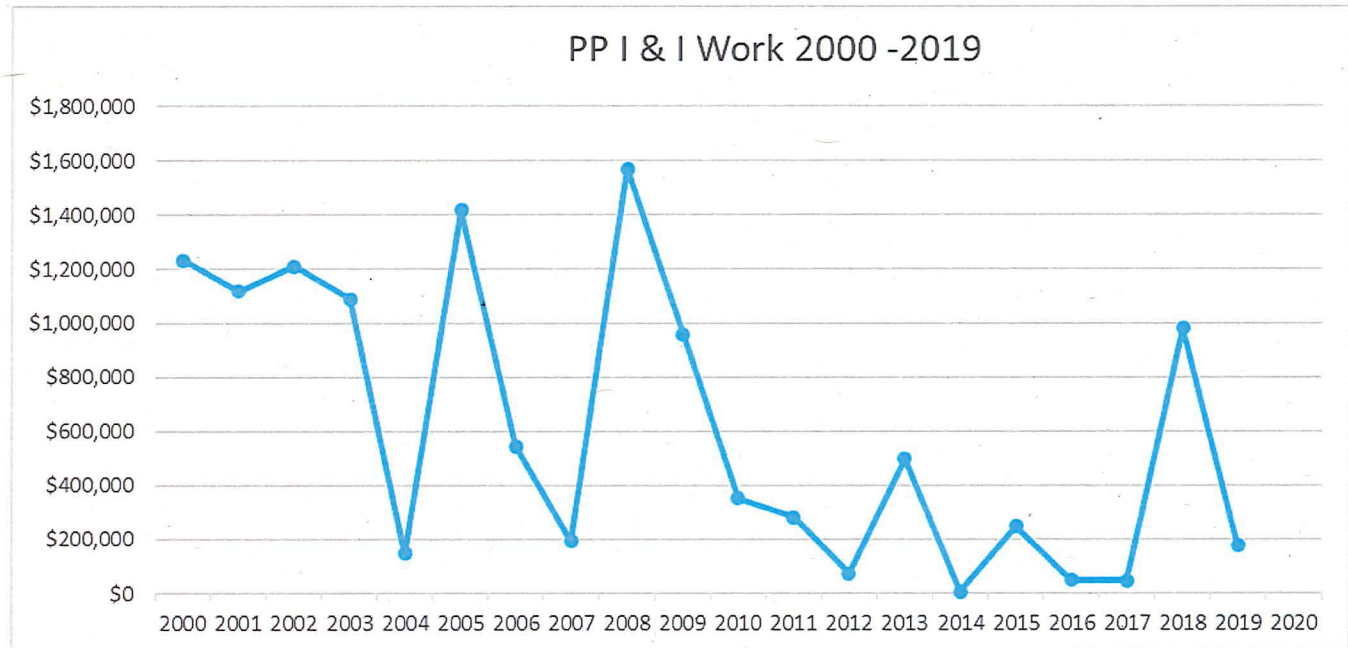
⇒ Water System Study Update for Impact Fees	1998
⇒ Westbrook Water Service Study	1998
⇒ Update Supply and Storage Analysis	1994
⇒ Geothermal Survey for Dolomite Well Site – Valley View Park	1992
⇒ Geothermal Survey for Locating a Dolomite Well Site – Westridge Subdivision	1992
⇒ Shallow Geothermal Survey for Valley View Park Test Well Site	1992
⇒ Report on the Phase II, Sand and Gravel Well Exploration Studies at the High Pointe and Woodfield Sites in the East Half of the City of New Berlin	1991
⇒ Report on the Phase II, Dolomite Well Exploration Study at the Westridge and Valley View Park Sites in the East Half of the City of New Berlin	1991
⇒ Report on the Phase I Study of the Groundwater Exploration Program for the East Half of the City of New Berlin	1991
⇒ Water System Facilities Study	1989-'91
⇒ Westbrook Water Service Study	1998
⇒ Update Supply and Storage Analysis	1994
⇒ Water System Facilities Study	1989-'91
⇒ Radium Compliance Study	1986
⇒ Section 25 Water Study	1985

