Great Lakes –St. Lawrence Regional Body and Compact Council
Waukesha Diversion Comments
c/o Conference of Great Lakes and St. Lawrence Governors and Premiers
20 N. Wacker Drive, Suite 2700
Chicago, Illinois
60606

March 14, 2016

Dear Regional Body/Compact Council Members:

Re: The City of Waukesha's application to divert water from Lake Michigan does not meet the requirements of the *Great Lakes–St. Lawrence River Basin Water Resources Compact*

These comments on the City of Waukesha's proposal to divert Lake Michigan water under the *Great Lakes–St. Lawrence River Basin Water Resources Compact* ("Compact") are submitted by nine Canadian public-interest organizations and individuals with longstanding expertise and interest in preserving our shared Great Lakes resources. We seek to ensure that the Exception Standard in the Compact and the corresponding *Great Lakes – St. Lawrence River Basin Sustainable Water Resources Agreement* ("Agreement") is given a robust interpretation so that it serves its intended purpose to protect, conserve and manage the Great Lakes ecosystem for future generations.

The City of Waukesha's proposal for a diversion with return flow should be rejected because it does not meet the strict requirements of section 4.9 of the Compact. Acceptance of Waukesha's diversion proposal would significantly undermine the Compact for the following reasons:

- Waukesha has not demonstrated that there are no reasonable alternatives to its proposal to divert Great Lakes water.

- Waukesha has significantly inflated its demand for water by projecting a high demand for water that is inconsistent with historical trends and by including service to an expanded Water Supply Service Area that does not require water.

- Waukesha has not ensured that the integrity of the Basin Ecosystem is protected, including consideration of the return flow via the Root River and climate uncertainties.

This is the first proposal for a diversion under the Compact and will establish a precedent for interpretation of key criteria under the Compact, including the interpretation of "without adequate supplies of potable water" or "no reasonable water supply alternative".[1] It is critical to the long term effectiveness of the Compact and Agreement that a diversion that does not meet the requirements of the Exception Standard is rejected.

There is a reasonable water supply alternative to diverting water from Lake Michigan

The Compact prohibits diversions unless there is "no reasonable water supply alternative".[2] The acceptance of a diversion in this case would undermine the effectiveness of the Compact because a reasonable, healthy water supply alternative is available.

As demonstrated by the GZA GeoEnvironmental, Inc. report *Non-Diversion Alternative Using Existing Water Supply with Treatment* dated July 9, 2015 (Appendix 1)[3], deep and shallow water wells can provide clean and healthy water to the City of Waukesha's residents. The GZA report proposed to meet Waukesha's water needs by installing three new reverse osmosis facilities to treat water from the deep wells.[4] It concluded that a combination of treatment at select wells and blending with the remaining wells was a feasible approach to reduce radium concentrations and meet water quality standards, and was significantly less expensive than the proposed Lake Michigan diversion alternative.[5]

The Wisconsin DNR also found that several proposed water supply alternatives met all public health criteria, including Alternative 1 which examined the use of deep and shallow aquifers.[6] Those alternatives are used to provide water to other Wisconsin communities. For instance, the Waupun Utilities and Burlington Waterworks currently use treatment to meet the radium standard. The Mukwonago Water Utility, Waukesha County uses a blending approach similar to Alternative 1 to meet contamination criteria.[7] As well, the gradual reduction in groundwater

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[1] *Great Lakes–St. Lawrence River Basin Water Resources Compact*, December 13, 2005 ("Compact"), para 4.9(3)(a) and (d). <http://www.glslregionalbody.org/Docs/Agreements/Great_Lakes-St_Lawrence_River_Basin_Water_Resources_Compact.pdf>; *Great Lakes – St. Lawrence River Basin Sustainable Water Resources Agreement* , December 13, 2005 ("Agreement"), Article 201(3)(a) and (d). <https://dr6j45jk9xcmk.cloudfront.net/documents/2700/200040.pdf>

[2] Compact, s 4.9(3)(d); Agreement, article 201(3)(d)

[3] Appendix 1: GZA GeoEnvironmental, Inc., *Non-Diversion Alternative Using Existing Water Supply with Treatment, City of Waukesha Water Supply*, July 9, 2015 ("*GZA Report*"). <http://static1.squarespace.com/static/55845d9de4b0b4466f1267b9/t/55b26a8de4b0f414ae482ea3/1437756045901/Non-Diversion+Alternative+Report_City+of+Waukesha+Water+Supply_Full.pdf>

[4] *GZA Report*, pp 1-2, 9

[5] *GZA Report*, pp 10-11

[6] Wisconsin Department of Natural Resources, *Technical Review for the City of Waukesha's Proposed Diversion of Great Lakes Water for Public Water Supply with Return Flow to Lake Michigan*, January 2016 ("Technical Review"), pp 20, 27 <http://www.waukeshadiversion.org/media/1639/wdnr_technicalreview.pdf>

[7] Technical Review, pp 27-30

pumping over the last 15 years has resulted in a rebound of the deep confined aquifer by approximately 100 feet.[8]

The Compact Implementation Coalition compiled evidence to demonstrate that other communities in Wisconsin dealing with similar gross alpha, radium and radon issues have utilized treatment technologies to bring themselves into compliance with Maximum Contaminant Level ("MCL") standards (Appendix 2). Wisconsin DNR forwarded data in December, 2015 to the Compact Implementation Coalition of communities which installed treatment technologies because they exceeded MCL standards for gross alpha, radium and radon, and communities which installed treatment technologies because of concerns they might exceed MCL standards in the future. The treatment technologies include WRT absorptive media, hydrous manganese oxide, conventional ion exchange, and pressure sand filtration. 31 communities were formerly out of compliance with WCL standards and used these technologies to come into compliance. 15 communities implemented these technologies to ensure that they did not fall out of compliance. The Brookfield Water Utility and the City of Pewaukee Water and Sewer Utility treat water with radium from the same aquifer used by Waukesha with WRT absorptive media technologies.[9]

In this factual context, Waukesha clearly has a reasonable water supply alternative and does not meet the requirement in section 4.9(3)(d) of the Compact.

Each section of the Compact must be considered using the same baseline for analysis

The only reasonable interpretation of the Compact requires that each element of section 4.9 be considered using the same baseline for analysis. Waukesha's proposal should be rejected because it has relied on an expanded Water Supply Service Area to demonstrate why it requires a large increase in the volume of potable water per day and why there is no reasonable water supply alternative, but does not demonstrate that the entire area covered by the proposal actually requires the diverted Great Lakes water or has met conservation criteria.[10] The Compact requires that the criteria that "all or part of the proposed Exception cannot be reasonably avoided" be met prior to acceptance of the proposal.

Conservation efforts should be the primary priority for all communities. Waukesha has not demonstrated that it meets the requirement of sections 4.9(3)(d), 4.9(4)(a) and 4.9(4)(e) for the entire area covered by the proposal.[11] Instead, Wisconsin DNR suggests that areas in the expanded area of service will enter into contracts with Waukesha regarding conservation measures in the future, if they require water.[12] The application should not be approved because it

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[8] Wisconsin Department of Natural Resources, *Preliminary Final Environmental Impact Statement, City of Waukesha Proposed Great Lakes Diversion*, January 2016 ("Environmental Impact Statement"), p 95 <http://www.waukeshadiversion.org/media/1641/preliminaryfinaleis.pdf>

[9] Appendix 2: "Water supply systems' compliance with Maximum Contaminant Level (MCL) standard", compiled by Compact Implementation Coalition, data from Wisconsin DNR, December, 2015.

[10] Compact, para 4.9(3)(a) and (d); Agreement, Article 201(3)(a) and (d)

[11] Compact, ss 4.9(3)(d), 4.9(4)(a) and 4.9(4)(e); Agreement, Article 201(3)(d), 201(4)(a) and 201(4)(e)

[12] Wisconsin DNR, "Comments and Responses, Draft Technical Review, Waukesha Great Lakes Water Diversion", January 2016
<http://www.waukeshadiversion.org/media/1640/wdnr_technicalreview_responsetocomments.pdf>

does not make it clear how each area, including all areas in the expanded Water Supply Service Area, will conserve water to avoid the need for a diversion.

Waukesha's proposal similarly does not demonstrate that the entire Water Supply Service Area has no reasonable water supply alternative. In fact, some of the areas included in the expanded Water Supply Service Area appear to have no need at all for diverted water.

The Technical Review notes that certain areas in the expanded Water Supply Service Area ***may*** request water service from the City of Waukesha in the future, but currently use private wells and septic systems.[13] The Environmental Impact Statement notes that the Water Supply Service Area includes "neighboring communities currently served by private wells and septic systems, where future land use plans, sanitary sewer area plans, or historic private well contamination indicate municipal service ***may*** be needed."[14]

The Wisconsin DNR confirmed that "areas included in the water supply service area not currently connected to municipal water supply may request water service from the Applicant ***if needed in the future***." It did not make a determination about the adequacy of private water supply in areas not currently served by the Waukesha Water Utility, with limited exceptions. It instead stated that the Wisconsin government will decide whether public water service should be extended within the service area, and the pace of extension of water service.[15]

Wisconsin DNR has misunderstood the cooperative approach agreed to by all Great Lakes states and provinces in the Compact and Agreement. The purpose of the Regional Review process is to ensure that each Great Lakes state and province has a say in the full extent of each diversion of Great Lakes water. As downstream users, Québec and Ontario have a particular interest in enforcing a rigorous approach to the Regional Review where the full diversion proposal is scrutinized and assessed by all parties.

The Compact requires caution to be exercised when determining if a proposal meets the conditions for an exception to the prohibition on diversions.[16] The Compact would be significantly undermined by allowing the City of Waukesha to bolster its proposal for a diversion based on the expanded Water Supply Service Area without demonstrating that the entire area actually requires water from the Great Lakes or meets the requirements for a diversion, including conservation requirements. Waukesha's proposal accordingly does not meet the requirement that the community be "without adequate supplies of potable water"[17], that "there is no reasonable water supply alternative within the Basin in which the community is located"[18], that "the need for all or part of the proposed Exception cannot be reasonably avoided through the efficient use

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[13] Technical Review, p 49
[14] Environmental Impact Statement, pp 102-103
[15] Wisconsin Department of Natural Resources, "Responses to Questions from the Michigan Department of Environmental Quality" dated February 10, 2016 ("Wisconsin Responses to Questions"), p 4 <http://www.michigan.gov/documents/deq/deq-ogl-Waukesha-WDNR_Response_514494_7.pdf>
[16] Compact, para 4.9(3)(e); Agreement, Article 201(3)(e)
[17] Compact, s 4.9(3)(a); Agreement, Article 201(3)(a)
[18] Compact, s 4.9(3)(d); Agreement, Article 201(3)(d)

and conservation of existing water supplies"[19] and that the request be "limited to quantities that are considered reasonable"[20].

The City of Waukesha has improperly inflated its demand for water

The City of Waukesha has also inflated its demand forecast by ignoring downward historical trends in water use, resulting in both an overinflated demand for water and an inappropriate analysis of reasonable alternatives to the diversion.

A National Wildlife Federation report by Jim Nicholas, a scientist and retired director of the U.S. Geological Survey's Michigan Water Science Center, found that Waukesha projects a high volume of water demand that is entirely inconsistent with historical trends and over-predicts future demand (see Appendix 3).[21]

The GZA Report found that water demand per capita decreased from 2003 to 2012 in all land use categories and continued to decline from 2008 to 2014. Waukesha's demand forecast does not reflect that trend.[22] Waukesha has inflated its water demand, for instance by basing its demand predictions on industrial usage of 1,297 gallons/acre/day based on data from 2000, rather than the average industrial usage from 2008 to 2012 of 642 gallons/acre/day. Industrial water usage decreased in Waukesha from 660.4 million gallons per year in 2000, to 326.3 million gallons per year in 2010, despite increases in total land development. The significant downward trend in industrial water usage is apparent in comparing gallons per capita per day for industrial usage in 2000 and 2008-2012, where a decrease of more than 50% per capita usage was observed.[23]

The GZA Report concluded that a conservative estimate of water demand, which appropriately accounts for long-term historical trends, is an average day demand of 6.7 million gallons per day and maximum day demand is 11.1 million gallons per day by ultimate build-out.[24] The City of Waukesha's diversion request is much higher. Waukesha requests an average of 10.1 million gallons per day and a maximum day demand of 16.7 million gallons per day.[25] Wisconsin DNR's review of alternatives was conducted based on 8.5 million gallons per day being withdrawn, rather than using the GZA Report's conservative estimate of 6.7 million gallons per day at ultimate build-out.[26]

Waukesha's application significantly inflates its water demand. Its application should not be assessed using data that ignores long-term historical trends.

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[19] Compact, s 4.9(4)(a); Agreement, Article 201(4)(a)
[20] Compact, s 4.9(4)(b); Agreement, Article 201(4)(b)
[21] Appendix 3: Jim Nicholas, "An Analysis of the City of Waukesha Diversion Application, February 2013, p 12, 30 < http://www.nwf.org/~/media/PDFs/Regional/Great-Lakes/GLRC-Waukesha-Analysis-3-27-2013.ashx>
[22] *GZA Report*, pp 5-6
[23] *GZA Report*, pp 5-6
[24] *GZA Report*, pp 7-8
[25] City of Waukesha, "Application Summary, City of Waukesha Application for a Lake Michigan Diversion with Return Flow", Volume 1, October 2013, p 3-7, 3-9
[26] Technical Review, pp 10, 34-35

Analyses of the environmental impacts of the diversion, including on the Root River, should not be deferred

The Compact requires that the applicant demonstrate that it meets all of the requirements of section 4.9 of Compact for its proposal to be accepted. There is a specific requirement to use caution.[27] It undermines the Compact to defer consideration of several significant environmental impacts of the proposal on the assumption that they will be addressed by later state regulatory processes. This approach improperly collapses the requirements of the Compact into paragraph 4.9(4)(f), which requires that any exception be in compliance with all applicable municipal, state, provincial and federal laws, and undermines the rigour of the other Compact criteria.[28]

In particular, the Wisconsin DNR has raised concerns about the return flow through the Root River.[29] The Root River is on Wisconsin's Impaired Waters list.[30] The Wisconsin DNR has noted that further study is needed on several issues, including the following:

- The Applicant must determine the final design of the phosphorous removal facilities.[31]
- The Applicant must submit designs, specifications and costs to show how the thermal plume would act in the receiving Root River before the department could issue a permit. The Applicant would be required to meet temperature limits before commencing a new discharge to the Root River.[32]
- The Applicant would have to make considerable reductions to meet Water Quality Based Effluent Limits for chloride in the Root River. It will need to fully implement all efforts in its annual chloride progress report and adopt additional efforts, including education and outreach, prior to discharging into the Root River.[33]

Wisconsin DNR has confirmed that it will not share any information regarding future permitting processes prior to the Regional Review.[34] This information is essential to Waukesha being able to show that it meets the requirements of section 4.9 of the Compact. If future regulatory processes are relied upon to meet Compact criteria, they should be considered prior to any Regional Review of the proposal so that Great Lakes states and provinces are provided with sufficient information to properly assess the proposal.

The potential effects of climate change have not been analyzed

The effects of climate change are likely to further exacerbate water quality and quantity issues in the Great Lakes. The International Joint Commission recently recommended that governments

[27] Compact, para 4.9(3)(e); Agreement, Article 201(3)(e)
[28] Compact, para 4.9(4)(f); Agreement, Article 201(4)(f)
[29] Technical Review, pp 82-88
[30] Technical Review, pp 82; Environmental Impact Statement, p 184
[31] Technical Review, p 83
[32] Technical Review, p 86
[33] Technical Review, pp 86-87
[34] Wisconsin Responses to Questions, p 14

incorporate climate resilience into policies and management practices regarding decision-making for diversions.[35] The Compact acknowledges the impacts of climate change on the Great Lakes by requiring periodic substantive consideration of climate change and other significant threats to Basin Water.[36]

Waukesha does not consider the impacts of climate change in its proposal, despite the Compact requirement that uncertainties with respect to demands on Basin water and future changes in environmental conditions be considered. In the face of climate uncertainties, Waukesha should have incorporated an analysis of climate change in its proposal.

Trade implications have not been analyzed

The precedential impact of this proposal vis-à-vis trade law must be carefully analyzed. The acceptance of any proposal that does not strictly adhere to the Compact standard regarding diversions could further jeopardize the Great Lakes. The International Joint Commission observed that Canada and the United States can decrease trade risk by clearly articulating their water-management policies and by acting in a manner entirely consistent with their stated policy.[37] The trade law implications of acceptance of Waukesha's proposal should be analyzed prior to any decision.

Conclusion

The Great Lakes and St. Lawrence Governors' and Premiers' Regional Body should oppose Waukesha's application.

The Compact acknowledges that future diversions and consumptive uses of basin waters have the potential to significantly impact the environment, economy and welfare of the Great Lakes-St. Lawrence River region.[38] The International Joint Commission recently observed that the Compact and Agreement will provide a solid foundation for managing diversions of Great Lakes water, but only if they are "fully and rigorously implemented".[39]

The Regional Body should adopt the resolution of the Great Lakes and St. Lawrence Cities Initiative, endorsed in Canada by the City of Toronto, the Town of Whitby, the County of Lambton, the Township of Huron-Kinloss, the Town of Parry Sound, the Municipality of Chathan-Kent, la Ville de Sorel-Tracy, and la Ville de Salaberry-de-Valleyfield, which asks the

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[35] International Joint Commission, *Protection of the Waters of the Great Lakes, 2015 Review of the Recommendations from the February 2000 Report*, December, 2015 ("*Protection of the Waters (2015)*"), pp 12-13 <http://ijc.org/files/tinymce/uploaded/Publications/IJC_2015_Review_of_the_Recommendations_of_the_PWGL_January_2016.pdf>

[36] Compact, s 4.15(1)(b); Agreement, Article 209(4)(b)

[37] International Joint Commission, *Protection of the Waters of the Great Lakes: Final Report to the Governments of Canada and the United States*, 22 February 2000, p 33

[38] Compact, s 1.3(1)(d)

[39] *Protection of the Waters (2015)*, p 6

Great Lakes governors and premiers to reject Waukesha's application in its current form (Appendix 4).[40]

The City of Waukesha's application for a diversion of Great Lakes water is not truly a last resort. It does not meet the strict requirements of the Compact and Agreement. Acceptance of this proposal would significant undermine the Compact and Agreement and would set a weak precedent for all future diversion applications.

Yours truly,

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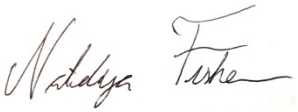

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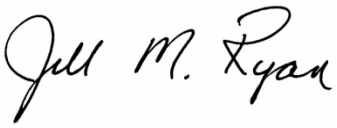

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[40] Appendix 4: Great Lakes and St. Lawrence Cities Initiative, "Resolution 2016-1B – Opposing the Waukesha Water Diversion Application, February 11, 2016 <http://cdn.glslcities.org/wp-content/uploads/2015/08/GLSLCI-Board-Resolution-Waukesha-Adopted.pdf>

Christine Elwell
Vice Chair
Sierra Club Ontario

Appendix 1

Non-Diversion Alternative Using Existing Water Supply With Treatment
City of Waukesha Water Supply
Waukesha, Wisconsin

July 9, 2015

Submitted to:

Clean Wisconsin and Milwaukee Riverkeeper
(on behalf of the Compact Implementation Coalition)

Prepared by:
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GZA GeoEnvironmental, Inc.

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Compact Implementation Coalition's Non-Diversion Solution

Executive Summary

The Compact Implementation Coalition (CIC) collectively represents tens of thousands of Wisconsinites working to protect our Great Lakes. The CIC has a long history beginning with ensuring the adoption of a strong Great Lakes Compact and aiding the Department of Natural Resources (DNR) in the implementation of administrative rules.

For the last five years, the City of Waukesha's ongoing request to divert Great Lakes water has raised numerous concerns about Waukesha's respect for the Great Lakes Compact and for the overall health of the Great Lakes region. The need for multiple versions of the city's application, all lacking sufficient information and evidence to support its request, demonstrates Waukesha's lack of real effort in evaluating all reasonable alternatives before requesting water from the Great Lakes as required under the Great Lakes Compact. By its own words, Waukesha has made it clear that its intent to divert Great Lakes water out of the Great Lakes Basin is a preferred option; it is not born out of current need and it is not a last resort. Further, Waukesha has manufactured a "need" by pulling in portions of communities who do not need or want a new water supply, who have not demonstrated water conservation and who may never ask for water from the diversion.

Since Waukesha has not met the legal and technical requirements set forth in the Great Lakes Compact, the CIC felt it was in the best interest of the Great Lakes region to have two independent engineering firms conduct an independent analysis of Waukesha's alternative water supplies.

The CIC retained GZA GeoEnvironmental, Inc. (GZA) and Mead & Hunt, Inc. to evaluate the City of Waukesha's water supply alternatives included in its application. The CIC also asked GZA and Mead & Hunt to evaluate alternative water supplies based on Waukesha's existing water service supply area since the proposed expanded service area included in its application does not legally adhere to the Great Lakes Compact.

The consultants excluded the neighboring communities of the City of Pewaukee and towns of Delafield, Genesee and Waukesha from the analysis. GZA also averaged the City of Waukesha's actual historical water use data to forecast future demand rather than cherry picking the largest year of consumption as Waukesha did when forecasting future industrial need. GZA and Mead & Hunt used the same exact assumptions found in the City of Waukesha's application when considering cost, the extent to which conservation

measures will be implemented in the future, population growth, and how much water the City of Waukesha is expected to use any given day.

The findings, formally compiled in the accompanying Non-Diversion Solution report, conclude that Waukesha can use its existing deep and shallow water wells to provide ample clean and healthy water to their residents now and in the future if they simply invest in additional water treatment infrastructure to ensure the water supply meets state and federal standards going forward. The Non-Diversion Solution costs dramatically less than a diversion, avoids a regulatory morass and secures independence for Waukesha residents, protects public health, and minimizes environmental impact.

The CIC is confident that the Non-Diversion Solution is a better way forward for the City of Waukesha, its residents, and the Great Lakes region as a whole.

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The Compact Implementation Coalition, collectively representing tens of thousands of Wisconsinites, has a long history of working on the Great Lakes Compact. From ensuring the adoption and implementation of a strong Great Lakes Compact to aiding the Department in the promulgation of administrative rules to implement the Compact, it has consistently advocated for the strongest protections available for the Great Lakes, in keeping with the spirit and the letter of the Compact.

Members of the Coalition include:

Clean Wisconsin
Midwest Environmental Advocates
Milwaukee Riverkeeper
National Wildlife Federation
River Alliance of Wisconsin
Waukesha County Environmental Action League
Wisconsin Wildlife Federation
Peter McAvoy, of counsel

The coalition wishes to thank the Charles Stewart Mott Foundation and the Joyce Foundation for their generous funding in support of this work.

The CIC is encouraging any concerned citizens to stay apprised of any further developments by visiting www.protectourgreatlakes.org

GZA
GeoEnvironmental, Inc.

Engineers and Scientists

July 9, 2015
File No. 20.0154335.00

Clean Wisconsin
634 West Main Street, Suite 300
Madison, Wisconsin 53703
Attention: Mr. Ezra Meyer, Water Resources Specialist

Milwaukee Riverkeeper
1845 North Farwell Avenue, Suite 100
Milwaukee, Wisconsin 53202
Attention: Ms. Jennifer Bolger Breceda, Executive Director

Re: Non-Diversion Alternative Using Existing Water Supply With Treatment
City of Waukesha Water Supply
Waukesha, Wisconsin

Global Water Center
247 Freshwater Way,
Suite 542
Milwaukee, Wisconsin
53204

414-831-2540

www.gza.com

Dear Mr. Meyer and Ms. Bolger Breceda:

In accordance with our June 17, 2015 conference call with representatives of the Wisconsin Department of Natural Resources (WDNR), GZA GeoEnvironmental, Inc. (GZA) has performed a review of water demand forecasts related to the evaluation of water supply alternatives for the City of Waukesha, Wisconsin. GZA is pleased to submit this summary of our evaluation to Clean Wisconsin and Milwaukee Riverkeeper (collectively, the "Client").

In the Draft Technical Review for the City of Waukesha's Proposed Diversion of Great Lakes Water for Public Supply with Return Flow to Lake Michigan, issued on June 25, 2015, the WDNR states the following:

- The City of Waukesha is without adequate supplies of potable water due to the drawdown in the deep sandstone aquifer and the presence of radium in its current groundwater water supply, and has no reasonable water supply alternative in the Mississippi River basin (MRB); and

- All of the proposed MRB water supply alternatives are similar in cost to the Lake Michigan alternative, yet none is as environmentally sustainable or as protective of public health as the proposed Lake Michigan water source.

As presented herein, the Non-Diversion alternative, which allows for the continued use of the City of Waukesha's ("City") existing well infrastructure with new radium treatment, represents the most cost-effective and technically feasible alternative to meet the existing and future water supply demands for the City. This alternative was developed by the Compact Implementation Coalition ("Coalition") following a thorough review of the declining water demands since 1970, and groundwater level rebound in the deep sandstone aquifer since 2000. It is protective of both human health

and the environment. Most importantly, the engineering cost analyses, which were developed by Mead & Hunt, Inc. (Mead & Hunt) using conservative engineering and the principal assumptions used by the City, confirm the non-diversion alternative represents about one-half of the cost of the diversion alternative on a 50-year net present worth basis.

BACKGROUND

The City submitted an Application for Lake Michigan Supply to the WDNR in May 2010, proposing to use Lake Michigan water with return flow to meet its long range water supply planning needs. The Application was based on the City's eligibility to apply for a new Great Lakes diversion with return flow in accordance with the Great Lakes-St. Lawrence River Basin Water Resources Compact ("Compact"). With extensive review of the 2010 application and request from WDNR for additional evaluation, the City submitted a revised Application for a Lake Michigan Diversion with Return Flow in 2013.[1] The revised application included an evaluation of six water supply alternatives: the continued use of the existing deep and shallow wells was referenced as Alternative 1 and the proposed diversion from Lake Michigan was referenced as Alternative 2. As discussed in the City's revised application Volume 2,[2] the City proposed an average water demand of 10.1 million gallons per day (mgd) and a peak water demand of 16.7 mgd.

Based on our discussions, it is understood that Client has reviewed the Compact and other related information and, as stated by the Coalition, has determined that the water demand forecasts and water supply alternatives proposed by the City are legally inconsistent with the Compact for two primary reasons. First, whereas the Compact requires that an applicant seeking a diversion must first demonstrate "the Community within a Straddling County…is without adequate supplies of potable water."[3] Waukesha's proposed Water Service Supply Area (WSSA) includes portions of neighboring communities, including the City of Pewaukee and the Towns of Delafield, Genesee and Waukesha, which have demonstrated *no need*, imminent or otherwise, for additional supplies of potable water.[4] Second, the inclusion of these neighboring communities in Waukesha's proposed WSSA contravenes the conservation requirements of both the regional Compact and Wisconsin's implementing statute;[5]

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[1] CH2MHill, 2013, Application Summary, City of Waukesha Application for a Lake Michigan Diversion with Return Flow.

[2] CH2MHill, 2013, City of Waukesha Water Supply Service Area Plan, Volume 2 of 5.

[3] Compact, Art. 4, sec. 4.9.3.a.; see also Wis. Stat. 281.346(4)(e)1.a, providing that "[t]he community is without adequate supplies of potable water."

[4] We do understand, through communications with our Client based on their communication with WDNR staff, that there may be a relatively small number of individual parcels in one or more locations adjacent to Waukesha's current water supply service area where existing water quality concerns may suggest hooking up to water utility service would be advantageous. This alternative could allow for those connections.

[5] Compact Art. 4, sec.4.9.4.a: "[t]he need for all or part of the proposed Exception cannot be reasonably avoided through the efficient use and conservation of existing water supplies"; see also Wis. Admin. Code NR 852, providing an applicant for a diversion under the Great Lakes Compact must implement specified conservation efficiency measures *before* submitting an application for a diversion.

specifically, none of these communities, or portions thereof, have initiated, much less met, required conservation and efficiency parameters. Accordingly, as requested by the Client, we have based the City's water demand forecasts and water supply alternatives exclusively on the City's existing WSSA.

In accordance with our proposal dated May 25, 2015, and our subsequent discussions, GZA has performed the following scope of work:

- Reviewed water demand forecasts for the existing WSSA and the City without expanding to include neighboring communities;
- Reviewed the existing radium data and, with technical support provided by Mead & Hunt, evaluated the potential of meeting radium water quality standards with treatment and blending; and
- Reviewed information related to the rebound and sustainability of the deep sandstone aquifer.

GZA reviewed the following documents and available data for the evaluation of water demand forecasts and consideration of water supply alternatives:

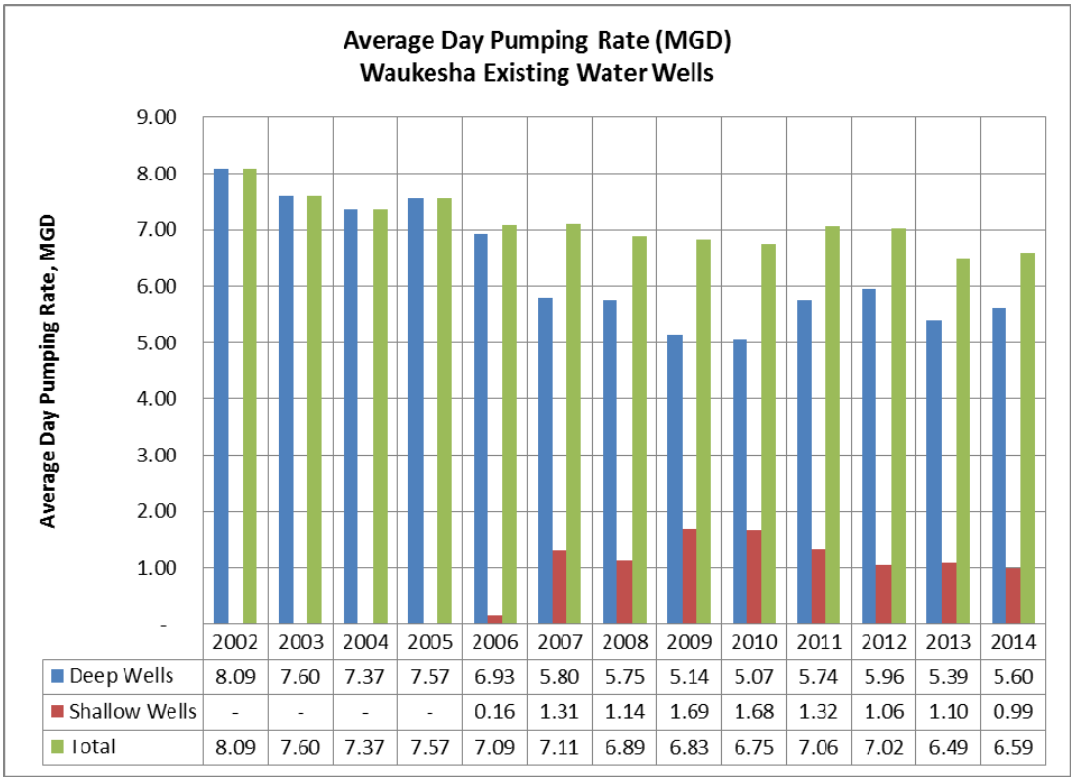
- Average day pumping rates from 2002 to 2014 (Waukesha Water Utility data);
- The City's Revised Application of 2013;
- An Analysis of the City's Diversion Application (Nicholas, 2013);[6]
- Radium data for the City's wells (downloaded from the WDNR);
- Proposed water supply alternative and cost estimates provided by Mead & Hunt,[7] who was previously retained by Client;
- Select Southeastern Wisconsin Regional Planning Commission (SEWRPC) and United States Geological Survey (USGS) reports; and
- Formal meetings with the WDNR on March 26 and June 17, 2015.

The following provide a summary of our review and evaluation.

[6] Nicholas, Jim, February 2013, "An Analysis of the City of Waukesha Diversion Application."
[7] Mead & Hunt, July 2015, "City of Waukesha 6.7 MGD Water Demand Alternative."

AVERAGE DAY PUMPING RATE

The average day pumping rate data for individual City of Waukesha wells from 2002 to 2014, are summarized in the attached Table 1, and grouped by deep water wells and shallow wells, as shown in Figure 1 below.



	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
Deep Wells	8.09	7.60	7.37	7.57	6.93	5.80	5.75	5.14	5.07	5.74	5.96	5.39	5.60
Shallow Wells	-	-	-	-	0.16	1.31	1.14	1.69	1.68	1.32	1.06	1.10	0.99
Total	8.09	7.60	7.37	7.57	7.09	7.11	6.89	6.83	6.75	7.06	7.02	6.49	6.59

Figure 1 – Average Day Pumping Rate, City of Waukesha Water Wells

As shown in Figure 1, the total average day pumping rate decreased from approximately 8.1 mgd to 7.1 mgd over the period from 2002 to 2006. Since 2006, the total average day pumping rate fluctuated from approximately 6.5 mgd to 7.1 mgd. During this same period of time, the estimated population in the City grew from 66,237 in 2002, to 71,697 in 2012 (Appendix of Application, Volume 2), indicating a general trend of declining per capita water use since 2006.

According to the City's Application, Volume 3, the City commits to expand its water conservation and efficiency measures, targeting an additional total water use reduction of approximately 0.5 mgd by 2030, and 1 mgd by 2050.

With the installation and initial operation of three shallow aquifer wells in 2006, the pumping rates of the deep aquifer wells decreased, ranging from approximately 5.1 mgd to 6.0 mgd over the period from 2007 to 2014, and the pumping rates of the shallow aquifer wells ranged from approximately 1 mgd to 1.7 mgd over the period from 2007 to 2014.

As indicated above, the average day pumping rate decreased and the population of the City increased over the period from 2002 to 2012, indicating a general trend of declining per capita water use. In addition, the average day pumping rate of the deep aquifer wells decreased since the operation of three shallow aquifer wells in 2007.

WATER DEMAND FORECASTS

The City's Application water demand forecasts were based on the following assumptions:

1. The WSSA, by 2030, will be expanded to include areas beyond the City's existing WSSA, including parts of the City of Pewaukee and the Towns of Genesee, Waukesha and Delafield;

2. Population will grow at a rate of 0.5% per year;

3. The average water usage from 2002 to 2012 was used in the water demand forecasts, including 44 gallons per capita day (gpcd) for residential customers, 33 gpcd for commercial and 4 gpcd for public customers;

4. For industrial customers, a value of 1,297 gallons/acre/day, which is equivalent to industrial water use intensity in the year 2000, was used;

5. The maximum day demand is 1.66 times greater than average day demand;

6. Unaccounted for water was projected at 8% of total water pumping; and

7. The City will continue expanding the conservation program to meet the City's 10% water saving target, with specific goals of 0.5 mgd by 2030, and 1 mgd at ultimate buildout.

GZA's evaluation is focused on assumptions 3 and 4, namely the assumed gpcd for residential, commercial, public and industrial water usage.

Industrial Water Uses

As discussed in Appendix C of the City's Application, Volume 2, the Application uses the industrial usage of year 2000 (1,297 gallons/acre/day) for water demand forecast, while the average industrial usage from 2008 to 2012 was 642 gallons/acre/day. It appears that the City considered the SEWRPC Industrial Usage Projection of 1,500 gallons/acre/day[8] and decided to use the 2000 usage for future projection.

[8] SEWRPC, December 2010, "A Regional Water Supply Plan for Southeastern Wisconsin."

As of 2010, approximately 1,452 acres of land within the City were developed for industrial use and it was estimated that the total industrial acreage will be approximately 1,832 acres at the ultimate buildout[9] of an expanded WSSA. The additional industrial acreage, approximately 380 acres, consists of 191.1 acres of undeveloped land zoned for industrial use in the City, 37.6 acres of developed industrial land in the Town of Genesee, 81.5 acres of undeveloped land zoned for industrial uses in the Town of Waukesha and 70.2 acres of developed industrial land in the Town of Waukesha (City's Application, Volume 2).

According to the City's Application, Volume 2, Appendix C, the total developed industrial land was approximately 1,395 acres in the City in 2000, and increased to 1,452 acres in 2010. However, the industrial water usage decreased from 660.4 million gallons per year in 2000, to 326.3 million gallons per year in 2010, or 1,297 gallons/acre/day in 2000 to 616 gallons/acre/day in 2010, indicating decreasing industrial water usage per acre per day by more than 50%.

Similarly, a decreasing trend was observed for industrial water usages if measured by gpcd. As shown in Table 2, Historical Per Capita Consumption, copied from Attachment C, Appendix C of Application Volume 2, industrial consumption was approximately 27.9 gpcd in 2000, but decreased since then, and the average industrial usage from 2008 to 2012 was 13.3 gpcd, a decrease of more than 50% of that in 2000. The City's water demand forecast for industrial uses for 2030 is equivalent to 27.4 gpcd; for 2050, it is 24.3 gpcd. Both of those estimates are significantly higher than the actual industrial average of 13.3 gpcd from 2008 to 2012.

Historical GPCD

The historical, total gpcd data shown in the attached Table 2 is plotted in Figure 2 below. Overall, the total gpcd for Waukesha shows a linear decreasing trend from 1970 to 2012, with an R Squared value, a statistical measure of how close the data are to the fitted regression line, of 0.96. The City's forecast is equivalent to 108 gpcd for 2030, and 105 gpcd for 2050, which is equivalent to the total gpcd in 2003 or 2004, and ignores the decreasing water demand trend from 2003 to 2012. Therefore, the City's demand forecast is not consistent with the historical trends of declining water use in all land use categories, as shown on Table 2, and the continued trend of declining water use over the period from 2008 to 2014, the most recent data available.

[9] CH2MHill, 2013, City of Waukesha Water Supply Service Area Plan, Volume 2 of 5.

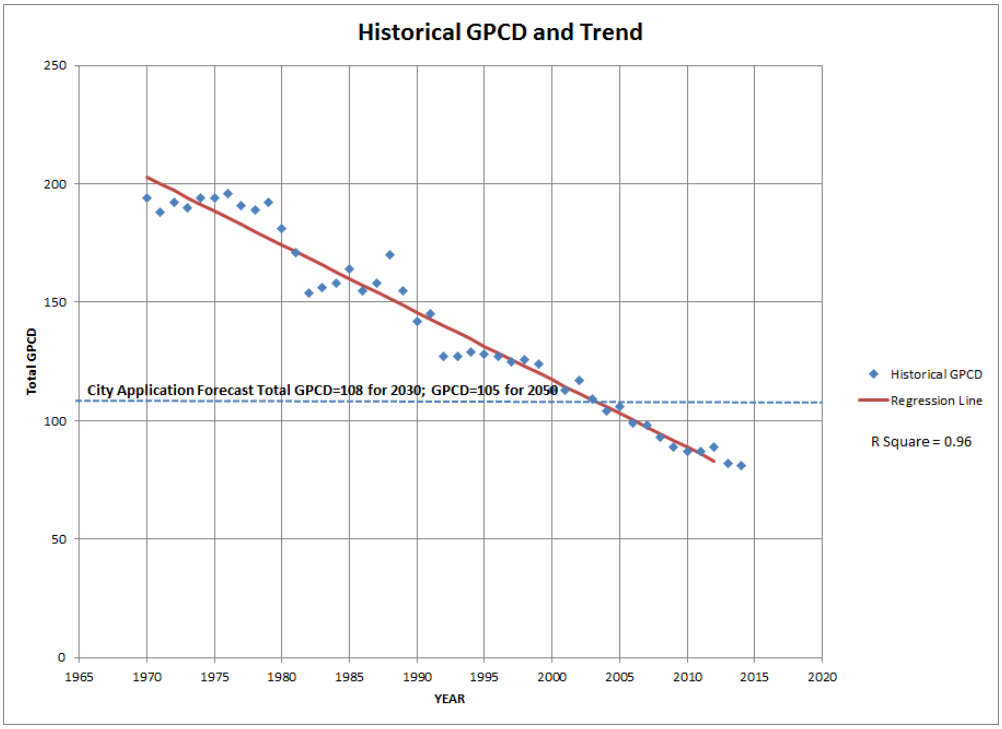


Figure 2: Historical GPCD and Trend

Proposed Water Demand Forecast

To simplify the forecast approach, we utilized gpcd for industrial, residential, commercial and public sectors, as discussed in Nicholas, 2013. This approach also has the benefit of having historical water usage data for all of the user categories over the years. To utilize data most representative and conservatively expected of the observed trend in decreasing water demand, GZA proposed to use five recent years of available water consumption data (from 2008 to 2012). As previously indicated and presented on Table 2, the continued decline in water use was also observed in 2013 and 2014, the most recent data available. The data used by GZA is considered conservative, as it does not include the additional decline in 2013 and 2014.

Land Use	Average GPCD (2008-2012)
Residential	40.3
Commercial	31.6
Public	3.9
Industrial	13.3
Total:	**89.1**

Based on the above land use distribution and the City's estimate of unaccounted water and effects of planned conservation measures, the estimated water demand for 2030 is as follows:

Projection	City (Existing WSSA)
2030 Population	71,105
Total Water Usage (89.1 GPCD), mgd	6.3
Unaccounted Water (8%), mgd	0.504
Conservation 10% or 0.5 mgd, whichever is less	-0.5
Total Average Day Demand, mgd	**6.3**
Maximum Day (1.66 Factor), mgd	**10.5**

The water demand for ultimate buildout of the existing WSSA is estimated as below:

Projection	City (Existing WSSA)
Ultimate Buildout Population	76,330
Total Water Usage (89.1 GPCD), mgd	6.8
Unaccounted Water (8%), mgd	0.544
Conservation 10% or 1 mgd, whichever less	-0.68
Total Average Day Demand, mgd	**6.7**
Maximum Day (1.66 Factor), mgd	**11.1**

As previously indicated and presented in the attached Table 2, the gpcd for the most recent years of 2013 and 2014, declined even further from the 2008 to 2012 average, confirming the conservative estimate used by GZA.

WATER SUPPLY ALTERNATIVE

Based on the above water demand forecasts for the existing WSSA at the ultimate buildout, Mead & Hunt of Marquette, Michigan evaluated the existing water wells in the City and proposed the following alternative consistent with the above analysis, including GZA's future demand forecasts:[10]

[10] Mead & Hunt, July 2015, "City of Waukesha 6.7 MGD Water Demand Alternative."

Water Source	Demand (msg)		Supply Wells	Treatment Facilities	Transmission Facilities
	Avg. 6.7 mgd	Max. 11.1 mgd			
Deep Confined Aquifer (existing wells)	5.7 mgd	9.6 mgd	7 existing wells; Well Nos. 3, 5, 6, 7, 8, 9, 10	3 new reverse osmosis treatment plants at Well Nos. 6, 8 and 10. Existing hydrous manganese oxide treatment at well 3.	Improvement for the 4.3 miles of existing distribution piping system. 7.0 miles of new piping for blending.
Shallow Aquifer (existing wells)	1.0 mgd	1.5 mgd	3 existing wells; Well Nos. 11, 12, 13	Existing groundwater treatment plant for iron and manganese removal for wells 11 and 12	

This water supply alternative utilizes the City's existing deep aquifer wells and shallow aquifer wells, the existing treatment plants at Well Nos. 3, 11 and 12, with three new reverse osmosis (RO) treatment plants at Well Nos. 6, 8 and 10. Well No. 2, expected to be abandoned in the near future, is not included. The existing distribution piping system will be improved and a new piping system, approximately 7 miles long, will be constructed to transmit water between the deep wells for blending and distribution.

RADIUM CONCENTRATIONS

Radium is present in the existing deep water wells (see Attachment 1 for plots of radium levels before treatment). Some of the deep wells complied with the radium water quality standard of 5 picocuries per liter (pCi/L), while others exceeded it. As discussed in Mead & Hunt's July 7, 2015 report,[11] the three new RO treatment plants proposed for the three largest existing deep wells will treat the well water for radium, total dissolved solids and gross alpha. With continued blending of water from all the wells outside of the distribution system, the proposed alternative is expected to meet water quality standards.

GZA performed a statistical evaluation of the pre-treatment total radium concentrations (sum of radium-226 and radium-228) and post-treatment total radium concentrations for the Waukesha water supply wells, and estimated the 95% upper confidence level

[11] Mead & Hunt, July 7, 2015, "City of Waukesha 6.7 MGD Water Demand Alternative."

(UCL) on the mean of the pre-treatment radium concentrations and post-treatment radium concentrations for each deep aquifer well, using United States Environmental Protection Agency (USEPA) statistical software ProUCL.[12] 95% UCLs are generally used as exposure concentrations for human health risk assessment by the USEPA.[13] For the wells where new RO treatment plants will be installed, the post-treatment total radium concentrations are estimated to be 10% of the pre-treatment 95% UCLs, assuming a RO removal efficiency of 90%.[14] For Well No. 3, where the existing hydrous manganese oxide treatment will be continued, the post-treatment total radium concentrations are expected to be the same as the 95% UCL of the post-treatment total radium concentrations. To demonstrate the ability to comply with the radium standard, the historical annual pumping rates from 2002 to 2014 were considered for all wells and the blended radium concentrations calculated in consideration of the proposed treatment at Well Nos. 3, 6, 8 and 10. As shown in Table 3, the blended radium concentrations would be less than the drinking water standard of 5 pCi/L, especially when increasing pumping rates at Well Nos. 3, 6, 8 and 10 from 2008 to 2014. This evaluation indicates that a combination of treatment at select wells and blending with the remaining wells represents a feasible technology to reduce radium concentrations and meet water quality standards for the existing water well system.

COST ESTIMATE

Mead & Hunt provided a cost estimate for the proposed alternative. The capital costs and operation and maintenance costs are summarized below, with comparison to the Lake Michigan Diversion alternative proposed by the City.