Appendix B
I/I Reduction
Efforts

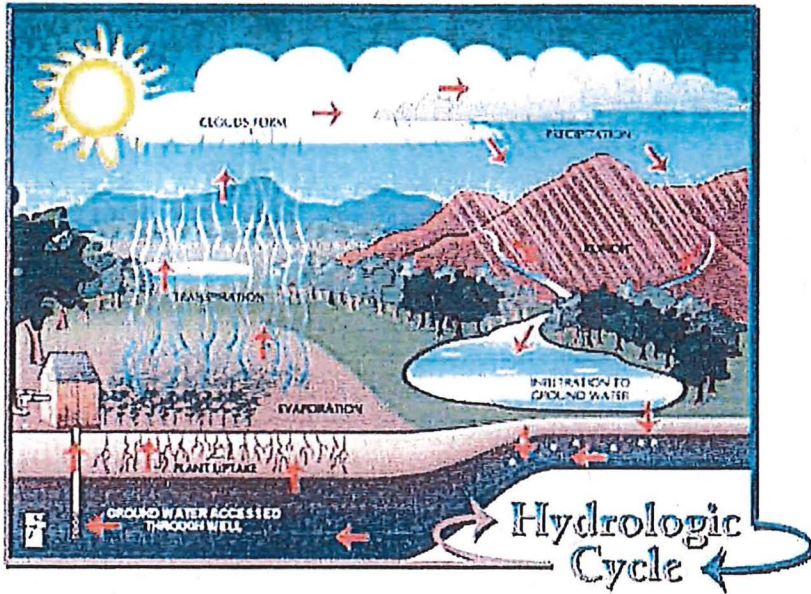
City of New Berlin

PP I & I WORK

Year	Amount
2000	\$1,234,824
2001	\$1,118,524
2002	\$1,212,340
2003	\$1,089,713
2004	\$148,310
2005	\$1,418,395
2006	\$544,788
2007	\$192,847
2008	\$1,570,444
2009	\$958,745
2010	\$352,785
2011	\$283,000
2012	\$73,000
2013	\$498,456
2014	\$5,000
2015	\$249,317
2016	\$48,613
2017	\$47,413
2018	\$977,819
2019	\$175,945
2020	
Total	\$12,200,278



APPENDIX B – GROUNDWATER CYCLE



Source: Illustrations depicting the world water supply and hydrologic cycle were developed by Stephen ADDucci, studio d'ADDuci, for original use in the Purdue Pesticide Programs Pesticide and Water Quality publication PPP-35 (1995). Reuse in this program is by express agreement with the illustrator. Developed in the Agricultural & Biological Engineering Department, Purdue University, 1997. Funded jointly by Purdue and U.S. EPA Region 5.

Illustrations depicting the world water supply and hydrologic cycle were developed by Stephen ADDucci, studio d'ADDuci, for original use in the Purdue Pesticide Programs Pesticide and Water Quality publication PPP-35 (1995). Reuse in this program is by express agreement with the illustrator.

Appendix C

Sewage Flow Estimates

Byczynski, Barbara

From: High, Ben <ben.high@raSmith.com>
Sent: Monday, January 27, 2020 2:08 PM
To: Hart, Jim
Cc: Byczynski, Barbara
Subject: RE: Message from "RNP5838791BAB29"

Hi Jim,

See below for the flows across the divide. The average daily flow for the Great Lakes Basin has increased by about 24% from the 2018 value (3.24 MGD). The average daily flow for the Mississippi River Basin has decreased by about 4% from the 2018 value (2.43 MGD). The table is what needs to be submitted, but feel free to review the rest of the information, which we've always just used to justify the data we present.

Below is Table 9-1, which has been used in past reporting by the City, which estimates the monthly sewage return flow across the divide. As in past years, I've also included the methodology used to arrive at the numbers below for your reference later in this email.

Basin	Average Daily Flow (MGD)	Monthly (30-Day Flow Gallons)	Annual Flow (Gallons)
Great Lakes Basin	4.29	128,700,000	1,565,850,000
Mississippi River Basin	2.34	70,200,000	854,100,000
Total	6.63	198,900,000	2,419,950,000

Here is the formula and information for first calculating the total sewer flows and then once again across the divide...