Water Supply Alternative	Capital Cost ($ mil)	Annual O&M Cost ($ mil)	20-yr. Present Worth Cost ($ mil, 6%)	50-yr. Present Worth Cost ($ mil, 6%)
Lake Michigan with Return Flow (City Application)	207	8.0	299	334
Proposed Alternative (Ave 6.7 mgd, Max 11.1 mgd)	87.7	5.5	150.8	173.6

The proposed alternative provides water to the City from the existing water wells, with existing and new treatment facilities to meet water quality standards. Since no

[12] USEPA, September 2013, "ProUCL Version 5.0.00 Technical Guidance," EPA/600/R-07/041.
[13] USEPA, July 2004, "Risk Assessment Guidance for Superfund, Volume I: Human Health Evaluation Manual (Part E, Supplemental Guidance for Dermal Risk Assessment), Final," EPA/540/R/99/005.
[14] According to a USEPA document, the average RO removal efficiency is expected to be greater than 90%. See USPEPA, July 2005, "A Regulators' Guide to the Management of Radioactive Residuals from Drinking Water Treatment Technologies," EPA 816-R-08-004.

additional wells are needed, no additional impacts on private water wells nor environmental impacts to wetlands and surface waters are expected. The cost for the proposed alternative is significantly less than the Lake Michigan with Return Flow and other alternatives, as evaluated in the City's application.

GROUNDWATER SUSTAINABILITY

Groundwater sustainability in the deep sandstone aquifer is one of the critical factors in the evaluation of the City's water supply alternatives. As stated in USGS Circular 1186 (USGS, 1999),[15] groundwater sustainability is defined as:

> "development and use of ground water in a manner that can be maintained for an indefinite time without causing unacceptable environmental, economic, or social consequences."

Similar to the USGS definition, SEWRPC defined sustainability as:

> "the condition of beneficially using water supply resources in such a way that the uses support the current and probable future needs, while simultaneously ensuring that the resource is not unacceptably damaged by such a beneficial use."

and:

> "unacceptable damage is defined as a change in an important physical property of the groundwater or surface water system—such as water level, water quality, water temperature, recharge rate, or discharge rate—that approaches a significant percentage of the normal range of variability in that property. Impacts that are 10 percent or less of the annual or historic period of record range for any property will be considered acceptable, unless it can be shown that the cumulative effect of the change will cause a permanent change in an aquatic ecosystem by virtue of increasing the extremes of that property to levels known to be harmful."[16]

In a March 13, 2008 letter from SEWRPC to the Illinois State Water Survey,[17] it was further clarified that "[i]n the specific case of the deep sandstone aquifer, the term sustainability is being interpreted to mean that the potentiometric surface in that aquifer is maintained at current levels or raised based upon use and recharge conditions within Southeastern Wisconsin." According to SEWRPC's definition and interpretation for the deep sandstone aquifer, both the SEWRPC's modeling effort in 2005 (SEWRPC

[15] USGS, 1999, "Sustainability of Ground-Water Resources." USGS Circular 1186, Page 2.
[16] SEWRPC, December 2010, "A Regional Water Supply Plan for Southeastern Wisconsin." Volume I, Page 311.
[17] Evenson, Philip C., March 13, 2008, a letter to Mr. Derek Winstanley, D. Phil, Chief, Illinois State Water Survey (downloaded from http://www.isws.illinois.edu/wsp/watermgmtoptns.asp).

Model)[18] and the rising groundwater elevation data measured in a USGS monitoring well and Waukesha's pumping wells from 2000 to 2012, indicate that the deep sandstone aquifer is sustainable under the current (and our projected future) level of water demand.

The SEWRPC Model indicated pre-development groundwater elevation in the deep sandstone aquifer near the City pumping center was approximately 800 feet (SEWRPC Model, Figure 7, page 23); predicted drawdown in 2000 was approximately 450 feet near the pumping center in the City (SEWRPC Model, Figure 6B, Page 21). The predicted groundwater elevation in the deep sandstone aquifer in 2000 is inferred to be approximately 350 feet mean sea level (MSL), 150 feet higher than the top of the sandstone aquifer, which is approximately 200 feet above MSL in the City area,[19] as illustrated in the SEWRPC Model, Figure 2 (Page 8). The SEWRPC model results also indicated that if overall pumping remains constant at year 2000 rates and locations, little additional drawdown will occur in the deep aquifer system over the subsequent 20 years although the cone of depression will continue to spread laterally. The predicted, additional drawdown in 2020, if the 2000 pumping rate were maintained, is less than 16 feet, or approximately 4% of the 2000 drawdown in the area of the City of Pewaukee and the Village of Elm Grove, two adjacent communities to the City.

Recent water use and groundwater level data further indicate the groundwater level in the deep sandstone aquifer has not only stabilized, but is also rebounding. The total groundwater use, including both shallow and deep aquifers, for the seven counties has decreased from 96.26 mgd in 2000, to 95.38 mgd in 2005.[20] Separate regional pumping rates for the shallow aquifer and deep aquifer are not available, but it is believed that some other communities may have switched to shallow aquifer pumping, as the City later did, and have relied on shallow aquifer wells to meet part of their water demand. Groundwater level data from a USGS observation well located near the City well field indicated the groundwater level in the deep sandstone aquifer has rebounded approximately 100 feet to an elevation of approximately 450 feet MSL.

[18] SEWRPC, June 2005, "Simulation of Regional Groundwater Flow in Southeastern Wisconsin, Report 2: Model Results and Interpretation, Technical Report #41."
[19] Foley, F.C., Walton, W. C. and Drescher, W. J., 1953, "Ground-Water Condition in the Milwaukee Waukesha Area, Wisconsin," Plate 7, and Plate 8.
[20] SEWRPC, December 2010, "A Regional Water Supply Plan for Southeastern Wisconsin." Volume I, Table 29.

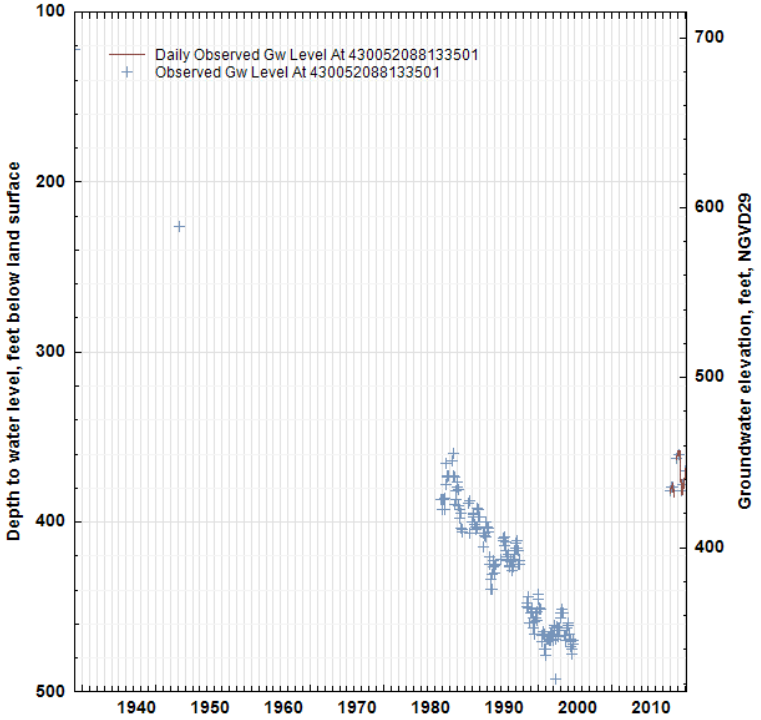


Figure 3: Groundwater Level Data, USGS Monitoring Well ID 430052088133501

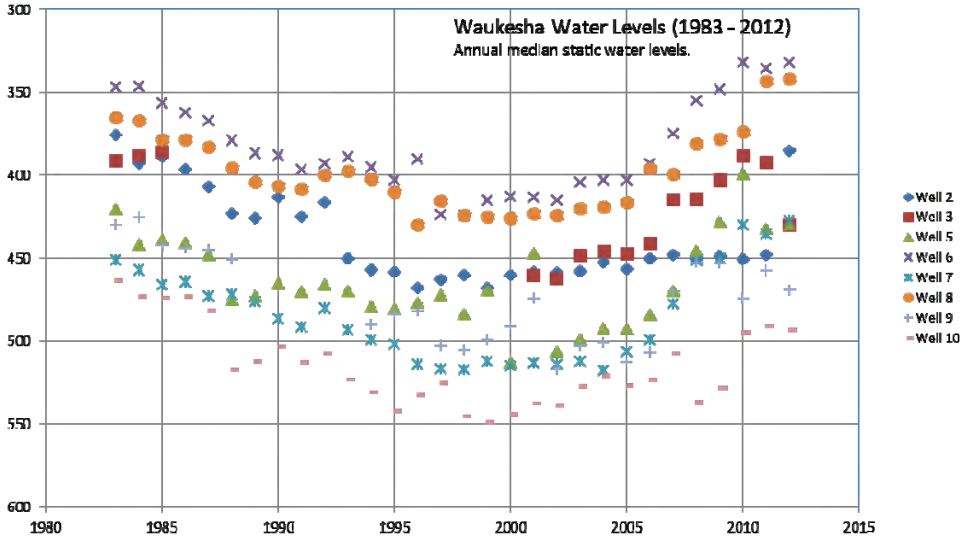


Figure 4: Groundwater Level Data, City of Waukesha Deep Aquifer Wells

As shown in Figure 4, groundwater levels in the City's deep pumping wells rebounded approximately 50 feet to 115 feet, with an average of approximately 80 feet, from 2000 to 2012. Based on approximate ground surface elevations at the well locations, groundwater elevations are estimated to range from approximately 390 feet to 505 feet

MSL in the deep aquifer wells in 2012, with an average of approximately 450 feet MSL, which is approximately 250 feet higher than the top of sandstone aquifer.

In summary, both the SEWRPC Model and the groundwater elevation data from 2000 to 2012, indicate that the groundwater elevation in the deep sandstone aquifer would be generally stabilized if the 2000 pumping rate were maintained, or raised if the deep aquifer pumping rate were less than the 2000 pumping rate. If the 2000 pumping rate were maintained, the additional drawdown in the deep sandstone aquifer is expected to be less than 4% of the historical drawdown in the subsequent 20 years. If the future pumping rates are less than the 2000 pumping rate, as the 2000 to 2012 data showed, the groundwater elevation in the deep sandstone aquifer is expected to rise. Based on this analysis, the deep sandstone aquifer appears to offer a sustainable water supply to meet the proposed water demand forecast. In addition, with this proposed water supply alternative, no additional impact to the surface water and wetlands are expected because no additional wells are proposed.

SUMMARY AND CONCLUSIONS

The non-diversion alternative represents the most cost-effective and technically feasible alternative to meet the existing and future water supply demands for the City. This alternative is protective of both human health and the environment and represents about one-half of the cost of the diversion alternative on a 50-year net present worth basis. Based on the above evaluation, GZA provides the following summary and conclusions:

- The City of Waukesha's Application has not incorporated the declining per capita trend evident in the historical water use data across customer classes;
- The predominant decline in demand appears to be derived principally by a lower demand by industrial users and the data shows that usage has been declining in residential and commercial uses as well;
- The declining water use and the City's reliance on shallow aquifer wells to satisfy part of the water demand has resulted in a rebound of water levels in the deep aquifer in the vicinity of Waukesha's deep aquifer well field. This condition, when combined with appropriate water demand forecasting for the City, will result in a sustainable water supply alternative for the City;
- Under this alternative, no additional water wells are proposed with no additional impact to surface waters and wetlands;
- Radium in the deep aquifer appears manageable and can meet the water quality standard by using RO treatment combined with blending; and
- The estimated cost for the proposed water supply alternative is approximately 50% of the City's Lake Michigan Diversion with Return Flow alternative.

With the additional water use and groundwater elevation data since the 2005 SEWRPC Model, GZA recommends revisiting the groundwater flow model using actual pumping rates from 2000 to 2014, and re-evaluating the predictive scenario with revised pumping rates based on data from 2001 to 2014. This will create a stronger groundwater management tool for WDNR and regional water users and more confident forecasting in the future.

We appreciate the opportunity to be of service to you. Please feel free to contact the undersigned at (414) 831-2540 with any questions.

Very truly yours,

GZA GeoEnvironmental, Inc.

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Attachments: Tables 1, 2 and 3
Attachment 1

TABLES

TABLE 1
Average Day Pumping Rates at City of Waukesha Water Wells

Year	Well 2	Well 3	Well 5	Well 6	Well 7	Well 8	Well 9	Well 10	Well 11	Well 12	Well 13	Deep well total	Shallow well total	Total	Source
2002	463,841	334,104	825,430	1,381,825	1,352,395	1,282,879	1,225,712	1,224,786				8,090,972	-	**8,090,972**	City Application
2003	446,107	793,071	518,764	1,067,364	1,040,474	1,057,096	1,141,740	1,538,008				7,602,624	-	**7,602,624**	City Application
2004	309,634	743,538	594,885	1,183,721	1,164,273	949,803	1,090,721	1,337,675				7,374,250	-	**7,374,250**	City Application
2005	170,110	573,523	544,290	1,434,058	848,107	879,455	1,450,849	1,671,685				7,572,077	-	**7,572,077**	City Application
2006	327,441	512,879	494,389	1,171,063	942,068	804,860	1,269,682	1,404,849	44,769	116,238	-	6,927,231	161,007	**7,088,238**	City Application
2007	514,345	745,216	484,592	617,260	955,671	1,318,490	187,008	972,970	431,888	879,200	-	5,795,552	1,311,088	**7,106,640**	City Application
2008	117,855	1,295,432	27,617	43,964	144,719	1,168,019	34,809	2,913,604	376,719	763,262	-	5,746,019	1,139,981	**6,886,000**	City Application
2009	299,918	1,268,134	408,181	354,164	605,238	789,773	-	1,414,411	272,548	716,718	703,797	5,139,819	1,693,063	**6,832,882**	City Application
2010	56,214	1,160,540	69,742	44,277	251,101	720,734	7,660	2,755,523	243,123	571,792	866,616	5,065,791	1,681,531	**6,747,322**	City Application
2011	22,603	865,307	205,638	858,419	448,444	1,053,882	8,447	2,273,063	208,677	491,984	621,962	5,735,803	1,322,623	**7,058,426**	City Application
2012	-	905,211	177,529	353,929	206,340	1,183,671	10,137	3,118,745	119,600	339,740	600,214	5,955,562	1,059,553	**7,015,115**	WDNR Web Site
2013	-	1,002,997	565,493	131,784	424,704	1,182,712	17,468	2,069,340	66,819	269,699	761,403	5,394,499	1,097,921	**6,492,419**	WDNR Web Site
2014		2,155,762	342,723	519,302	529,253	1,225,819	96,279	733,395	23,156	336,645	631,477	5,602,533	991,278	**6,593,812**	WDNR

Unit: gallons per day

Table 2
Historical Per Capita Consumption
Waukesha Water Utility
Waukesha, Wisconsin

Year	Estimated Population	Gallons Per Capita Per Day				
		Residential	Commercial	Industrial	Public	Total Sales
1970	39,695	56.8	19.1	106	11.7	194
1971	40,762	59.8	18.8	97.3	11.3	188
1972	41,829	57.7	18.8	102.5	11.3	192
1973	42,896	62.3	20.7	93.6	12.3	190
1974	43,963	63.9	20.5	95.8	12.9	194
1975	45,030	64.1	20.1	97.0	11.4	194
1976	46,097	72.3	18.6	91.5	11.4	196
1977	47,164	71.0	18.5	88.8	10.8	191
1978	48,231	68.8	18.9	89.5	10.9	189
1979	49,298	56.2	34.0	89.5	10.2	192
1980	50,365	54.8	33.2	82.4	9.7	181
1981	51,024	53.1	32.5	74.2	9.7	171
1982	51,684	50.7	30.9	61.9	9.2	154
1983	52,343	53.0	32.7	58.9	9.9	156
1984	53,002	51.3	32.3	65.4	8.7	158
1985	53,662	53.4	32.5	67.9	9.3	164
1986	54,321	49.4	32.6	63.9	8.7	155
1987	54,980	50.6	33.2	63.9	9.3	158
1988	55,639	58.3	35.7	66.3	9.3	170
1989	56,299	52.8	36.3	56.8	8.3	155
1990	56,958	49.8	34.8	49.6	7.7	142
1991	57,613	52.5	36.0	45.9	8.5	145
1992	58,268	49.9	37.4	35.0	4.8	127
1993	58,923	47.3	37.9	37.7	4.4	127
1994	59,578	49.5	38.9	35.4	4.8	129
1995	60,232	49.0	39.0	34.8	5.4	128
1996	60,887	48.9	38.7	34.3	5.4	127
1997	61,542	48.5	36.6	34.9	5.2	125
1998	62,197	48.9	36.9	35.1	5.1	126
1999	63,027	48.4	36.9	31.4	7.7	124
2000	64,825	45.1	35.9	27.9	4.6	113
2001	65,324	47.3	36.7	24.6	4.8	113
2002	66,237	49.0	37.8	25.3	4.9	117
2003	66,807	48.2	36.7	18.9	4.9	109
2004	66,816	45.8	35.0	17.8	5.0	104
2005	67,466	48.5	35.5	17.4	4.9	106
2006	68,117	43.3	34.5	17.1	4.4	99
2007	68,767	43.3	33.7	16.1	4.4	98
2008	69,417	41.7	32.7	15.1	3.9	93
2009	70,068	41.2	31.5	12.7	3.9	89
2010	70,718	39.4	31.1	12.6	3.6	87
2011	70,867	38.8	31.1	13.2	3.8	87
2012	71,697	40.2	31.6	12.8	4.4	89
2013	71,172	37.7	30.3	10.3	3.6	82
2014	70,847	36.7	30.2	10.5	3.6	81
Average (2008-2014)		39.4	31.2	12.4	3.8	86.8

Source: Table 2 of Attachment C, Appendix C of "City of Waukesha Water Supply Service Area Plan, Volume 2."
2013-2014 Data downloaded from http://psc.wi.gov/

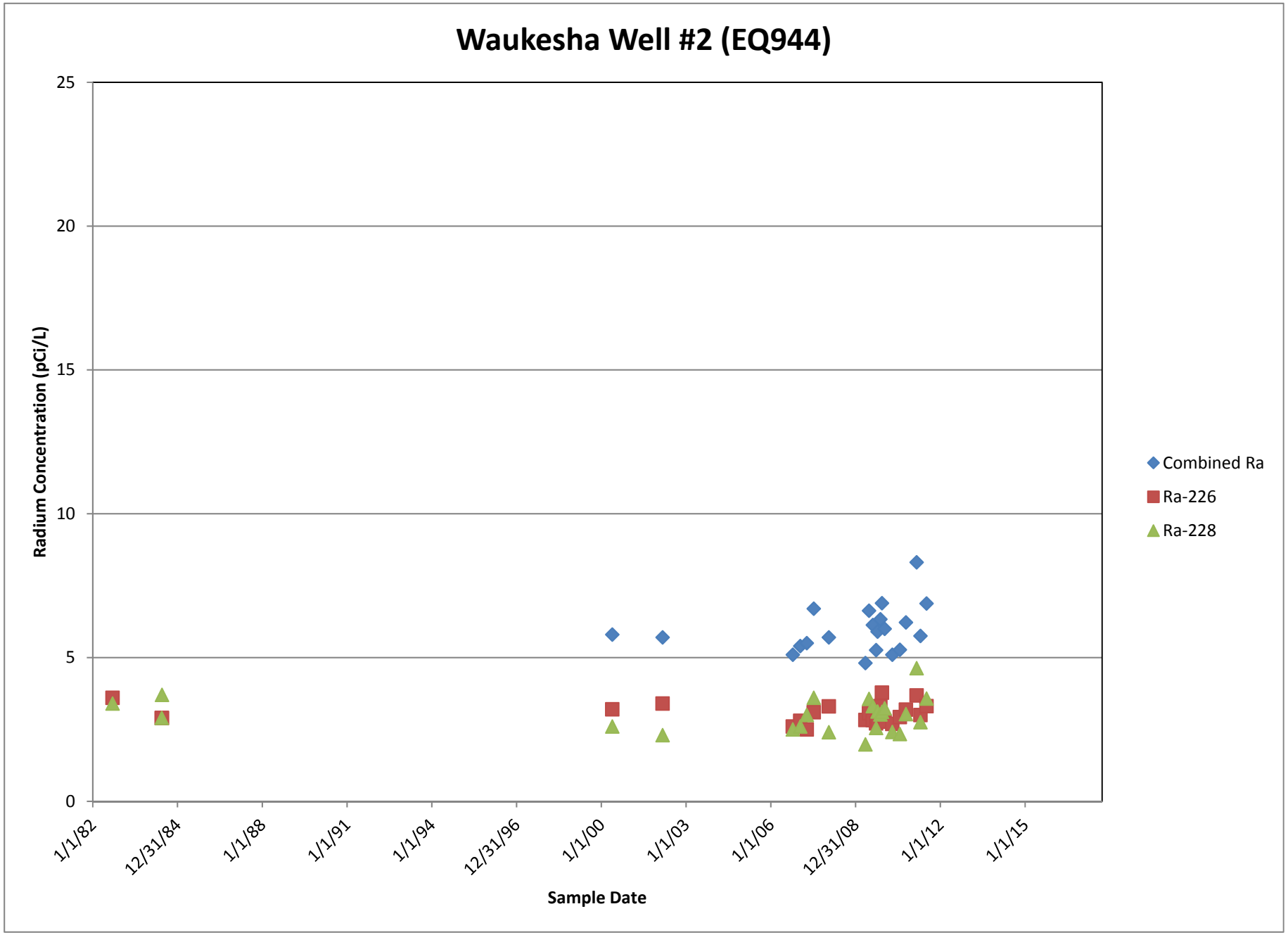
Table 3
Estimated 95% UCLs of Pre-treatment Radium Concentrations, and Post-Treatment Radium Concentrations
Blended Radium Concentrations

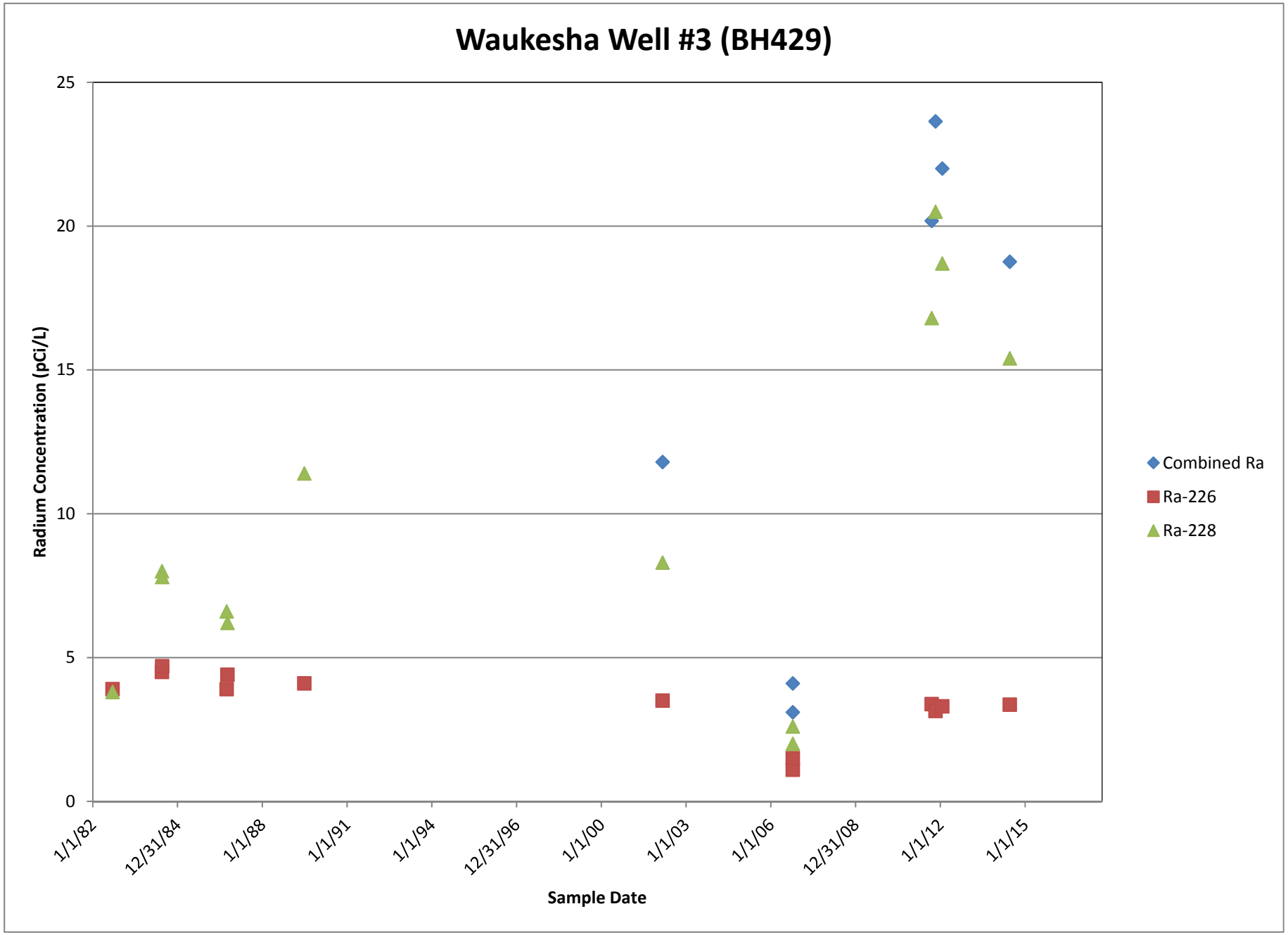
Year	Well 2	Well 3	Well 5	Well 6	Well 7	Well 8	Well 9	Well 10	Blended Concentration if Pumping at Previous Annual Rate, pCi/L
Pre-Treatment Radium Concentration (95 UCL), pCi/L	6.273	21.05	8.461	10.48	5.75	9.879	11.82	11.41	
Proposed Treatment Technology	None	Existing HMO	None	RO	None	RO	None	RO	
Post-Treatment Radium Concentration (Existing 95% UCL for Well 3, 90% Removal for RO at Wells 6, 8 and 10), pCi/L	6.3	3.963	8.5	1.0	5.8	1.0	11.8	1.1	
Annual Pumping Rate (MGD)									
2002	0.464	0.334	0.825	1.382	1.352	1.283	1.226	1.225	**4.65**
2003	0.446	0.793	0.519	1.067	1.040	1.057	1.142	1.538	**4.44**
2004	0.310	0.744	0.595	1.184	1.164	0.950	1.091	1.338	**4.50**
2005	0.170	0.574	0.544	1.434	0.848	0.879	1.451	1.672	**4.52**
2006	0.327	0.513	0.494	1.171	0.942	0.805	1.270	1.405	**4.67**
2007	0.514	0.745	0.485	0.617	0.956	1.318	0.187	0.973	**3.63**
2008	0.118	1.295	0.028	0.044	0.145	1.168	0.035	2.914	**2.07**
2009	0.300	1.268	0.408	0.354	0.605	0.790	0.000	1.414	**3.23**
2010	0.056	1.161	0.070	0.044	0.251	0.721	0.008	2.756	**2.17**
2011	0.023	0.865	0.206	0.858	0.448	1.054	0.008	2.273	**2.18**
2012	0.000	0.905	0.178	0.354	0.206	1.184	0.010	3.119	**1.93**
2013	0.000	1.003	0.565	0.132	0.425	1.183	0.017	2.069	**2.79**
2014	0.000	2.156	0.343	0.519	0.529	1.226	0.096	0.733	**3.25**

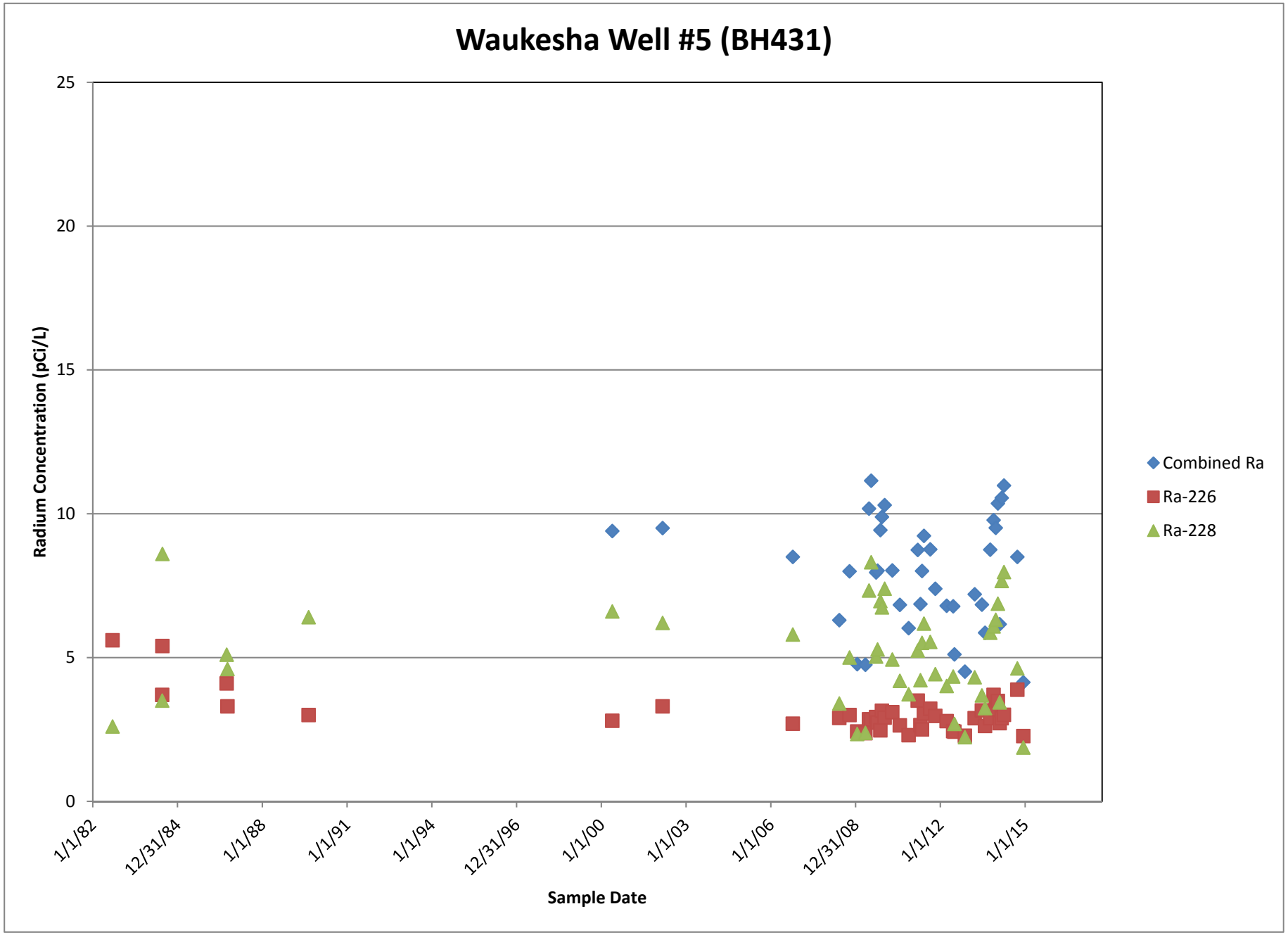
Note: RO denotes reverse osmosis; HMO denotes hydrous manganese oxide treatment.
The Maximum Contaminant Levels (MCLs) for combined radium is 5 pCi/L.

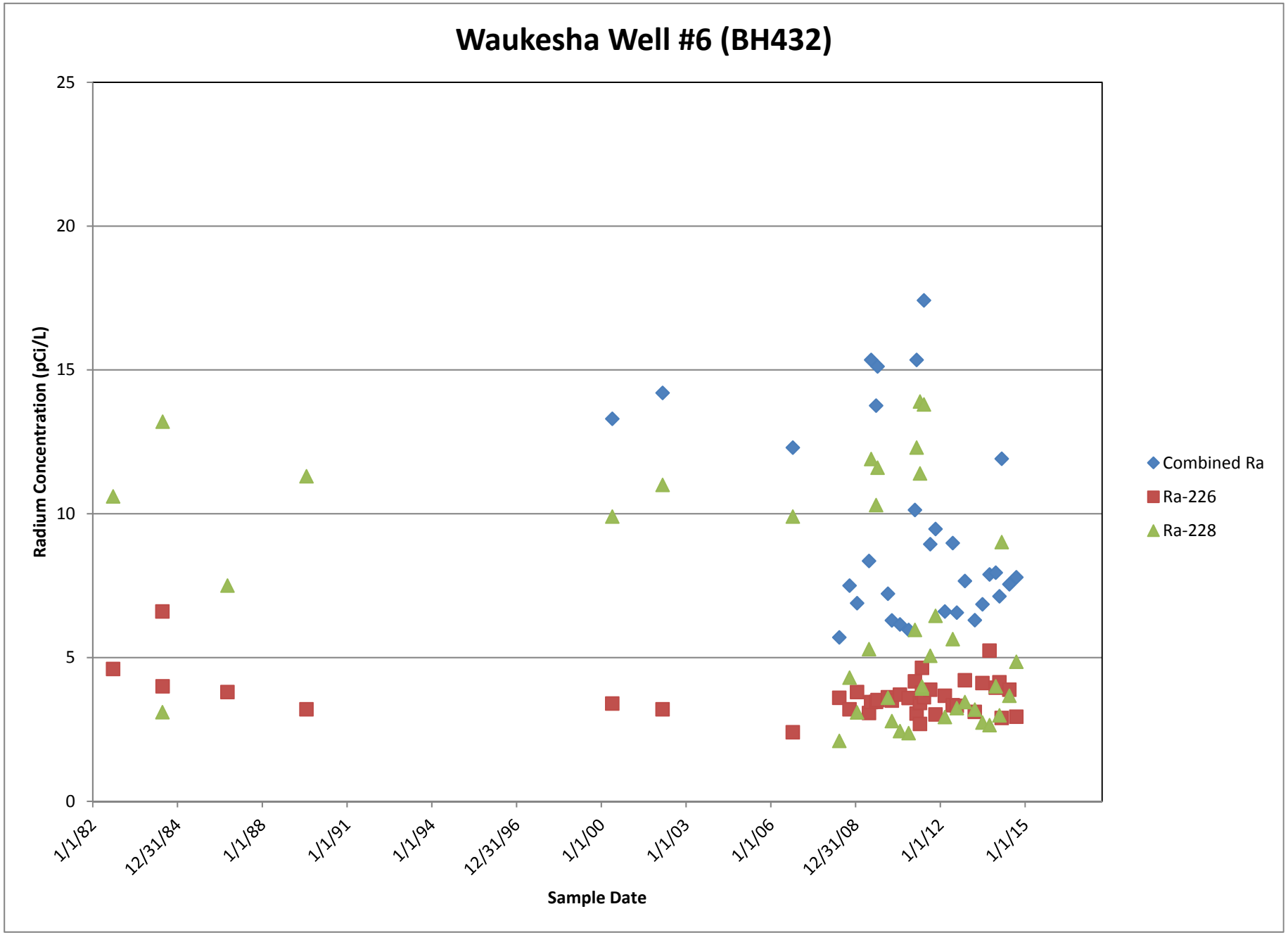
ATTACHMENT 1

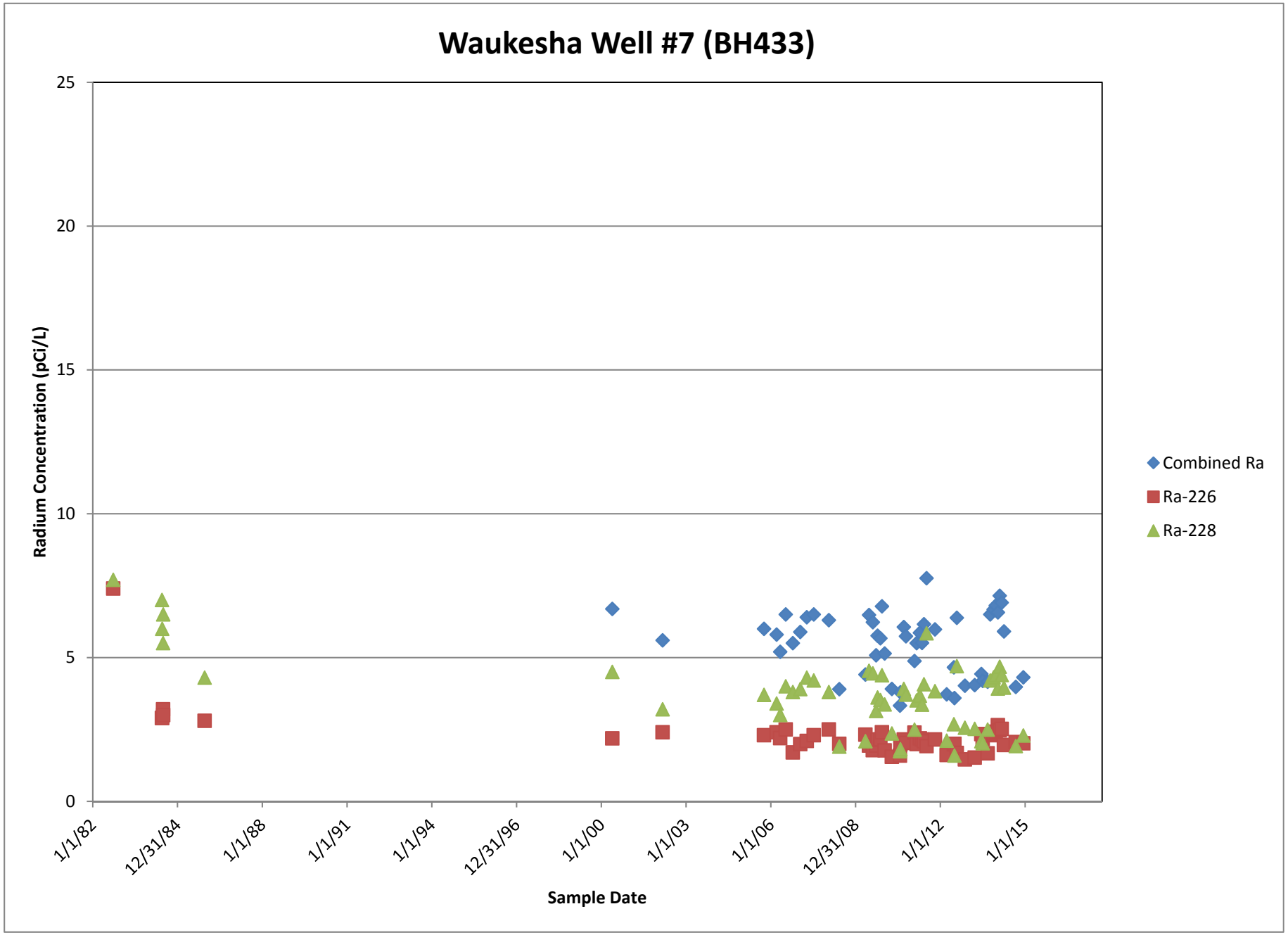
Plots of Pre-Treatment Radium Levels

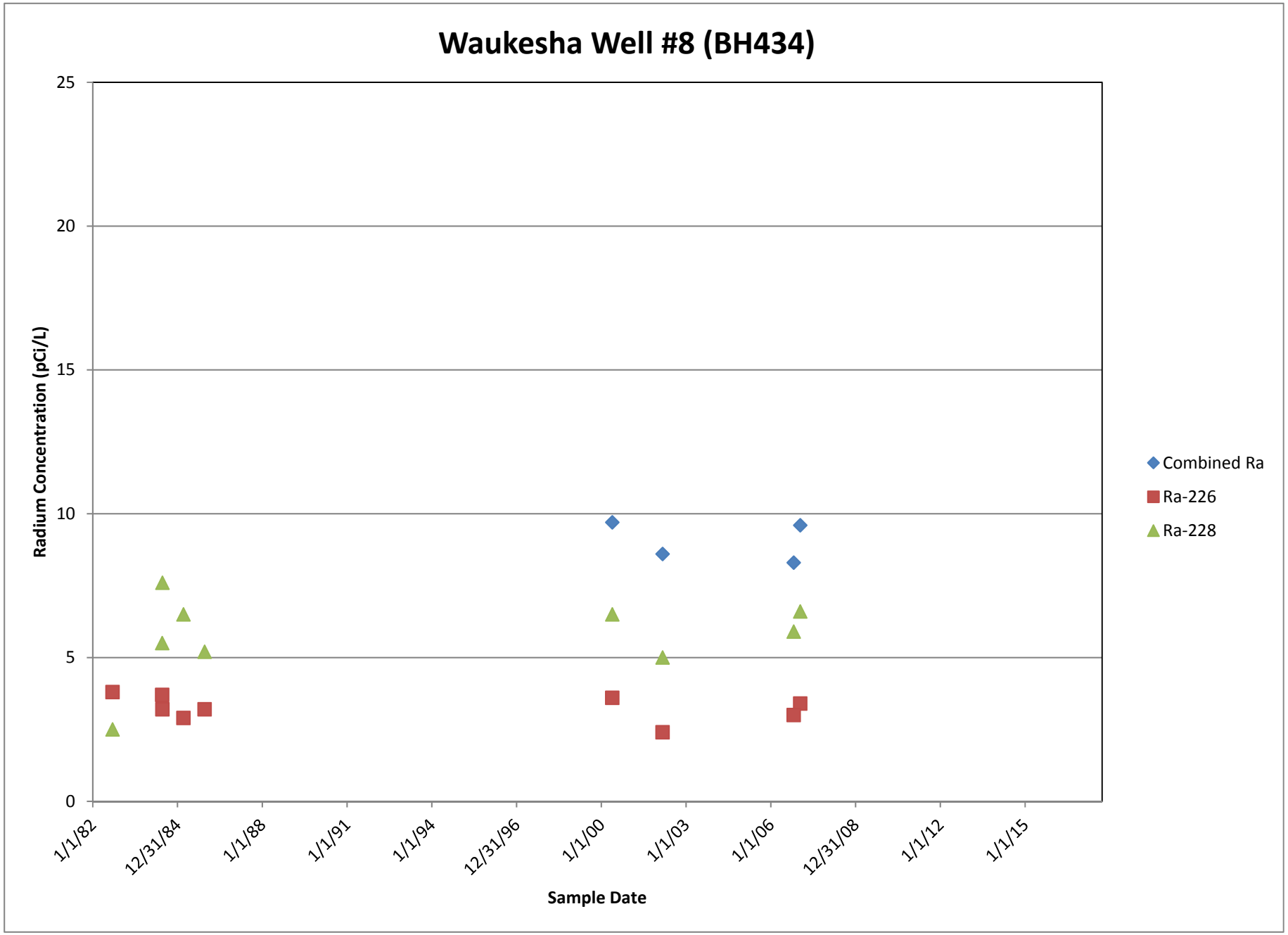

Waukesha Well #2 (EQ944)
Radium Concentration (pCi/L)
25
20
15
10
5
0
1/1/82
12/31/84
1/1/88
1/1/91
1/1/94
12/31/96
1/1/00
1/1/03
1/1/06
12/31/08
1/1/12
1/1/15
Sample Date
Combined Ra
Ra-226
Ra-228

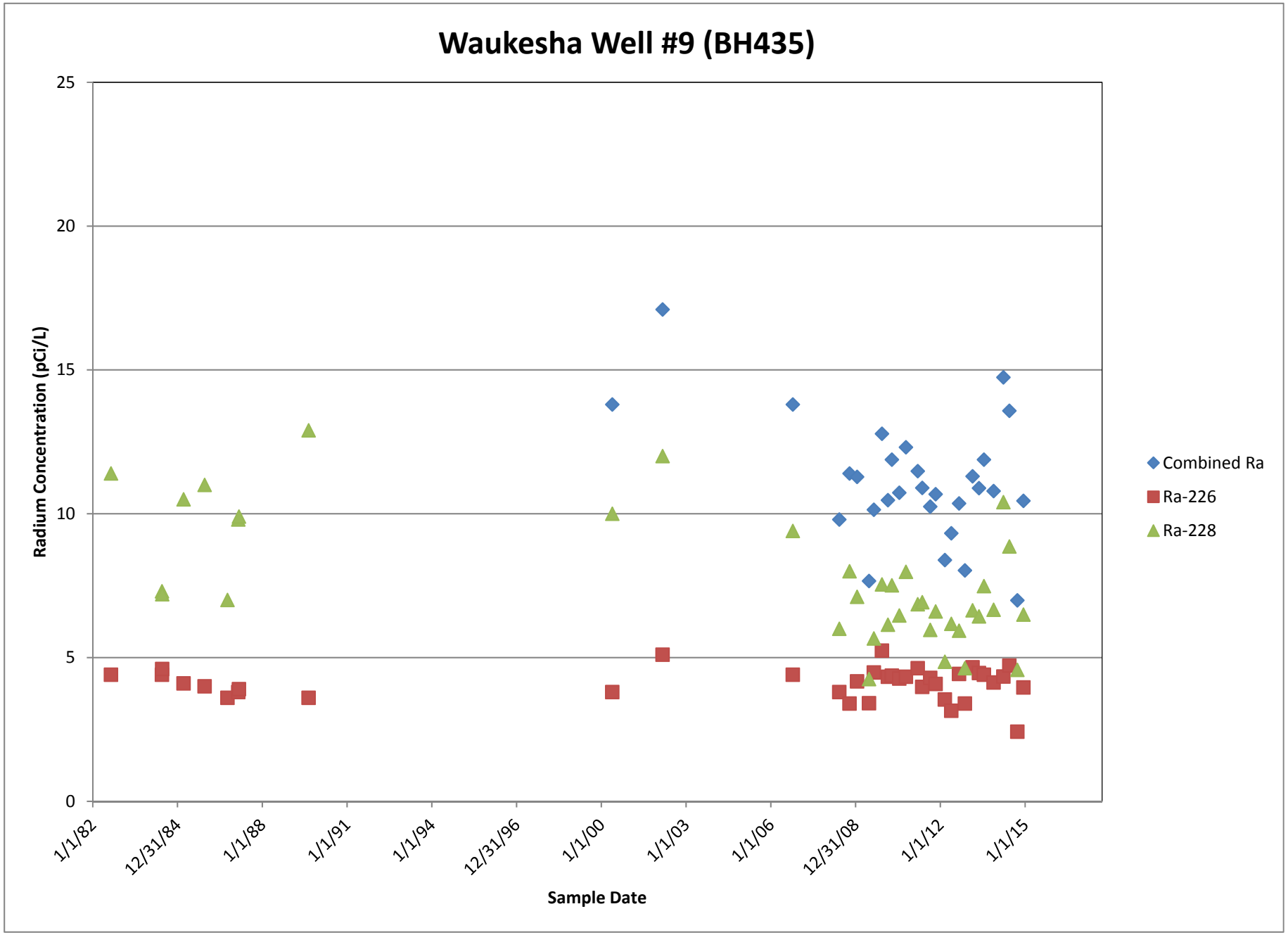

Waukesha Well #3 (BH429)
Radium Concentration (pCi/L)
25
20
15
10
5
0
1/1/82
12/31/84
1/1/88
1/1/91
1/1/94
12/31/96
1/1/00
1/1/03
1/1/06
12/31/08
1/1/12
1/1/15
Sample Date
Combined Ra
Ra-226
Ra-228