The following information is a summary of metered information from the MMSD, City-wide flow monitoring, and lift station pumping data. The information below gives a conservative estimate of the flows from the City to MMSD in 2019.

Because MMSD has only two meters monitoring flows from the City, we needed to rely more heavily on Utility-Owned meters to estimate the flows below. The following are the average flows for the City during 2019.

MMSD Meter DC0306 (This is an area-velocity meter similar to what the utility uses. I trust the accuracy of this data. The average flow below is from March 2019 through October 2019.)

(New Berlin Basins 1, 4, 5, and 6) = 2.47 MGD (2.812 MGD in 2009, 2.766 in 2010, 2.430 in 2011, 2.292 in 2012, 2.479 in 2013, 2.00 in 2014, 1.66 in 2015, 2.05 in 2016, 2.21 in 2017 and 2.06 in 2018)

MMSD Meter MS0213 (This is an area-velocity meter similar to what the utility uses. I trust the accuracy of this data. The average flow below is from March 2019 through November 2019.)

(New Berlin Basin 9) = 1.23 MGD (0.403 MGD in 2009, 0.452 in 2010, 0.369 in 2011, 0.65 in 2012, 0.982 in 2013, 0.474 in 2014, 0.967 in 2015, 1.17 in 2016, 1.04 in 2017 and 1.07 in 2018)

(New Berlin Basin 2, utility owned meter 2002-A) = 0.158 MGD (0.084 MGD in 2013, .095 in 2014, 0.141 in 2015, .075 in 2016, 0.146 in 2017 and 0.14 in 2018)

(New Berlin Basin 3, utility owned meters 2003-B and 2003-C) = 0.749 MGD (0.503 in 2009, 0.551 in 2014, 0.327 in 2015, 0.41 in 2016, 0.45 in 2017 and 0.49 in 2018)

(New Berlin Basins 7 and 10, utility owned meters 2007-B and 2010-A) = 2.01 MGD (2.292 MGD in 2009, 2.530 in 2010, 2.083 in 2011, 1.420 in 2012, 2.527 in 2013, 1.834 in 2014, 1.55 in 2016, 1.88 in 2017 and 1.89 in 2018)

(New Berlin Basin 8, utility owned meter 2008-C and lift station 6) = 0.016 MGD (0.041 MGD in 2015, 0.058 in 2016, 0.026 in 2017 and 0.02 in 2018)

Total 2019 Average Daily Flow = 6.63 MGD → * 365 = 2.42 Billion Gallons
(about a 16.9% increase from 2018 numbers and about a 15.2% increase from 2017 numbers)

Total 2018 Average Daily Flow = 5.67 MGD → * 365 = 2.07 Billion Gallons
(about a 1.4% decrease from 2017 numbers and about a 6.78% increase from 2016 numbers)

Total 2017 Average Daily Flow = 5.75 MGD → * 365 = 2.10 Billion Gallons
(about a 8% increase from 2016 numbers and about a 16.2% increase from 2015 numbers)

Total 2016 Average Daily Flow = 5.31 MGD → * 365 = 1.94 Billion Gallons
(about a 8.6% increase from 2015 numbers and about a 6.9% increase from 2014 numbers)

Total 2015 Average Daily Flow = 4.89 MGD → * 365 = 1.785 Billion Gallons
(about a 1.5% decrease from 2014 numbers and about a 25.75% decrease from 2013 numbers)

Total 2014 Average Daily Flow = 4.966 MGD → * 365 = 1.813 Billion Gallons
(about a 25% decrease from 2013 numbers and about a 2% increase from 2012 numbers)

Total 2013 Average Daily Flow = 6.586 MGD → * 365 = 2.404 Billion Gallons
(about a 35% increase from 2012 numbers)

Total 2012 Average Daily Flow = 4.874 MGD → * 365 = 1.780 Billion Gallons
(about a 10% decrease from 2011 numbers)

Total 2011 Average Daily Flow = 5.397 MGD → * 365 = 1.970 Billion Gallons
(about a 10% decrease from 2010 numbers)

Total 2010 Average Daily Flow = 5.979 MGD → 5.979 * 365 = 2.182 Billion Gallons
(about a 1% decrease from 2009 numbers)

Total 2009 Average Daily Flow = 6.025 MGD → 6.025 * 365 = 2.199 Billion Gallons

2019

(about a 10% increase from 2006 numbers)

Since the above indicates total flow from the City, we need to estimate what it is on each side of the divide... here is how we do it...