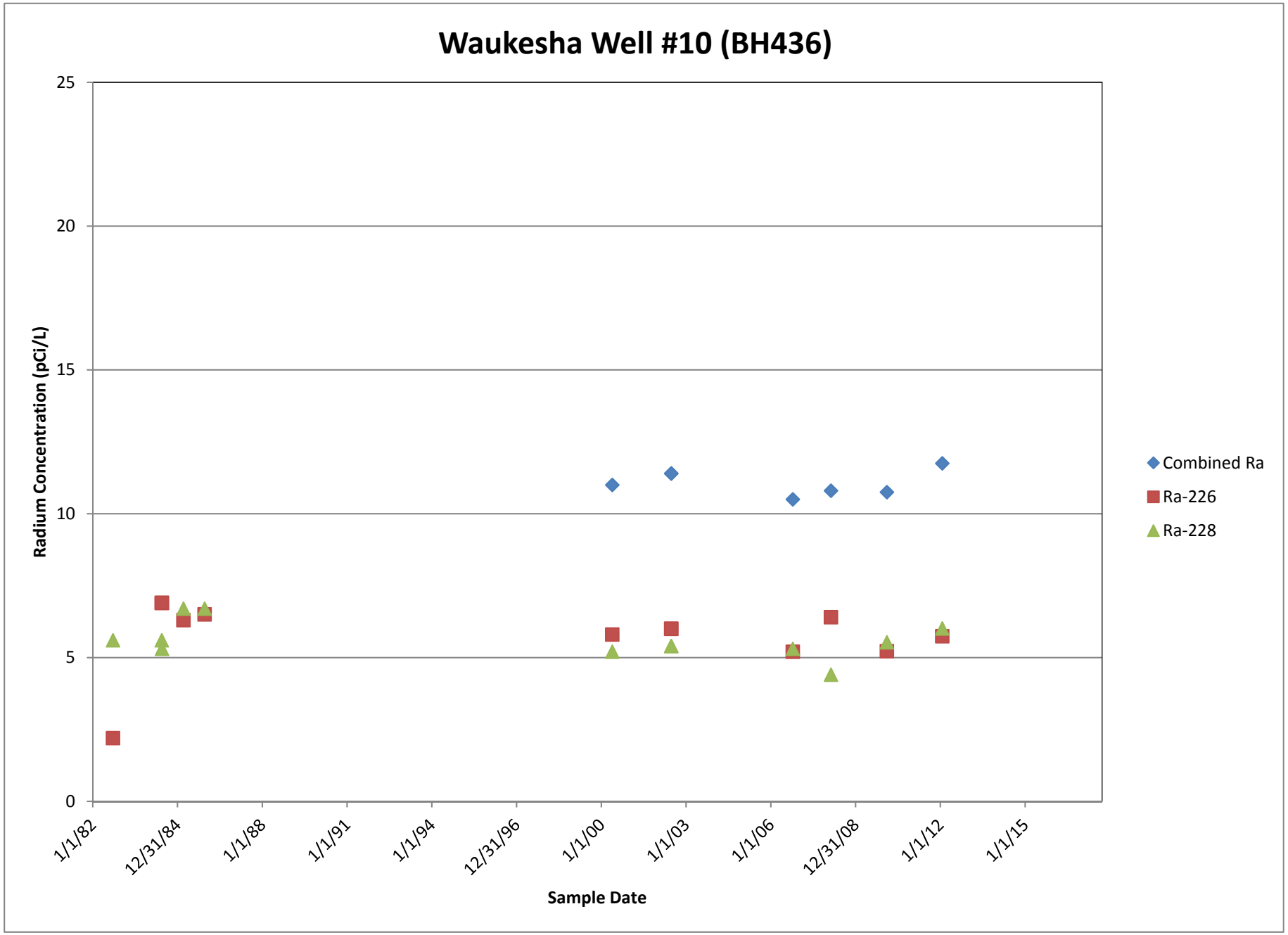

Waukesha Well #5 (BH431)
Radium Concentration (pCi/L)
25
20
15
10
5
0
1/1/82
12/31/84
1/1/88
1/1/91
1/1/94
12/31/96
1/1/00
1/1/03
1/1/06
12/31/08
1/1/12
1/1/15
Sample Date
Combined Ra
Ra-226
Ra-228


Waukesha Well #6 (BH432)
Radium Concentration (pCi/L)
25
20
15
10
5
0
1/1/82
12/31/84
1/1/88
1/1/91
1/1/94
12/31/96
1/1/00
1/1/03
1/1/06
12/31/08
1/1/12
1/1/15
Sample Date
Combined Ra
Ra-226
Ra-228


Waukesha Well #7 (BH433)
Radium Concentration (pCi/L)
25
20
15
10
5
0
1/1/82
12/31/84
1/1/88
1/1/91
1/1/94
12/31/96
1/1/00
1/1/03
1/1/06
12/31/08
1/1/12
1/1/15
Sample Date
Combined Ra
Ra-226
Ra-228


Waukesha Well #8 (BH434)
Radium Concentration (pCi/L)
25
20
15
10
5
0
1/1/82
12/31/84
1/1/88
1/1/91
1/1/94
12/31/96
1/1/00
1/1/03
1/1/06
12/31/08
1/1/12
1/1/15
Sample Date
Combined Ra
Ra-226
Ra-228


Waukesha Well #9 (BH435)
Radium Concentration (pCi/L)
25
20
15
10
5
0
1/1/82
12/31/84
1/1/88
1/1/91
1/1/94
12/31/96
1/1/00
1/1/03
1/1/06
12/31/08
1/1/12
1/1/15
Sample Date
Combined Ra
Ra-226
Ra-228


Waukesha Well #10 (BH436)
Radium Concentration (pCi/L)
25
20
15
10
5
0
1/1/82
12/31/84
1/1/88
1/1/91
1/1/94
12/31/96
1/1/00
1/1/03
1/1/06
12/31/08
1/1/12
1/1/15
Sample Date
Combined Ra
Ra-226
Ra-228

Appendix 2

Water supply systems' compliance with Maximum Contaminant Level (MCL) standard

SYSTEMS EXCEEDED AN MCL FOR GROSS ALPHA, RADIUM, RADON

Totals			
Yes	**No**	**Inactive**	**Total**
76	11	21	108

ID	Name	Currently in compliance
26701048	ALLENTON SANITARY DISTRICT	Yes
15401122	ALLIANT UTILITIES & WP&L CO BELOIT	Yes
40504552	ALLOUEZ WATERWORKS	Yes
40504563	ASHWAUBENON WATERWORKS	Yes
40504596	BELLEVUE TN SANITARY DIST #1	Yes
42402162	BERLIN WATERWORKS	Yes
12200892	BOSCOBEL WATERWORKS	Yes
23000505	BRISTOL WATERWORKS TOWN OF	Yes
26802534	BROOKFIELD WATER UTILITY	Yes
11401390	BROWNSVILLE WATERWORKS	No
25201770	BURLINGTON WATERWORKS	Yes
25201803	CALEDONIA WEST UTIL DIST- CADDY VISTA	INACTIVE
42004611	CAMPBELLSPORT WATERWORKS	Yes
23000648	CAROL BEACH ESTATES WTR UTIL	INACTIVE
26802314	CITY OF PEWAUKEE WATER & SEWER UTILITY - HIGHLAND COOP	INACTIVE
26802149	CITY OF PEWAUKEE WATER & SEWER UTILITY - MAIN	No
73701694	COLBY WATERWORKS	Yes
43804365	COLEMAN WATERWORKS	No
26501277	COUNTRY ESTATES SANITARY DISTRICT TOWN OF LYONS #1	Yes
25201869	CRESTVIEW UTILITY DISTRICT	INACTIVE
42402250	DALTON WATERWORKS	Yes
40504530	DE PERE WATER DEPARTMENT	Yes
26846424	DELAFIELD WATERWORKS	Yes
61702630	DOWNSVILLE SANITARY DISTRICT	Yes
26801984	EAGLE WATERWORKS	Yes
15401199	EDGERTON WATERWORKS	Yes
26500628	ELKHORN WATERWORKS	No
26802358	ETHAN ALLEN SCHOOL	INACTIVE
15400473	EVANSVILLE WATERWORKS	Yes
42004699	FOND DU LAC WATERWORKS	Yes
40803774	FOREST JUNCTION PUB UTIL	Yes
24105631	FRANKLIN WATER UTILITY	Yes
26500584	GENOA CITY WATERWORKS	Yes
26701059	GERMANTOWN WATER UTILITY	Yes

ID	Name	Currently in compliance
40503562	GREEN BAY WATERWORKS	Yes
45904540	GRESHAM WATERWORKS	Yes
26701103	HARTFORD WATERWORKS	Yes
40507269	HOLLAND TN SANITARY DIST	Yes
40504684	HOWARD WATERWORKS	Yes
65600876	HUDSON WATERWORKS	Yes
11401489	HUSTISFORD WATERWORKS	Yes
12801041	JEFFERSON WATERWORKS	Yes
12801074	JOHNSON CREEK WATERWORKS	Yes
44503360	KAUKAUNA ELECTRIC & WATER DEPT	Yes
44503426	KIMBERLY WATERWORKS	Yes
12201079	LANCASTER WATERWORKS	Yes
40516256	LAWRENCE TN SANITARY DIST #1	Yes
40514188	LEDGEVIEW TN SANITARY DIST #2	Yes
44304931	LENA WATERWORKS	No
11401511	LOMIRA WATERWORKS	Yes
11302379	MARSHALL WATERWORKS	No
42004655	MARY HILL PARK SANITARY DIST	Yes
11400576	MAYVILLE WATERWORKS	Yes
61702685	MENOMONIE WATERWORKS	Yes
12300783	MONROE WATERWORKS	Yes
26802094	MUKWONAGO WATERWORKS	Yes
26817417	MUSKEGO WATER UTILITY	Yes
26802171	NEW BERLIN WATER UTILITY	Yes
42004050	NORTH FOND DU LAC WATERWORKS	Yes
44304953	OCONTO WATERWORKS	No
43804420	PESHTIGO WATERWORKS	Yes
26802292	PEWAUKEE VILLAGE WATERWORKS	Yes
23001682	PLEASANT PRAIRIE INDUSTRIAL PK	INACTIVE
23001671	PLEASANT PRAIRIE WATER UTILITY	Yes
42402195	PRINCETON WATERWORKS	Yes
40500713	SCOTT WATER UTILITY DIST	Yes
44503371	SEYMOUR WATERWORKS	Yes
13300771	SOUTH WAYNE WATERWORKS	Yes
25201990	SOUTHERN WISCONSIN CENTER	Yes
26802336	SUSSEX VILLAGE HALL & WATER UTILITY	No
42004787	TAYCHEEDAH CORRECTIONAL INST	INACTIVE
64202545	TOMAH WATERWORKS	No
26802380	WAUKESHA WATER UTILITY	No
47103540	WINNECONNE WATERWORKS	Yes
40510316	SUAMICO WATERWORKS	Yes
25202001	UNION GROVE WATERWORKS	Yes
25202023	WATERFORD WATERWORKS	Yes
24105664	FRANKLIN ESTATES	INACTIVE
46903219	RAWHIDE YOUTH HOMES	Yes
24105609	SECURITY ACRES SUBD	INACTIVE

ID	Name	Currently in compliance
44504207	APRIL AIRE MOBILE HOME PARK	INACTIVE
26827955	ARBORS THE	Yes
40513066	BIRCH CREEK ESTATES	INACTIVE
26802765	BROOKFIELD HILLS APARTMENTS	Yes
47104629	EDISON ESTATES MHP	INACTIVE
75001454	FAIRVIEW VILLAGE MHP	INACTIVE
26509076	GENEVA NATIONAL GOLF CLUB	Yes
40517686	HARBOR LIGHTS DEVELOPMENT	INACTIVE
11401588	HIDDEN MEADOWS WELLS 2 & 4	Yes
26501431	INTERLAKEN RESORT AND VILLAGE	Yes
73701672	KILTYS KOUNTRY KOURT	INACTIVE
26802105	LAKE LORE WATER TRUST	INACTIVE
26802281	LAKE MEADOWS WATER TRUST	Yes
25202045	LAKEVIEW SPECIALTY HOSPITAL	Yes
11401302	MAJESTIC HILLS	INACTIVE
11401566	MARSHVIEW TERRACE	No
24105818	MONACO HEIGHTS SUBDIVISION	INACTIVE
11404393	NORTH HILLS MHP	Yes
26802413	NORTHVIEW FACILITY	INACTIVE
26810861	OAKTON BEACH CONDOMINIUMS	Yes
45904683	RICHMOND ESTATES	Yes
44304942	RUSTIC ACRES MHP	Yes
12801052	ST COLETTA OF WISCONSIN	INACTIVE
44504064	SUNSET WELL COOP 1	INACTIVE
61802906	VILLA DIANN MHP	Yes
24607429	WHITE COACH CONDOS	Yes
24109184	WHITNALL GARDEN APARTMENTS	Yes
42007988	WOODLAND PARK	Yes

SYSTEMS THAT INSTALLED TREATMENT FOR GROSS ALPHA, RADIUM, RADON THAT DID NOT EXCEED AN MCL

Totals			
Yes	**No**	**Inactive**	**Total**
15	0	2	17

ID	Name	Currently in compliance
73701485	ABBOTSFORD WATERWORKS	Yes
73701496	ATHENS WATERWORKS	Yes
44508673	BEAR CREEK WATERWORKS	Yes
77201630	BETHEL NURSING & REHAB CENTER	Yes
26863254	CAMBRIDGE PLACE OF DELAFIELD	Yes
26824061	CARRIAGE HILLS CONDOMINIUMS	Yes
44501171	DARBOY SANITARY DIST 1	Yes
26501134	DELAVAN WATERWORKS	Yes
44516076	FREEDOM SANITARY DISTRICT	Yes
44502788	GREENVILLE SANITARY DIST	Yes
25223902	LAKEVIEW LANDING	INACTIVE
46903967	MARION WATERWORKS	Yes
26822433	PARK AT ELM GROVE	INACTIVE
86105503	STETSONVILLE WATERWORKS	Yes
61003371	THORP WATERWORKS	Yes
44504229	VAN HANDELS MOBILE HM PK 2	Yes
11401313	WAUPUN UTILITIES	Yes

*Data compiled using information provided by Public Water Supply Section of the Wisconsin Department of Natural Resources in combination with Wisconsin DNR Drinking Water data from the Wisconsin DNR Drinking Water System for Public Water Supply Systems (prodoasext.dnr.wi.gov/inter1/pws2$.startup)

Public Water Supply Systems

Use of treatment technologies to achieve compliance

SYSTEMS EXCEEDED AN MCL FOR GROSS ALPHA, RADIUM, RADON

Totals				
WRT	**HMO**	**Ion**	**Pressure**	**Total**
3	7	15	6	31

ID	Name	Currently in compliance UPDATED	Compliance option
26827955	ARBORS THE	Yes	WRT absorptive media
26802534	BROOKFIELD WATER UTILITY	Yes	WRT absorptive media
26802149	CITY OF PEWAUKEE WATER & SEWER UTILITY - MAIN	No	WRT absorptive media**
26500584	GENOA CITY WATERWORKS	Yes	Hydrous Manganese Oxide treatment
26701059	GERMANTOWN WATER UTILITY	Yes	Hydrous Manganese Oxide treatment
12801041	JEFFERSON WATERWORKS	Yes	Hydrous Manganese Oxide treatment
12801074	JOHNSON CREEK WATERWORKS	Yes	Hydrous Manganese Oxide treatment
44503360	KAUKAUNA ELECTRIC & WATER DEPT	Yes	Hydrous Manganese Oxide treatment
11401511	LOMIRA WATERWORKS	Yes	Hydrous Manganese Oxide treatment
42402195	PRINCETON WATERWORKS	Yes	Hydrous Manganese Oxide treatment
42402162	BERLIN WATERWORKS	Yes	Ion Exchange treatment
40803774	FOREST JUNCTION PUB UTIL	Yes	Ion Exchange treatment
45904540	GRESHAM WATERWORKS	Yes	Ion Exchange treatment
40507269	HOLLAND TN SANITARY DIST	Yes	Ion Exchange treatment
11401489	HUSTISFORD WATERWORKS	Yes	Ion Exchange treatment
25202045	LAKEVIEW SPECIALTY HOSPITAL	Yes	Ion Exchange treatment
42004655	MARY HILL PARK SANITARY DIST	Yes	Ion Exchange treatment
26810861	OAKTON BEACH CONDOMINIUMS	Yes	Ion Exchange treatment
45904683	RICHMOND ESTATES	Yes	Ion Exchange treatment
25201990	SOUTHERN WISCONSIN CENTER	Yes	Ion Exchange treatment
40510316	SUAMICO SANITARY DIST #1	Yes	Ion Exchange treatment
25202001	UNION GROVE WATERWORKS	Yes	Ion Exchange treatment
61802906	VILLA DIANN MHP	Yes	Ion Exchange treatment
24109184	WHITNALL GARDEN APARTMENTS	Yes	Ion Exchange treatment
47103540	WINNECONNE WATERWORKS	Yes	Ion Exchange treatment
23000505	BRISTOL WATERWORKS TOWN OF	Yes	Pressure sand filtration
25201770	BURLINGTON WATERWORKS	Yes	Pressure sand filtration
42004611	CAMPBELLSPORT WATERWORKS	Yes	Pressure sand filtration

ID	Name	Currently in compliance UPDATED	Compliance option
11400576	MAYVILLE WATERWORKS	Yes	Pressure sand filtration
44503371	SEYMOUR WATERWORKS	Yes	Pressure sand filtration
13300771	SOUTH WAYNE WATERWORKS	Yes	Pressure sand filtration

**The City of Pewaukee successfully treated for radium using WRT Absorptive Media; one of their wells has recently fallen out of compliance and the city is in the process of installing WRT Absorptive Media system on that one well to come back into compliance

SYSTEMS THAT INSTALLED TREATMENT FOR GROSS ALPHA, RADIUM, RADON THAT DID NOT EXCEED AN MCL

Totals		
N/A	RO	Total
14	1	15

ID	Name	Currently in compliance UPDATED	Compliance option
73701485	ABBOTSFORD WATERWORKS	Yes	Don't have info
73701496	ATHENS WATERWORKS	Yes	Don't have info
44508673	BEAR CREEK WATERWORKS	Yes	Don't have info
77201630	BETHEL NURSING & REHAB CENTER	Yes	Don't have info
26863254	CAMBRIDGE PLACE OF DELAFIELD	Yes	Don't have info
26824061	CARRIAGE HILLS CONDOMINIUMS	Yes	Don't have info
44501171	DARBOY SANITARY DIST 1	Yes	Don't have info
26501134	DELAVAN WATERWORKS	Yes	Don't have info
44516076	FREEDOM SANITARY DISTRICT	Yes	Don't have info
44502788	GREENVILLE SANITARY DIST	Yes	Don't have info
46903967	MARION WATERWORKS	Yes	Don't have info
86105503	STETSONVILLE WATERWORKS	Yes	Don't have info
61003371	THORP WATERWORKS	Yes	Don't have info
44504229	VAN HANDELS MOBILE HM PK 2	Yes	Don't have info
11401313	WAUPUN UTILITIES	Yes	Reverse Osmosis

*Data compiled using information provided by Public Water Supply Section of the Wisconsin Department of Natural Resources in combination with Wisconsin DNR Drinking Water data from the Wisconsin DNR Drinking Water System for Public Water Supply Systems (prodoasext.dnr.wi.gov/inter1/pws2$.startup)

Appendix 3

An Analysis of the City of Waukesha Diversion Application

Focusing on Conservation and Efficiency Measures,
Demand Forecast, and Alternative Sources of Water Supply

Jim Nicholas
February 2013

Contents

Introduction

This paper presents an analysis of certain aspects of the City of Waukesha's Water Diversion Application (Application). The Application was submitted to Wisconsin DNR (WDNR) in May 2010. In addition to the Application, numerous other documents were submitted or referred to. Many of these are at WDNR's City of Waukesha Water Diversion Application web page. Documents reviewed in part or in whole are listed at the end of this paper.

The scope of this paper is limited to three aspects of the Application: conservation and efficiency measures, demand forecast, and sources of water supply. For sources the focus is on hydrologic and environmental aspects of withdrawals in the Application. Issues related to economic factors and return flows to Lake Michigan, for instance, are not addressed. The author assumes readers are familiar with the Application and related documents, so material from documents is not presented again in this paper; rather it is referred to and is described only to provide insight into analyses.

The goal of this paper is to provide an objective scientific analysis of particular aspects of the Application. The author is a scientist and an experienced hydrologist. He is neither an opponent nor a proponent of the Application. This paper contains no recommendations for actions by any parties.

The Application is for water to meet the needs of a service area that is not congruent with the City of Waukesha's current utility. Information in the Application regarding water sources, conservation measures, and demand is not presented separately for the parts of the service area outside of the City of Waukesha. Therefore, this paper assumes that facts and figures presented, in the Application and associated documents, are for the service area, unless documents specify otherwise. Where this paper refers to Waukesha water conservation measures, demand forecasts, and water sources, "Waukesha" refers to the service area for which the Application was made.

Water Conservation and Efficiency Measures

This section describes Waukesha's water conservation and efficiency measures (CEMs). It summarizes which CEMs have been implemented, which are still planned, and water savings for each, if available.

Regardless of the source of Waukesha's future water supply, water conservation is an essential part of the City's long-term strategy to meet future demands. Waukesha adopted a Water Conservation and Protection Plan in 2006 and updated it in 2012 as the Final Water Conservation Plan (FWCP). This plan describes water conservation and implementation strategies for all use sectors. The program will be evaluated annually and formally updated in 2016.

The FWCP sets a goal of 10 percent savings in water demand by 2050, based on the 2050 average day demand projection of 10.9 Mgd. Interim goals are savings of 0.2 Mgd by 2016 and 0.5 Mgd by 2030, with a final goal of 1.0 Mgd by 2050.

The principal CEMs are focused on 5 areas:

- Monitoring unaccounted for water and focusing on leak detection and repair;
- Promoting water conservation through public information and education campaigns;
- Replacing high-use fixtures by providing users with financial incentives;
- Reducing lawn sprinkling through ordinances; and
- Reducing average day and maximum day demand using inclining water rate block structures.

No specific water conservation targets are set for each CEM, except for fixture replacement. Rather they collectively are expected to meet the goals for 2016, 2030, and 2050.