One MMSD meter measured flows from all of New Berlin Basins 1, 4, 5, and 6. Since we only wanted the flows from 5 and 6, I subtracted the flows recorded for 1 and 4 from the flow monitoring data that we have been collecting for the City every year. The result should give us a good idea of what flows basins 5 and 6 are contributing.

- MMSD Meter DC0306 = 2.47 MGD
 - New Berlin Flow Meter Basin 1 (utility meter 3001-G, 0.77 MGD) and Basin 4 (utility meter 3001-A, 0.336 MGD)
 - Resultant Basin 5 and 6 flows = 1.364 MGD

Assuming that half of flow from Basin 7 and 10 is pumped over the sub-divide line we get:

- New Berlin Basins 7 and 10 (utility owned meters 2007-B and 2010-A) = $2.01 \text{ MGD} / 2 = \underline{1.005} \text{ MGD}$

Add Basin 8 (utility owned meter 2008-C and lift station 6), and the above two together and we get our number $\rightarrow 1.364 + 1.005 + 0.016 = \underline{2.34} \text{ MGD}$

Thanks and let me know if you have any questions.

Ben G. High, P.E.
Project Manager

raSmith
16745 West Bluemound Road, Brookfield, WI 53005-5938
direct: 262-317-3273
Ben.High@raSmith.com

Hart, Jim

From: High, Ben <ben.high@raSmith.com>
Sent: Tuesday, January 29, 2019 8:19 AM
To: Hart, Jim
Cc: Stamborski, Chris
Subject: RE: Diversion Report

Hi Jim,

See below for the flows across the divide. The figures for 2018 are similar to the readings we calculated for 2017 for both the Great Lakes Basin (3.19 MGD) and Mississippi River Basin (2.56 MGD). The table is what needs to be submitted, but feel free to review the rest of the information, which we've always just used to justify the data we present.

Below is Table 9-1, which has been used in past reporting by the City, which estimates the monthly sewage return flow across the divide. As in past years, I've also included the methodology used to arrive at the numbers below for your reference later in this email.

Basin	Average Daily Flow (MGD)	Monthly (30-Day Flow Gallons)	Annual Flow (Gallons)
Great Lakes Basin	3.24	97,200,000	1,182,600,000
Mississippi River Basin	2.43	72,900,000	886,950,000
Total	5.67	170,100,000	2,069,550,000

Here is the formula and information for first calculating the total sewer flows and then once again across the divide...

The following information is a summary of metered information from the MMSD, City-wide flow monitoring, and lift station pumping data. The information below gives a conservative estimate of the flows from the City to MMSD in 2018.

Because MMSD has only two meters monitoring flows from the City, we needed to rely more heavily on Utility-Owned meters to estimate the flows below. The following are the average flows for the City during 2018.

MMSD Meter DC0306 (This is an area-velocity meter similar to what the utility uses. I trust the accuracy of this data. The average flow below is from March 2018 through October 2018.)

(New Berlin Basins 1, 4, 5, and 6) = 2.06 MGD (2.812 MGD in 2009, 2.766 in 2010, 2.430 in 2011, 2.292 in 2012, 2.479 in 2013, 2.00 in 2014, 1.66 in 2015, 2.05 in 2016 and 2.21 in 2017)

MMSD Meter MS0213 (This is an area-velocity meter similar to what the utility uses. I trust the accuracy of this data. The average flow below is from March 2018 through November 2018.)

(New Berlin Basin 9) = 1.07 MGD (0.403 MGD in 2009, 0.452 in 2010, 0.369 in 2011, 0.65 in 2012, 0.982 in 2013, 0.474 in 2014, 0.967 in 2015, 1.17 in 2016 and 1.04 in 2017)

(New Berlin Basin 2, utility owned meter 2002-A) = .14 MGD (0.084 MGD in 2013, .095 in 2014, 0.141 in 2015, .075 in 2016 and .146 in 2017)

(New Berlin Basin 3, utility owned meters 2003-B and 2003-C) = .49 MGD (.503 in 2009, .551 in 2014, 0.327 in 2015 .41 in 2016 and .45 in 2017)

(New Berlin Basins 7 and 10, utility owned meters 2007-B and 2010-A) = 1.89 MGD (2.292 MGD in 2009, 2.530 in 2010, 2.083 in 2011, 1.420 in 2012, 2.527 in 2013, 1.834 in 2014, 1.55 in 2016 and 1.88 in 2017)

(New Berlin Basin 8, utility owned meter 2008-C and lift station 6) = .02 MGD (.041 MGD in 2015, .058 in 2016 and .026 in 2017)

Total 2018 Average Daily Flow = 5.67 MGD → * 365 = 2.07 Billion Gallons
(about a 1.4% decrease from 2017 numbers and about a 6.78% increase from 2016 numbers)

Total 2017 Average Daily Flow = 5.75 MGD → * 365 = 2.10 Billion Gallons
(about a 8% increase from 2016 numbers and about a 16.2% increase from 2015 numbers)

Total 2016 Average Daily Flow = 5.31 MGD → 5.31 * 365 = 1.94 Billion Gallons
(about a 8.6% increase from 2015 numbers and about a 6.9% increase from 2014 numbers)

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Total 2014 Average Daily Flow = 4.966 MGD → 4.966 * 365 = 1.813 Billion Gallons
(about a 25% decrease from 2013 numbers and about a 2% increase from 2012 numbers)

Total 2013 Average Daily Flow = 6.586 MGD → 6.586 * 365 = 2.404 Billion Gallons
(about a 35% increase from 2012 numbers)

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(about a 10% decrease from 2010 numbers)

Total 2010 Average Daily Flow = 5.979 MGD → 5.979 * 365 = 2.182 Billion Gallons
(about a 1% decrease from 2009 numbers)

Total 2009 Average Daily Flow = 6.025 MGD → 6.025 * 365 = 2.199 Billion Gallons
(about a 10% increase from 2006 numbers)

Since the above indicates total flow from the City, we need to estimate what it is on each side of the divide... here is how we do it...

One MMSD meter measured flows from all of New Berlin Basins 1, 4, 5, and 6. Since we only wanted the flows from 5 and 6, I subtracted the flows recorded for 1 and 4 from the flow monitoring data that we have been collecting for the City every year. The result should give us a good idea of what flows basins 5 and 6 are contributing.

- MMSD Meter DC0306 = 2.06 MGD
 - New Berlin Flow Meter Basin 1 (utility meter 3001-G, 0.43 MGD) and Basin 4 (utility meter 3001-A, 0.17 MGD)
 - Resultant Basin 5 and 6 flows = 1.46 MGD

Assuming that half of flow from Basin 7 and 10 is pumped over the sub-divide line we get:

- New Berlin Basins 7 and 10, (utility owned meters 2007-B and 2010-A) = $1.89 \text{ MGD} / 2 = \underline{.95} \text{ MGD}$

Add Basin 8 (utility owned meter 2008-C and lift station 6), and the above two together and we get our number $\rightarrow 1.46 + .95 + .02 = \underline{2.43} \text{ MGD}$

Thanks and let me know if you have any questions.

Ben G. High, P.E.
Project Engineer



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Top Workplace

direct: 262-317-3273

From: Hart, Jim <jhart@newberlin.org>
Sent: Monday, January 28, 2019 2:06 PM
To: High, Ben <ben.high@raSmith.com>
Subject: RE: Diversion Report

Thank you!

From: High, Ben <ben.high@raSmith.com>
Sent: Monday, January 28, 2019 1:43 PM
To: Hart, Jim <jhart@newberlin.org>
Subject: RE: Diversion Report

Jim,

I will get right on that.

Thanks.

Ben G. High, P.E.