Implemented CEMs

Unaccounted for water CEM—Waukesha has fairly low percentage of unaccounted for water, about 6 percent, with some variability from year to year. This is well below the average of 18 percent for large municipal systems in Wisconsin reported in Water Efficiency Potential Study (WEPS) for Wisconsin. It is also below AWWA's recommended 10 percent. Waukesha continues its leak detection and repair program, as well as auditing that can point to unaccounted for water. No specific amount of conserved water is associated with this CEM, because unaccounted for water continues to hover around 6 percent and is expected to do so in the future.

Public information and education CEM— According to WEPS, EPA estimates a 3 to 5 percent reduction in water use as a result of information and education programs. Waukesha has promoted conservation through a variety of media and methods. In 2011, Waukesha spent $16,545 on these efforts, according to their Report on Water Conservation Programs to the Public Service Commission of Wisconsin (PSC). Although no specific amount of conserved water is associated with this CEM, it is a critical part of ensuring success in rebate programs, outdoor watering, inclining water rate block structures, and reducing overall demand.

Fixture replacement rebate CEM—Waukesha launched a toilet rebate program in October 2008, with a goal stated in the Application of saving 0.5 Mgd by 2050. From inception through 2011, the program has resulted in replacements of 88 toilets at a cost of $25 per toilet. According to the Report on Water Conservation Programs the savings over this time period was 1,430,825 gallons or 0.001 Mgd. Waukesha estimates a savings of 15,000 gallons per year per toilet in the Application. Thus to reach the 2050 goal of 0.5 Mgd savings, the total number of toilets that would need to be replaced is a little over 12,000 or 300 per year between 2011 and 2050. Possibly the Application meant to refer to replacement of other fixtures besides toilets, because

the FWCP sets a goal of 7,444,000 gallons saved over 5 years (2112-2016), which equates to about 99 toilets per year.

The PSC's Summary of 2010 Utility Water Conservation Reports is a summary of water conservation efforts for eight utilities required to report these to the PSC. The number of toilet rebates for these utilities ranged from 14 to 2504, the latter for a city three times bigger than Waukesha (table 1). Waukesha had 17 toilet rebates. The amount of water saved per rebate was quite variable, ranging from 2000 to 12,000 gallons per year. Waukesha's was 8000 gallons per year. This is significantly less than, nearly half, the amount Waukesha estimated to save in the Application, which was 15,000 gallons per year per toilet. Thus, there is some uncertainty with respect to projections of water savings from the toilet rebate program.

Reported Water Savings from Toilet Rebate Programs in Wisconsin (CY 2010)

Utility	Number of Toilet Rebates	Estimated Water Savings (Gallons)	Estimated Water Savings per Rebate (Gallons)	Estimated Water Savings (Mgd)
Janesville Water Utility	104	335,809	3,229	0.0009
Kaukauna Water Utility	95	1,144,440	12,047	0.003
Madison Water Utility	2,504	18,345,151	7,326	0.05
Marshfield Utilities	54	108,000	2,000	0.0003
New Berlin Water Utility	77	820,000	10,649	0.002
Sun Prairie Utilities	14	34,829	2,488	0.0001
Waukesha Water Utility	**17**	**137,064**	**8,063**	**0.0004**
Total	2,865	20,925,293	7,304	0.0567

Source: Table 2 in 2010 PSC Conservation Summary.

Table 1. Reported water savings from toilet rebate programs in 2010 for eight water utilities in Wisconsin.

According to WEPS, toilets account for nearly 30 percent of indoor water consumption. Average residential single-family water use per household is 30 GPD for a toilet. Based on 2010 Census data on the year homes were built, 85 percent of residential customers in Wisconsin are estimated to have 3.5 gallons per flush (gpf) toilets, 13 percent have 1.6 gpf, and 2 percent have 1.28 gpf toilets. The distribution in Waukesha has not been estimated.

Outdoor watering ordinance CEM—Waukesha implemented outdoor sprinkling restrictions for all customer classes in 2006. According to Waukesha's 2010 Water Conservation report to the PSC, the restrictions are applicable from May 1 to October 1. The restrictions ban daytime sprinkling from 9:00 a.m. to 5:00 p.m. Customers are allowed to irrigate two days a week

according to their address. According to WEPS, inefficient irrigation practices can cause observed water loss of 20 to 50 percent of outdoor water use.

In 2010, maximum day demand was 8.65 Mgd, which is 67 percent lower than the 2005 peak demand of 12.87. For the same time period, the difference in average day to maximum day demand decreased 61 percent. Although other factors affect maximum day demand, the sprinkling ordinance is likely a major factor in reducing it.

Inclining water rate block structures CEM—In 2007, Waukesha was the first city in Wisconsin to adopt an inclining water rate block structure. The structure is applicable to residential users. It sets different costs (or rates) for water according to the amount of use. Rate blocks are associated with different levels of quarterly use (for example, 0 to 10,000 gallons, 10,001 to 30,000 gallons, and over 30,001 gallons). Costs in the highest rate block are 40 percent higher than in the lowest rate block. The idea is to provide a price incentive for customers to use less water.

Since implementation of the inclining water rate block structure, residential water use has decreased. Over the same time period, water use has declined in the industrial, commercial, and public water use sectors also, so factors other than the inclining water rate block structure are likely causing a decline in water use in the residential sector. Still price incentives have been shown to significantly reduce water use, although adjustments in the number of rate blocks, the amounts of water associated with each, and the cost of water in each sometimes take several years to achieve desired results. Timely feedback (billing) to customers is also necessary so that decisions on use can be made. Monthly billing would likely influence water-use decisions more effectively than does quarterly billing. According to WEPS, EPA estimates that an inclining block rate structure can lead to a 5 percent overall reduction in water use.

Planned CEMs 2012 to 2016

Waukesha's current implementation strategy, outlined in the FWCP, is designed to develop a foundation for the programs in Year 1 (2012) through public education and incentives for residential customers, particularly the top 10 percent water users. Starting in Year 2 (2013), the program focus would expand to include incentives for commercial and industrial customers. As the program expands over the subsequent three years (2014 to 2016), additional measures would be emphasized to capture the greatest savings and the lowest costs. This plan is outlined in Table 8-5 in the FWCP.

Table 2, adapted from Table 8-1 in the FWCP, shows a projected 86 MG (0.24 Mgd) in water savings across all sectors in millions of gallons per year between 2007 and 2016. Waukesha's implementation schedule is outlined only until 2016, leaving some uncertainty about how the additional 0.26 Mgd in savings will be achieved by 2030. Furthermore, how Waukesha will achieve an additional 0.5 Mgd between 2030 and 2050 has not been described. That being said, plans need to remain flexible in order to be effectively budgeted and implemented. When the

Conservation Plan is reviewed again in 2016, Waukesha should know what its future water supplies will be and can better evaluate and adopt appropriate measures.

Total Projected Cumulative Water Savings										
User	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Residential	6.1	12	17.7	23	28.1	35.4	43.2	51	59.1	67
Commercial, Industrial, & Public	1.8	3.6	5.2	6.8	8.3	9.8	12.1	14.3	16.6	19.7
Total (Mgy)	7.9	15.5	22.9	29.8	36.4	45.2	55.3	65.4	75.8	86.8
Total (Mgd)	0.02	0.04	0.06	0.08	0.1	0.12	0.15	0.17	0.21	0.24

Table 2. Projected Waukesha water savings 2007-2016.

Unaccounted for Water CEM – As previously stated, unaccounted for water is relatively low in Waukesha. Waukesha will continue its leak detection and repair programs and water audits.

Public Information and Education CEM – Current measures already implemented will be further publicized and expanded in scope through 2016. Educational programs will expand into schools, from elementary to college campuses, such as Teach the Teacher workshops and course projects. Partnerships with coalitions throughout Waukesha County will strengthen and expand as well. Although this CEM is an essential part of any water conservation plan, no specific goal of water savings is associated with it.

Fixture Replacement Rebate CEM – Measures incentivizing fixture replacement will be expanded from 2012 to 2016 as well. For residential customers, the toilet rebate program will provide $100 rebates, rather than the current $25, with the objective of accelerating the number of replacements. Rebates or a distribution program will also begin for high-efficiency showerheads. Indoor water audits will also be available to residential customers. As shown in Table 3, the projected water savings from these measures are 8.34 MG (0.0046 Mgd).

For commercial, industrial, and institutional customers, rebates for high-efficiency toilets, showerheads, clothes washers, spray-rinse valves, and urinals will begin in order to provide incentives for these customers to make their facilities more efficient. Indoor water use audits will also begin for these use sectors between 2012 and 2016. According to WEPS, residential and nonresidential audits that include plumbing retrofits, evaluations of kitchen and irrigation systems, and leak reduction have the potential to reduce demand by 15 to 35 percent. Based on only the CII water demand from 2008-2010 in the FWCP, that would equate to 0.0009 to 0.0022 Mgd in water savings. As shown in Table 3, according to the FWCP an estimated 4.93 MG (0.0027 Mgd) in water savings is attributed to these programs.

Projected Water Savings 2012-2016			
User	Conservation Measure	Projected Water Savings (MG)	Projected Water Savings (Mgd)
Commercial, Industrial, and Public	High-Efficiency Toilet Rebate	0.41	
	Water-Efficient Showerhead	0.04	
	Indoor Water Use Survey	0.06	
	Outdoor Water Use Survey	-0.11	
	Urinal Rebate	0.28	
	Spray-Rinse Valves Rebate	4.24	
	High-Efficiency Clothes Washer Rebate	0.01	
		4.93	**0.0027**
Residential	High-Efficiency Toilet Rebate	7.44	
	Water-Efficient Showerhead	0.88	
	Indoor Water Use Survey	0.08	
		8.39	**0.0046**
Total		**13.32**	**0.007**

Source: Table 6-6 in FWCP

Table 3. Projected Waukesha water savings in millions of gallons for various fixtures, 2012-2016.

Outdoor Watering Ordinance CEM – The sprinkler ordinance will remain in effect through 2016 to continue to help reduce average and maximum day demand in summer months.

Inclining Water Rate Block Structure CEM - Water pricing is an important driver of a comprehensive conservation program. The current rate structure will continue to be evaluated annually.

Recommended Future CEMs in FWCP post-2016

A detailed outline of Waukesha's long-term implementation strategy is available in Appendix F of the FWCP. As many of these measures are continued or expanded versions of measures already implemented, proper tracking and evaluation over the next few years is essential in allowing stakeholders to better project water savings for the following measures.

Unaccounted for Water CEM –Leak detection and repair programs will continue post-2016. A new policy regarding the survey and repair of leaks upon the sale or lease of property may also come into affect.

Public Information and Education CEM – This CEM is planned to continue.

Fixture Replacement Rebate CEM - There are many areas within each use sector that Waukesha can, and in some cases already is, exploring for water savings through rebates. For example, one area that appears to have a high potential for water savings is addressing inefficiencies of cooling systems through audits and retrofits. According to WEPS, cooling systems account for 16.8 percent of indoor water use in nonresidential accounts. Irrigation technology or spinkler head replacement rebates are also being considered. A new policy requiring plumbing retrofits upon sale or lease of property may also come into effect. Furthermore, incentives or policies

regarding water-efficiency standards for new buildings and low-impact development techniques are likely to begin.

Outdoor Watering Ordinance CEM – The sprinkler ordinance will continue to remain in effect. Irrigation control outreach, along with distribution of rain gauges or sensors to high water users with either large lots or high peak seasonal use will also be explored. New efficiency standards addressing outdoor decorative features and swimming pools may also be implemented.

Inclining Water Rate Block Structure CEM – The current rate structure will continue to be evaluated annually. Waukesha will also explore monthly billing which has been shown to increase customer awareness about water use and thus decrease demand.

Comparison to other cities

The EPA recently published a report that highlights the results of water conservation plans implemented by different cities around the country. As shown in Table 4, water savings from conservation plans that incorporate elements similar to Waukesha's ranged from 7.3 to 30 percent. Obviously, differences in climate, population, infrastructure, water savings potential, and user profiles exist between these cities and Waukesha. However, it does provide insight as to the level of water savings a city can hope to achieve following implementation of a comprehensive water conservation plan. The amount of water savings these cities achieved show that Waukesha's goal of a 10 percent reduction in average day demand is reasonable and may be conservative.

Water Conservation Case Studies		
City	**Approach**	**Results**
Houston, TX	Education Program, Plumbing Retrofits, Audits, Leak Detection and Repair, Increasing-Block Rate Structure, and Conservation Planning.	Estimated 7.3% reduction in water demand by 2006.
Goleta, CA	Plumbing Retrofits and Increased Rates.	30% decrease in district water use. 50% reduction in per-capita residential water use.
Irvine Ranch Water District, CA	Five-Tiered Rate Structure.	19% decrease in water use in the first year.
Cary, NC	Education Program, Toilet Rebates, Landscape and Irrigation Codes, and Rate Structure.	Water savings of 16% by 2028.
Santa Monica, CA	Education Program, Water Use Surveys, Toilet Retrofits, and Landscaping Measures.	14% reduction in water use.
Seattle, WA	Education Program, Plumbing Retrofits and Code, Seasonal Rate Structure, and Leak Detection and Repair.	20% drop in per capita water use in the 1990s.
Tampa, FL	Education Program, Plumbing Retrofits, Increasing-Block Rate Structure, and Irrigation and Landscape Codes.	Pilot retrofit program achieved 15% reduction in water use.

Source: USEPA Cases in Water Conservation.

Table 4. Results of water conservation case studies for eight North American cities.

Effect on average day demand and maximum day demand

Waukesha's plans for conservation and efficiency measures are to reduce average day demand by 10 percent. Maximum day demand, while important, is only the demand for a single day and can be affected by activities that are not impacted by conservation, such as firefighting. Maximum day demand is important mostly for design and infrastructure, and less so for

environmental impacts of withdrawals. A better target might be reducing maximum week or month demand. Measures related to outdoor water and cooling will reduce maximum day demand, but more importantly, they will reduce maximum week or month demand.

FWCP 4.2.3 makes the argument that demand will increase due to improving economic conditions, especially growth in the commercial and industrial sectors. While it appears reasonable to argue that an increase in water utility customers will result in higher demand, the history of demand and per capita use by sector does not support this argument, as discussed in the next section on Demand Forecast.

If the FWCP is fully implemented and successful, then per capita demand and maximum day demand should continue to decrease. It is difficult, however, to directly measure progress towards the conservation goal for individual CEMs, other than fixture replacement, because there are many confounding factors that affect trends in demand. Demand and water use per capita were decreasing for a long time prior to implementation of CEMs, as shown in the next section. Estimates of savings for each CEM could be made, as they are, for example in WEPS.

Water Demand Forecasts

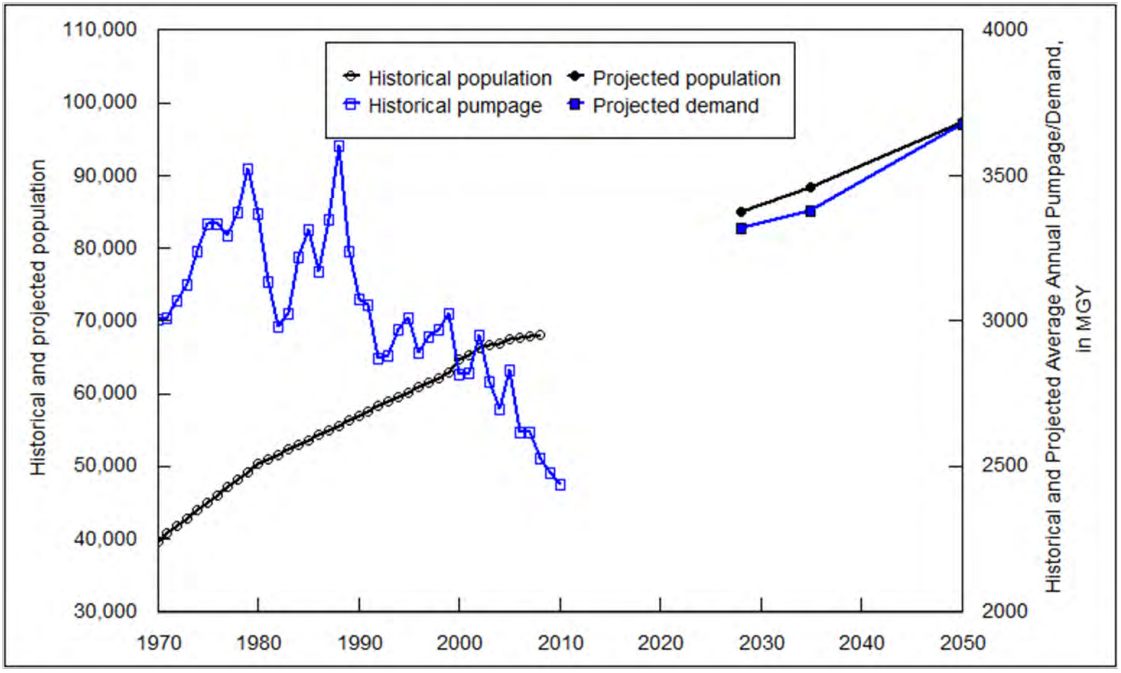
Future water needs are based upon projections of population growth, a future mix of water-use sectors (residential, commercial, industrial, and public), estimates of the amount each sector will use, and improvements and efficiencies in infrastructure and water use that conserve water. Estimates of future water needs are conservative in the sense that they must not under-predict future needs. Potential and largely unpredictable changes in infrastructure, demand, and climate must all be accounted for.

Waukesha forecasts water needs for 2050. The Application assumes that 2050 represents a timeframe in which the population and associated use sectors have reached their maximum based upon planning studies done by the City of Waukesha and SEWRPC. There are projections in various other documents for timeframes before 2050, such as SEWRPC's 2035 projections. However, the Application is conservative in the sense that it applies for water needs in "ultimate" buildout and water use for Waukesha.

Water demand forecasts, through the use of future population and water use estimates, project needs for water in the future. The Waukesha Diversion Application includes several documents that contain water demand forecasts or information relevant to forecasts. These were reviewed for this analysis and include: Appendix C—Future Water Supply (March 2002), Appendix K—Summary of Water Requirements, (May 2009), Appendix D—Water Supply Service Area Plan (April 2010), the Application (May 2010), and Final Water Conservation Plan (May 2012).

The most recent demand forecasts for 2050 are an average day demand of 10.9 million gallons per day (Mgd) and a maximum day demand of 18.5 Mgd (Appendix D, exhibit 13). The average day demand projected for 2050 assumes a constant gallons per capita per day (GPCD) from 2008 through 2050 for three use sectors (residential, commercial and public) that is near, but above, current GPCD (Appendix D, exhibit 13). GPCD is not given specifically for the industrial sector, but instead a total water use for 2050 is given (Appendix D, exhibit 13). Future average day demand is forecast simply by using a static GPCD of 112 and future population estimates, along with assumptions on unaccounted for water and a percent reduction in demand from implementing CEMs. Future maximum day demand is based on a ratio of maximum day demand to average day demand of 1.68 (Appendix D, p. 16), using analyses of historical ratios and precautionary assumptions regarding factors that may increase maximum day demand, such as extended drought (Appendix D, p. 16).

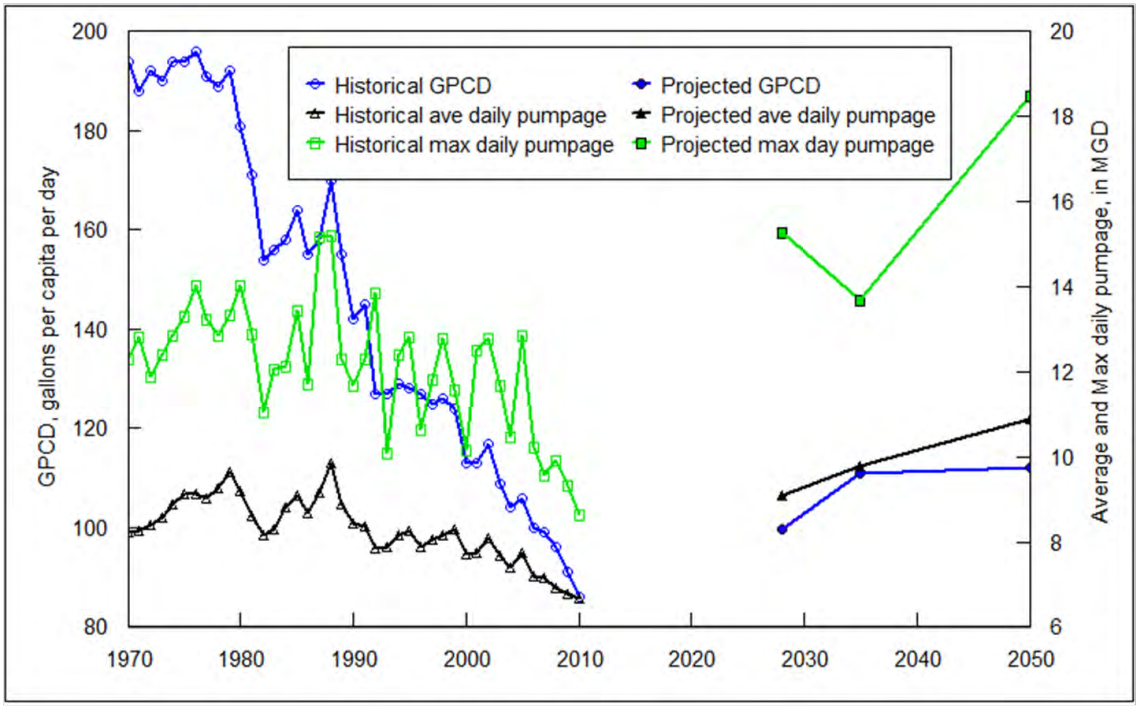
Figure 1 illustrates the historical trends in population and pumpage, along with projected population and demand. Note that both the historical and projected population have increasing trends. In contrast, Historical pumpage has a decreasing trend, and projected demand has an increasing trend.



Historical data through 2008 from App K, table 1, 2009-10 from Final Water Conservation Plan, figure 4-1. Projected 2028 data values from App K, table 5. Projected 2035 and 2050 values from App D, exhibits 11 and 13.

Figure 1—Historical and projected water demand and population for Waukesha.

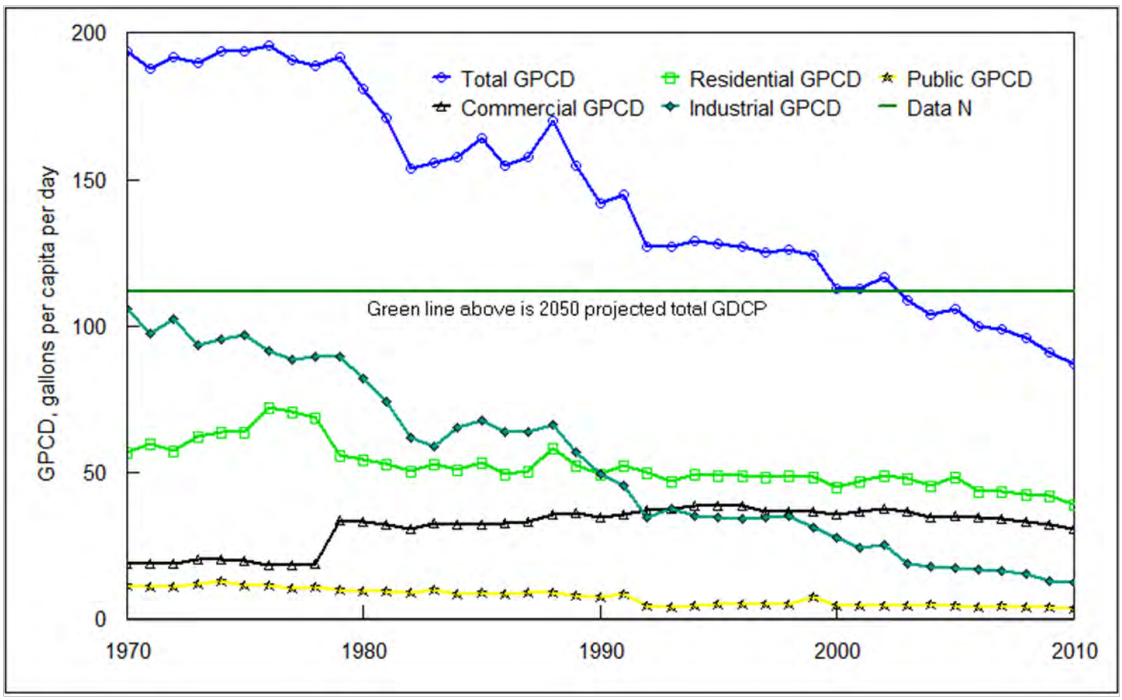
Illustrating similar trends to Figure 1, Figure 2 shows historical declines in GPCD, average day pumpage, and maximum day pumpage, while showing increases in projected values for all three of these.



Historical data through 2008 from App K, table 2 and 3, 2009-10 from Final Water Conservation Plan, figure 4-6. and 4-1. Projected 2028 data values from App K, table 5. Projected 2035 and 2050 values from App D, exhibits 11 and 13.

Figure 2—Historical and projected GPCD, average and maximum day demand for Waukesha.

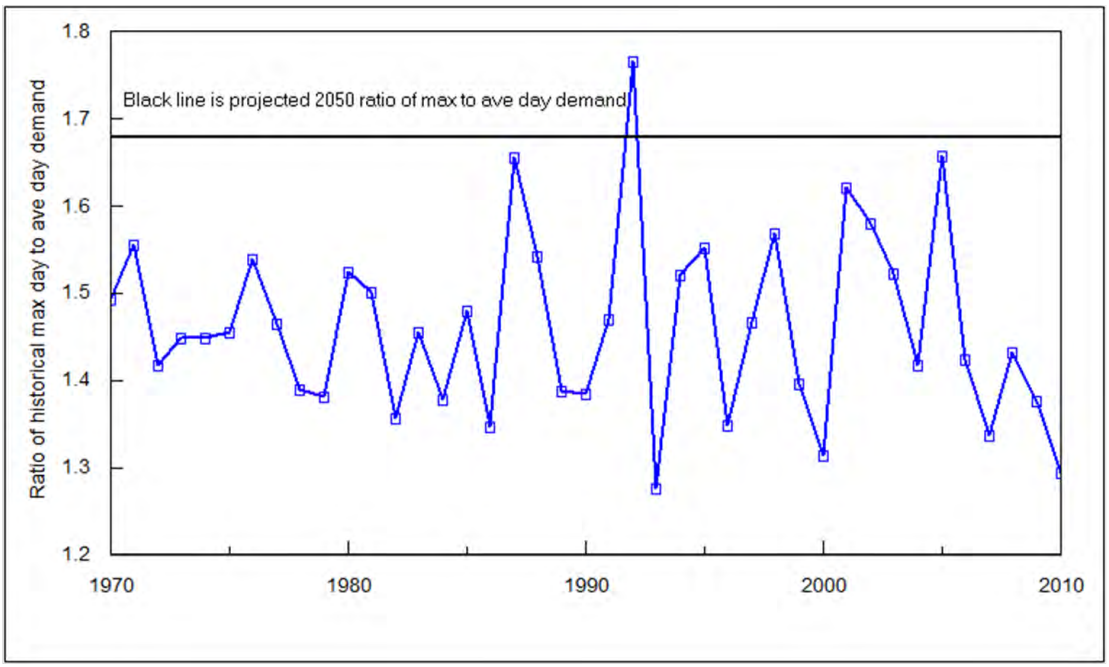
Figure 3 shows trends in GPCD for various use sectors and total GPCD. Aside from the commercial use sector, other use sector GPCDs and total GPCD show historical declines. The horizontal line indicates the total GPCD, 112, which is used to project 2050 average day demand (Appendix D, exhibit 13). In comparison, the total GPCD for 2010 was 86.



Historical GDCP through 2008 from App K, table 2, 2009-10 from Final Water Conservation Plan, figure 4-6. 2050 GDCP is from App D, exhibit 13.

Figure 3—Historical GPCD compared to projected GPCD for Waukesha.

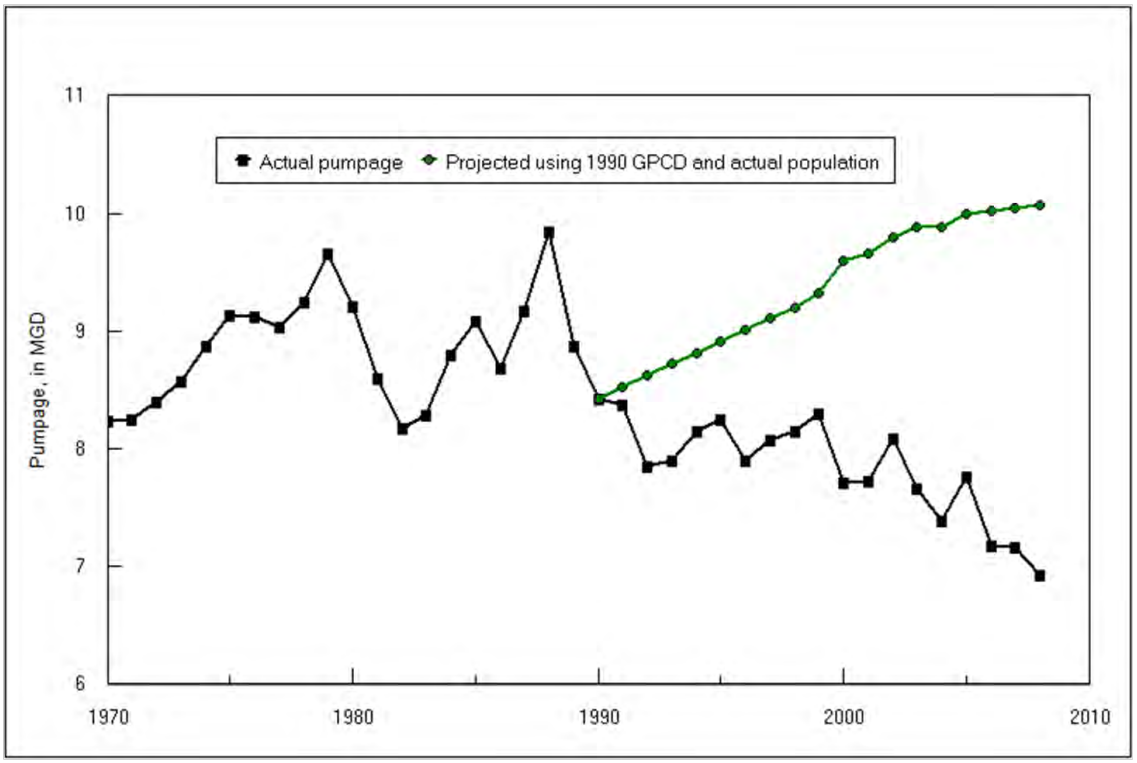
Future maximum day demand is projected by using a ratio of 1.68, based on historical ratios of maximum day demand to average day demand. Figure 4 shows the historical ratios. No trend is apparent. The average ratio is 1.46, and only thirteen years from 1970 to 2010 had ratios above 1.5. The most recent ratio for 2010 is 1.30. The horizontal line illustrates the ratio used for projection of 2050 maximum day demand. Only one year, 1992, has a value equal to or greater than 1.68.



Historical ratios through 2008 calculated from data in App K, table 3; 2009-10 calculated from data in Final Water Conservation Plan, figure 4-2.

Figure 4—Historical ratio of max imum to average day demand compared to projectedfor Waukesha.

Models of any kind that predict the future typically are calibrated to historical data. Doing so gives confidence that predictions are based on known historical relationships and functions. The demand forecast model used for Waukesha does not appear consistent with historical data; that is, it cannot predict historical data, as illustrated in this paragraph and Figure 5. The model used to forecast average day demand assumes a constant GPCD of 112, similar to that in 2000. Using a similar approach, one can test the predictive capabilities of the model by using the historical GPCD of 1990 (142), predict future demand, and compare it to historical average day pumpage from 1991 to 2008. The results of this test of the predictive model are shown below in Figure 5. Clearly, the further in time one moves from the base date of 1990, the more the model over-predicts demand.



Data from App K, table 2 and 3.

Figure 5—Actual pumpage compared to projected pumpage for Waukesha using 1990 GPCD and actual population as basis for projection

Another example of the difficulty in making demand projections can be illustrated using the projections for 2010 in Appendix C, which was written in 2002. Appendix C projects a 2010 average day demand of 9.32 Mgd and a maximum day demand of 15.37 Mgd, using a ratio of 1.65. In contrast, the actual figures for 2010 were an average day demand of 6.68 and a maximum day demand of 8.65, with a ratio of 1.30. The overprediction for this 8-year period is 40 percent for the average day demand and 78 percent for maximum day demand.

Demand projection is a difficult field, because it must account for possible future changes that are unknown. It must be precautionary in the sense of projecting the greatest possible demand and make appropriate assumptions in doing so. It should, however, be consistent with historical data and planned implementation of CEMs. These might at least hold GPCD stable at the recent level of 86. More likely, these measures would continue the historical decreasing trend. Measures directed at outdoor watering might decrease the ratio of maximum day pumpage to average day pumpage. Maximum day pumpage from 1970 to 2008 is almost always during the summer (Appendix K, table 3), a period during which most outdoor watering occurs. If demand projections are to be inconsistent with historical trends and with planned conservation and efficiency measures, then a clear explanation should be given of why changes in GPCD trends and ratios of maximum day to average day pumpage are anticipated.

A future demand scenario for 2050 could be made assuming that all downward historical trends in GPDC cease as of 2010, that proposed CEMs are successful in conserving water, and that the ratio of maximum to average day demand remains the same as the recent average from 2006-2010. The 2010 GPCD was 86 (Final Conservation Plan, figure 4-6), unaccounted for water from 2007-2010 averaged about 6 percent (Final Conservation table 4.1), and 2050 estimated population is 97,400. The average day demand for this scenario is 8.9 Mgd. With additional conservation savings of 10 percent (Appendix D, exhibit 11), the average day demand decreases to 8.0 Mgd. The ratio of average maximum to average day pumpage from 2006-2010 is 1.38 (Final Conservation Plan, table 4.2). Using this recent ratio, maximum day demand is 11.1. Again, note that this estimate does not assume that the clear and decreasing trend in GPCD continues. Rather it assumes, conservatively, that GPCD remains constant from 2010 to 2050.

Sources of Water Supply

This section discusses potential sources of water supply to meet Waukesha's future needs. These are evaluated with respect to the hydrological feasibility and environmental impact of the withdrawal. Costs related to infrastructure, treatment, and greenhouse gas emissions, for instance, are not considered.

Several documents listed at the end of this paper explore alternative sources of water for Waukesha's future needs. In these documents, sources were evaluated by several criteria and compared to each other. Additionally, possible combinations were explored, though not all possibilities, since all possible combinations is a very large number. This paper does not describe the alternative sources in detail, because such detail is given in many of the documents listed at the end of this paper.

Currently, Waukesha has two sources of water supply: (1) The Cambrian-Ordovician Aquifer, which is a relatively deep and confined aquifer, referred to as "deep confined aquifer" in this paper; and (2) sand and gravel deposits of glacial and recent origin, some unconfined and others semiconfined, referred to as "shallow aquifer" in this report". Waukesha has 10 wells in the deep confined aquifer. Two wells (#1 and #4) are no longer used due to contamination from human sources (#1) or the potential for contamination from human sources and low yield (#4). Well #2 was recently taken out of service due to decreasing yield. The remaining 7 wells have a combined capacity of 14.35 Mgd. Waukesha has 3 wells in the shallow aquifer near the Fox River. These 3 wells have combined capacity of 2.38 Mgd.

Natural sources of radium in the deep confined aquifer, and the costs associated with treatment to meet radium standards at all points of entry into the water supply system, were major factors that motivated Waukesha to explore alternative sources of water supply. In Waukesha's Future Water Supply study (Appendix C), fourteen alternative sources are considered. Nine are not discussed in detail, being removed from consideration using the evaluation criteria. Five are

considered in more detail. The result of this analysis indicated that the best alternative source is a diversion from Lake Michigan (although Appendix C, written in 2002 before the Compact was completed, concluded this was only feasible if no return flow to Lake Michigan was required). The Application considers 6 alternative sources. Two are not discussed in detail, being removed from consideration using the evaluation criteria. Four are considered in more detail, and three of these are a combination of sources. The result of this analysis indicated that the best alternative source is a diversion from Lake Michigan. Additionally, WDNR requested that Waukesha reconsider the unconfined aquifer west of Waukesha (it was one of the two not considered in detail in the Application) and that they also consider a multiple source alternative. These latter two are reported in Response to Water Supply Questions WS7, WS7A, and WS10.

Evaluation Criteria and Issues

The Application used four main criteria for evaluating alternative sources and return flow: environmental impact, long-term sustainability, public health, and implementability. These criteria were chosen based on a Wisconsin Statute that defines a "reasonable water supply alternative" and which is applicable to a community in a straddling county in Wisconsin that wishes to apply for a diversion.

In the discussion of many of the alternative sources in the Application, five common concerns or issues are raised which this author views as problematic. These are discussed below.

The first is concern about contamination of source water supply. This results in lower ranking for sources in rivers or shallow aquifers, yet higher rankings for Lake Michigan. In fact, all sources are susceptible to contamination and need protection. Deep confined aquifers are typically viewed as those safest from contamination, yet 20 percent of Waukesha's wells in the deep confined aquifer are not used due to contamination, or the potential for contamination, from human sources. Lake Michigan, viewed as "high quality and safe" in the Application, was the source of a major water-borne disease outbreak in Wisconsin in the 1990s. These two examples illustrate that all water sources, even those deemed safe, can be contaminated. Rivers and groundwater are used throughout the Upper Midwest as sources of safe, potable water. Therefore concern about contamination of source water supply is not part of the evaluation in this paper.

The second are issues related to the effect of groundwater withdrawals on Waters of the Great Lakes Basin. By Compact definition, none of the groundwater sources considered by the Application are Waters of the Great Lakes Basin. Stopping deep confined aquifer pumping in Waukesha will not improve the Waters of the Great Lakes Basin; continued pumping in Waukesha will not impair Waters of the Great Lakes Basin. Regionally in southeast Wisconsin pumpage from the deep confined aquifer does result in a small amount of inducement of flow from Lake Michigan (1.33 Mgd in the SEWRPC model for 2000) and a small amount of capture of water that would have flowed to Lake Michigan (2.67 Mgd) and an unknown amount of streamflow capture and inducement within the Great Lakes Basin (not reported separately by

watershed for SEWRPC model, though the total from inside and outside the Great Lakes Basin was 19.7 Mgd). Besides having small or unknown impacts on Waters of the Great Lakes Basin, there has been no study to indicate how changes in only Waukesha's pumping, using updated pumping in the area, will affect flow of groundwater to Lake Michigan or to streams tributary to Lake Michigan. Without knowing the impacts of continued or no pumpage from the deep confined aquifers, there is nothing to say about the environmental impacts on Waters of the Great Lakes Basin. Therefore the pros or cons of pumpage from the deep confined aquifer, with respect to impacts on Waters of the Great Lakes Basin, are not part of the evaluation in this paper.

The third issue is the Application's evaluation of how uses of various sources will or will not meet Compact requirements (Application exhibit 4-20). This exhibit treats the deep confined and shallow aquifer sources in Waukesha as Waters of the Basin, which they are not. The Compact sections referenced in the first column of exhibit 4-20 refer only to Source watershed and water sources that are parts of Waters of the Great Lakes Basin. They do not apply to other water sources in Wisconsin. Therefore the final two columns in exhibit 4-20 are not relevant to Compact requirements and should be filled in with "NA—not applicable". The Application's line of reasoning in this regard is illustrated by the following statement from Appendix D, p. 31 (and quoted in the Application):

> *One of the decision making standards of the Compact (4.11.1) states "All Water withdrawn shall be returned, either naturally or after use to the Source watershed less allowance for Consumptive Use." Since the deep aquifer and the waters of the Lake Michigan Basin are hydrologically connected, pumping the deep aquifer and discharging the water into the Fox River does not comply with this Compact decision-making standard.*

In fact, the Compact states that groundwater outside of the watershed boundary of the Great Lakes is not in any of the Source Watersheds of the Great Lakes Basin. Thus the Compact Decision-Making Standard is not relevant to Waukesha's return of wastewater from groundwater sources to the Fox River. Therefore the evaluation in this paper separately treats Waters of Wisconsin outside the Great Lakes Basin and Waters of the Great Lakes Basin and does so in a manner consistent with Compact language.

The fourth issue is related to statements about continued decline of water levels in the deep confined aquifer, such as "drastically declining water levels". The regional groundwater modeling done for SEWRPC clearly showed the historical and significant declines of groundwater levels in the deep confined aquifer. However, pumping patterns and amounts have changed. In particular, pumping in many areas has decreased (Waukesha, for example, has had decreasing pumpage since the late 1980's, as shown in Figure 1). There are only two long-term monitoring wells in the deep confined aquifer in southeast Wisconsin, in Kenosha and Walworth counties. Both of these wells show stable or increasing trends in recent years (Figure 6), although they are certainly also affected by decreases in pumpage in the Chicago area. Claims in the Application regarding continued groundwater level declines are without substantiation. That is, no

observational data are presented that show continued groundwater level declines. A 2010 USGS report used regional pumpage around Lake Michigan through 2005 to evaluate changes in water levels, among other things. This model shows simulated heads in Waukesha increasing after 1986 (Figure 7).

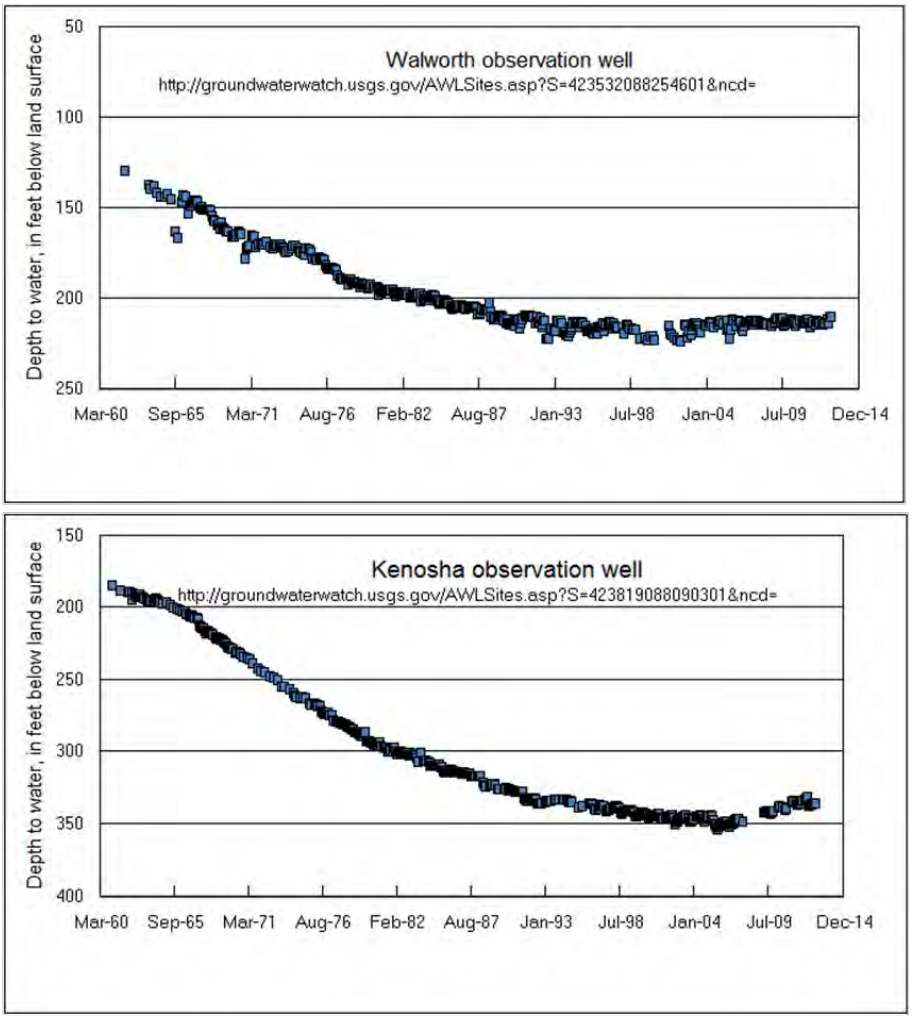
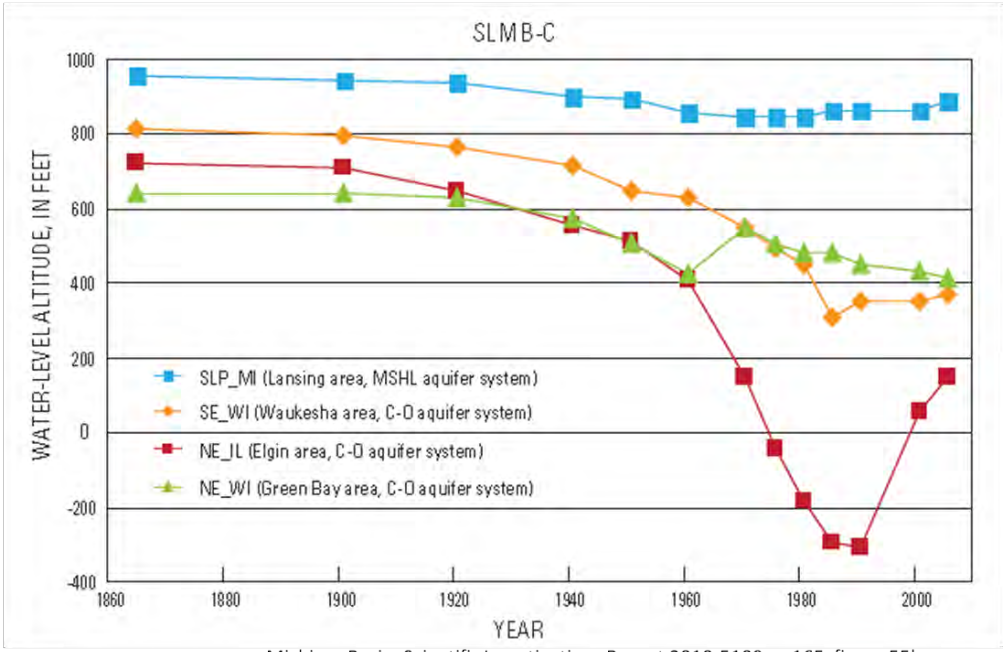


Figure 6—Historical groundwater levels for two observation wells in the deep confined aquifer in southeast Wisconsin.

Therefore, negative impacts linked to groundwater level declines in the Application may not occur. These include: increasing radium and TDS levels (with economic, public health, and environmental issues); decreasing well capacity (with economic and sustainability issues); and decreased flow to surface water (with environmental issues). Each of these potential impacts and issues are important, especially the issue of radium and TDS levels. Waukesha has several wells that would each have to be treated to comply with water quality standards. Future degradation in water quality or well capacity caused by future declining groundwater levels,

however, will only occur if levels decline. Therefore these factors, as they relate to declining groundwater levels in the deep confined aquifer, are not part of the evaluation in this paper.



Michigan Basin, Scientific Investigations Report 2010-5109, p. 165, figure 55b

Figure 7—Simulated groundwater levels 1864 through 2005 in Lake Michigan area.

The fifth issue is related to treating water to meet drinking water standards and how this affects the merit of various sources. All of the types of water supply sources considered in the Application are used throughout the Upper Midwest. All are treated to meet drinking water regulatory standards or for aesthetics. The only real issue here is economic, that is, the costs of various treatments, which this paper does not consider. Therefore issues related to treating water to meet drinking water standards are not part of the evaluation in this paper.

Discussion of Alternative Sources

This section discusses the alternative sources considered in the Application and provides an evaluation of each. Combinations of sources are not evaluated. Evaluation includes the availability of information regarding capacity of the source, sustainability, and environmental impacts of the withdrawal. There is no evaluation of a return flow to Lake Michigan.

Artificial Recharge

Artificial recharge is not actually a source, but rather replenishes the shallow aquifer and mitigates some of the impacts of water withdrawals from that aquifer. Artificial recharge consists of inducing stormwater or treated wastewater to recharge aquifers. It is a common practice in some water-scarce areas of the U.S. A related concept is Aquifer Storage and Recovery, which is considered in some detail in Appendix C.

As noted in the Application, there are significant concerns related to using artificial recharge in shallow aquifers near Waukesha. These include access to substantial land areas for infiltration, potential contamination from stormwater, regulatory obstacles to using treated wastewater to recharge a potable drinking aquifer, the long-term viability of infiltration facilities (including those on land surface and in wells), and the potential to mobilize arsenic in the shallow aquifer using ASR. Furthermore, no estimates are available regarding how much capacity could be added to a shallow aquifer source near Waukesha using artificial recharge or how much artificial recharge would increase water levels in the shallow aquifer. Therefore, this potential supplement to water supply sources for Waukesha is not considered further in this paper.

Deep Unconfined Aquifer west of Waukesha

West of Waukesha, the Maquoketa Shale is absent, leaving the Cambrian-Ordovician Aquifer unconfined. Because it is unconfined, the deep aquifer west of Waukesha has much better hydraulic connection to the shallow aquifer than the confined portion, and is therefore more connected to surface water features, such as streams, lakes, and wetlands. This water supply source is dealt with briefly in the Application and more fully in *Response to Water Supply Questions, Attachment WS7 and WS7A*. Appendix C concluded this was a viable water supply source, except for legal considerations regarding access to land and potential negative impacts on surface water bodies. As noted in WS7, the aquifer produces water of good quality.

WS7 discussion of environmental impacts is based on findings from a groundwater flow model described in WS7A. These studies looked at the feasibility of meeting all of Waukesha's projected water needs in 2050 from the deep unconfined aquifer west of Waukesha, 10.9 Mgd average day demand and 18.5 Mgd maximum day demand, although those exact amounts of withdrawal were not simulated. WS7 states that at 15 Mgd the drawdown in the shallow aquifer would be less than 2 feet and that at 10 Mgd pumping would impact 480 acres of wetland and over 100 acres of surface waters within the 1-foot drawdown contour line in the shallow aquifer.

WS7 concludes that withdrawals from the unconfined deep aquifer would have a significant adverse environmental impact and a significant adverse impact on long-term sustainability, which this author assumes to mean these withdrawals are not sustainable. The arguments against sustainability, however, refer back mostly to those related to groundwater connection to Waters of the Great Lakes Basin and effect on groundwater levels in the deep confined system. These issues were discussed previously, and this paper concludes that no substantive issues regarding long-term sustainability are presented in WS7. The aquifer is largely protected from effects of drought, and the only issue of long-term sustainability would be increasing demand on the aquifer from new or increased withdrawals other than Waukesha's.

WS7A summarizes the use of the SEWRPC regional model to simulate pumping from the unconfined deep aquifer west of Waukesha. The modeling effort described in WS7A has

technical issues. First, the SEWRPC model is not appropriately discretized for evaluation of local groundwater-surface water relationships, as noted in SEWRPC Memorandum Report 188 (MR 188). The telescoping mesh refinement should have been used, as it was in MR 188. Second, all of the pumpage was simulated from two wells in the proposed well field due to a misunderstanding that wells could not be simulated in layers 11 through 16 if layer 1 was represented as a surface-water feature. Thus the entire pumping amount was split among 2 simulated wells, rather than the 13 proposed for the well field in WS7. Concentrating unrealistically high amounts of pumpage into a single model cell exacerbates the local effects of drawdown. They are unrealistically high. Third, the MODFLOW module used to represent streams is not specified. If it is STR, then that is appropriate boundary condition (STR limits the amount of water than can flow from a stream into an aquifer according to flow estimates for that stream). However, WS7A does not state how streamflow was estimated for cells, nor how stream losses were compiled along a stream to calculate baseflow reduction. If RIV was used as a boundary condition, then unrealistically large amounts of water could be produced from these cells (RIV does not limit the amount of water that can flow from a stream into an aquifer). The effect of this could be to overestimate the amount of water induced from streams, but it also could be to underestimate drawdown in the uppermost layer, since the water level in so many cells is fixed by a surface water feature.

Therefore this paper concludes that there is insufficient information to determine if the unconfined deep aquifer west of Waukesha can provide for all or a significant part of Waukesha's future water supply needs without causing significant adverse environmental impacts to streams, lakes, and wetlands.

Silurian Dolomite Aquifer

The Silurian Dolomite aquifer, where not eroded through in bedrock valleys, directly underlies the glacial deposits in the Waukesha area. This aquifer can be very productive throughout eastern Wisconsin, and in fact, throughout much of the Great Lakes region. The aquifer is heterogeneous with respect to hydraulic conductivity, however, because it depends on subvertical fractures and subhorizontal bedding plane openings to transmit water. Therefore, productivity can vary greatly from place to place. The Silurian Dolomite aquifer provides water for municipal supplies in and near Waukesha, about 30 wells in eastern Waukesha County. Water from this aquifer can have objectionable levels of manganese and iron, which typically require treatment. Similar to the unconfined deep aquifer west of Waukesha, the Silurian Dolomite aquifer has good hydraulic connection to the overlying shallow aquifer, which means it has better connection to surface water features than does a confined aquifer. Where glacial deposits are thin, the Silurian Dolomite aquifer may be susceptible to drought; where glacial deposits are thick, they dampen the effect of drought on the Silurian Dolomite aquifer.

Attachment WS8 of the Response to Water Supply Questions evaluates The Silurian Dolomite aquifer as a potential water-supply source. WS8 notes that casing requirements of at least 60 feet and Silurian dolomite thickness requirements of at least 100 feet limit the geographic areas

that could produce significant quantities of water. Well yields in the area are variable, but an average of 450 gpm from 3 to 5 possible wells may be realistic in the opinion of the WS8 author (the WS8 author is very experienced with developing municipal water supplies from the Silurian Dolomite Aquifer in this part of Wisconsin). If 3 to 5 wells were developed and produced 450 gpm each, then the well field would yield 1350 to 2250 gpm.

The Silurian Dolomite aquifer cannot meet all of Waukesha's projected 2050 water needs. However, this aquifer could provide 1.9 to 3.2 Mgd with 3 to 5 wells pumping 450 gpm each. Municipal wells in the Silurian Dolomite aquifer must have at least 60 feet of glacial deposits, which protects the aquifer in these areas from major withdrawal issues related to drought.

The Silurian Dolomite aquifer is not presented in the Application as an alternative source. It is presented as one of the 14 alternative sources in Appendix C, but is one of the 9 that are not considered in detail. It is eliminated because it cannot meet all of Waukesha's projected 2050 water needs. No discussion of any environmental impacts resulting from withdrawals from the Silurian Dolomite aquifer is presented in Appendix C or WS8. This author assumes there could be some local effect on surface water features because of the hydraulic connection to the overlying glacial deposits. However low porosity and highly transmissive solutional features tend to spread out effects of pumping and also make them unpredictable locally.

Deep Confined Aquifer

Using the deep confined aquifer as a source of water is described in detail in many of the documents listed at the end of this paper. Currently, this is the major source of water for Waukesha. The reasons to seek other sources have already been noted above.

The capacity of Waukesha's 7 remaining wells in the deep confined aquifer is 14.35 Mgd. The Application states these wells will be used at a rate of 7.6 Mgd, with treatment of 3 of the wells for TDS and radium. In the Application, use of the deep confined aquifer is only evaluated as an alternative in combination with use of the shallow aquifer. It is not evaluated as the sole source.

The issue of the long-term sustainability of this aquifer at historical regional rates is a regional concern. These concerns launched many regional and local studies related to future water use and supply. Results from the SEWRPC model led to the conclusion that ongoing regional increases in withdrawals from the deep confined aquifer do not appear to be sustainable.

There are ongoing changes in the region, however, that suggest that demand on this aquifer may not increase at rates similar to historical ones of the 20th century. Demand increase is slowing in some areas and declining in some areas. Some communities that historically relied on the deep confined aquifer have switched to shallow aquifers and to Lake Michigan. Groundwater levels may be stabilizing or increasing regionally (see figures 6 and 7). According to SEWRPC, groundwater pumpage in the 7-county SEWRPC region and in Waukesha County

decreased from 2000 to 2005 (this includes all sources of groundwater). In the City of Waukesha, total pumpage has been decreasing since the late 1980's.

Locally, Waukesha's use of the deep confined aquifer may be sustainable in the long-term. Waukesha's total water use has declined from about 9 Mgd in the mid-80's to about 7 Mgd in recent years, a reduction of 20 percent. Use from the deep confined aquifer has declined a greater percentage, since the 3 wells in the shallow aquifer are relatively new (#11 and #12 began operation in 2006; #13 in 2009) and make up a part of the recent use of about 7 Mgd. As noted previously, there are no observational or model data presented to show that water levels in the deep confined aquifer are continuing to decline.

The Application presents only two types of negative environmental impacts from using the deep confined aquifer: (1) the effect of regional withdrawals from this aquifer on regional surface water supplies and (2) increasing chloride loading to streams from use of home water softeners. (Note, the Application presentation of other environmental impacts is discussed under *Evaluation Criteria and Issues* previously in this paper). Any waste stream discharged to the Fox River would have a permit requiring it meet water quality standards of Wisconsin, which are developed to protect against negative environmental impacts.

The SEWRPC regional groundwater flow model has not been used to specify only the impact of Waukesha's use of the deep confined aquifer on streams. It is not possible with a regional groundwater flow model to determine the local impact of Waukesha's use of the deep confined aquifer on specific small streams, such as Pebble Brook or Mill Brook. The amount and location(s) of impacts on streams remain unknown until appropriate local modeling is done. Similarly, the amount and location of any positive impact to streams from Waukesha stopping pumpage from this aquifer is unknown. If part of the effect is a flow reduction in the upper Fox River, then this reduction is mitigated by wastewater return. We do know how much of the source of water to Waukesha's deep confined aquifer wells is ultimately either release from storage (lower water levels) or from surface water (by inducement or capture). Though there is some negative impact on one or both, but less than there was in the 1980s. Thus it is not possible with information presented in various reports to quantify environmental impacts of Waukesha's use or nonuse of the deep confined aquifer.

Shallow Aquifer

The shallow aquifer consists of coarse unconsolidated sand and gravel of glacial or recent origin. Within the aquifer are deposits of fine material of the same origin, which act as confining units. As noted in many of the documents listed at the end of this paper, the distribution of coarse and fine material is very complex, difficult to map, and difficult to simplify for groundwater flow modeling.

The major negative environmental impact of withdrawals from the shallow aquifer is the reduction of groundwater flow to surface water bodies and the resulting ecological impacts.

Thus this analysis focuses on the effect of groundwater withdrawals on surface water. The shallow aquifer is directly connected to surface water bodies, such as the Fox River, Pebble Brook, and Vernon Marsh. All groundwater modeling studies that include the shallow aquifer recognize the complexity of understanding the local relationship between groundwater withdrawals from the shallow aquifer and effects on surface water bodies. Correct understanding of this relationship requires significant hydrogeological and monitoring data along with properly constructed groundwater flow models, with careful attention to the boundary conditions that represent the surface water bodies. A particular challenge is knowing the resistance to flow in the shallow materials that make up the surface of streambeds and wetlands. Even when known, it is difficult to represent that resistance appropriately in model cells that represent surface water features. Where transient data are available, a model can be calibrated to approximate this resistance appropriately. For some important surface water bodies, such as Vernon Marsh, no data are available to calibrate a groundwater flow model to a known system response of the marsh to a known system stress, such as a well.

The various local and subregional studies of groundwater withdrawal from the shallow aquifer describe or differentiate among three sources within the shallow aquifer. One is the Troy Bedrock Valley, another is the Fox River Alluvium, and the third is aquifer material not associated with the former two. The differentiation among these aquifers is, however, not clear in some of the reports. The alluvium in the Fox River Valley is fairly thin and discontinuous and no actual or simulated wells derive all of their water from these deposits. So, in this paper, wells in the Fox River Alluvium refer to wells that are in close proximity to the Fox River, are screened in glacial materials, and induce or capture a significant portion of their water from the Fox River. According to MR-188, Waukesha currently has no wells in the Troy Bedrock Valley. Waukesha wells #11 and #12 are in the Fox River Alluvium. Waukesha well #13 is in aquifer material other than the Troy Bedrock Valley or Fox River Alluvium.

Application Alternative 1 (deep and shallow aquifer) uses current shallow aquifer wells #11, #12, and #13 with a capacity of 2.38 Mgd (firm capacity of 1.2 Mgd), plus 14 new wells south of Waukesha near Vernon Marsh in the Troy Bedrock Valley with a firm capacity of 9.7 Mgd.

Application Alternative 2 (shallow aquifer and Fox River alluvium) uses current shallow aquifer wells #11, #12, and #13 with a capacity of 2.38 Mgd (firm capacity of 1.2 Mgd), 4 new Fox River Alluvium wells with a firm capacity of 4.5 Mgd), plus 14 new wells south of Waukesha near Vernon Marsh in the Troy Bedrock Valley with a firm capacity of 12.8 Mgd.

Troy Bedrock Valley

According to MR 188 (Troy Bedrock Aquifer model Waukesha and Walworth Counties), the Troy Bedrock Valley trends through three Wisconsin counties, including southern Waukesha County and includes tributary valleys that are not all fully mapped. The valley is filled with glacial deposits that range from fine confining material to coarse aquifer material. Several

municipalities in southeast Wisconsin supply drinking water from the Troy Bedrock Valley aquifer.

MR 188 describes a groundwater flow model developed to assist in understanding groundwater flow in the Troy Bedrock Valley aquifer. The authors used existing data from wells, borings, geophysical surveys, aquifer tests, and water level measurements to develop a hydrogeological understanding of the valley for designing the groundwater flow model. The model was extracted from the SEWRPC model. Telescoping mesh refinement was used because the SEWRPC model horizontal discretization is too coarse to simulate the effects of groundwater withdrawals on surface water at a local scale.

Deeper aquifer materials in the Troy Bedrock Valley are typically confined by 200 feet or more of fine material. However, MR 188 points out that there are local gaps ("windows") in the confining material which allow better hydraulic connection between deeper aquifer material and shallow material. The location of these windows is known only where drilling or boring data have found them. There are certainly other windows than the known ones. Locally, the location of windows would be critical for understanding if a new well might impact a nearby surface water body. Additionally, if windows were in the area of a simulated well field, then any groundwater flow model would have to account for this by treating the lower sand unit as unconfined, rather than confined.

Appendix O describes the application of the model developed in MR 188 to four development scenarios. Scenario 1-1 simulates pumpage of 6.4 Mgd from 8 wells: existing wells #11, #12, and #13; and 5 wells in the area referred to as the Lathers property. Scenario 1-2 simulates pumpage of 6.4 Mgd from 17 wells: existing wells #11, #12, and #13; 5 wells in the area referred to as the Lathers property; and 9 wells in the Troy Bedrock Aquifer. Scenario 2-1 simulates pumpage of 10.9 Mgd from 12 wells: existing wells #11 and #13; 3 wells in the area referred to as the Lathers property; 4 wells in the Troy Bedrock Aquifer; and 3 wells near the Fox River. Scenario 2-2 simulates pumpage of 10.9 Mgd from 28 wells: existing wells #11, #12, and #13; 5 wells in the area referred to as the Lathers property; and 20 wells in the Troy Bedrock Aquifer. Appendix O describes the impact of these withdrawals on various nearby surface water bodies and on domestic wells in the area.

The text for Appendix O is brief; less than 3 pages. Therefore reviewing this modeling effort is difficult. However, several observations are possible. First, there is nothing said about impacts on domestic wells. The number in each section is plotted on maps of drawdown, but their location and screen depths are not given. So no conclusions can be drawn regarding impact on domestic wells. Second, the location of the simulated wells relative to the map of the Troy Bedrock Valley presented in MR 188 is not shown. Are they actually in the valley? Comparison of figure 1 in MR 188 to the maps in Appendix O suggests the simulated wells are outside or at the edge of the Troy Bedrock Valley. It is difficult to determine. Could wells be simulated further south, away from Pebble Brook and Mill Creek and closer to the center of the Troy Bedrock

Valley? Third, no information is given on the depth or layer of the Lather property or Fox River wells.

Fourth and most importantly, the concluding paragraph of MR 188 provides advice that is vital to doing model simulations such as those in Appendix O, but which appears to have been not been followed. That paragraph states:

> *It must be kept in mind that the geologic conditions in the Troy Bedrock Valley are only known in general terms. While the regional flow system is well described, the bedrock valley aquifer system is more complex than currently known. The model cannot, and does not, account for these unknown complexities, nor does it fully incorporate all of the geologic data available which can vary on scales smaller than the cell size of the model. Some of these variations between the model and the natural system may be significant, particularly on a local scale.* ***In applying the model to estimate the local impacts to a particular water body or specific area it will be essential to consider the degree of geologic complexity necessary to produce a simulation to the degree of desired detail. It may be necessary to revise portions of the model or construct inset models within the larger model to obtain the degree of detail required for specific applications. In many cases it may be necessary to conduct additional testing to obtain the data needed and the degree of local detail desired.***

Furthermore, D.S. Cherkauer's 2007 report to the Board of the Town of Waukesha regarding groundwater at the Lather's property presents a comprehensive set of questions that need to be answered to understand the impacts of withdrawals on domestic wells and surface water resources. The report also presents the information needed to answer these questions and whether or not that information is available. While many of these issues are addressed at a multi-county scale in MR 188, they are not addressed locally in Appendix O.

Fox River Alluvium

Municipal wells in the shallow aquifer in close proximity to the Fox River can derive a substantial amount of their water from induced flow from the river and captured groundwater that would otherwise flow to the river. This process is known as riverbank inducement (RBI). There are two principal effects from using RBI. First, there will be a significant reduction in Fox River baseflow. Second, there will be less drawdown, thus less impact on domestic wells and nearby surface water features, because release of water from storage becomes a smaller source of water to the municipal wells. The first effect can be mostly mitigated if wastewater return is upstream of a well field, since all of the water, less consumptive losses, would be returned to the portion of the Fox River affected by pumping. A probable consequence of having wastewater return upstream of a well field is an increasing concentration of chloride, and other constituents common to treated wastewater, in the well field water. Current wells #11 and #12 are RBI wells, whereas #13 is not. #13 derives its water from west of the well, not from the Fox River.

A recent USGS report (SIR 2012-5108) describes development and application of a groundwater flow model to hypothetical wells pumping from the Fox River Alluvium. The model is finely discretized horizontally and vertically. It uses a statistical approach to develop the hydrogeologic framework, resulting in two models (fine-favored and coarse-favored) that potentially bracket the system response to pumpage. The model uses boundary conditions that account for the amount of water in the Fox River. Flows in or out of the bottom of the model are set based on the SEWRPC model.

The model described in SIR 2012-5108 has 2 sets of wells: 12 wells downstream of the Waukesha WWTP and 15 wells upstream. Pumpage from each well is constrained to a maximum of 0.667 Mgd. For the simulation, the two sets of wells produce a little over 9 Mgd, about 3 Mgd from the upstream wells and about 6 Mgd from the downstream wells. Some downstream wells likely could have produced more than 0.667 Mgd had they not been constrained to that amount.

Two types of impacts of the hypothetical modeling are described. The fine-favored model derived about 65 percent of its water either by inducing flow from the Fox River or capturing water that would have flowed to the river; for the coarse favored model, the number is about 73 percent. For both models, maximum drawdown in the uppermost layer is 20 feet. Maximum drawdown in layer 3 is 30 feet (most wells pump from layers 3 and 4). Sensitivity analysis showed that without RBI drawdown in layer 1 drawdown would be as much as 90 feet, demonstrating the positive effect of RBI on issues related to drawdown.

The model described in SIR 2012-5108 is not a planning tool for a municipal well field. It does, however, suggest that a substantial part of Waukesha's water supply could come from a similar well field that uses RBI to reduce drawdown impacts and uses treated wastewater return flow to mitigate most of the effects of RBI on baseflow in the Fox River. A site-specific study for a well field similar to the one represented by the 12 downstream wells could also incorporate aquifer management modeling. Aquifer management models can maximize pumpage from each well, while using constraints to minimize impacts on drawdown and surface water bodies other than the Fox River.

Lake Michigan

Lake Michigan can provide sufficient water to meet all of Waukesha's future needs. Any impact of a withdrawal on Lake Michigan would be negligible. The loss of the current wastewater return to the Fox River would result in smaller baseflow in the river downstream from the current WWTP. Appendix N states that there would be a 25 percent reduction in the upper Fox River near Waukesha, assuming an average annual WWTP discharge of 10 Mgd. Appendix N concludes that the likely effect of this flow reduction would be a small adverse environmental impact on aquatic habitat. Effects on the Fox River may be mitigated to some degree by local increases in groundwater flow to surface water if Waukesha stops using groundwater.

Evaluation of Alternative Sources

This paper does not use the evaluative criteria from the Application for reasons stated previously. Alternative sources are evaluated by: (1) hydrological feasibility of the withdrawal; (2) the environmental impacts of the withdrawal on Waters of Wisconsin outside the Great Lakes Basin (that is, waters that are not defined as *Waters of the Basin* in the Compact); and (3) environmental impacts of the withdrawal on Waters of the Great Lakes Basin, defined as *Waters of the Basin* in the Compact. Hydrological feasibility includes capacity of the source, sustainability, and other issues; it is merely a summary of conclusions reached in the previous section. There is no evaluation of a return flow to Lake Michigan.

Deep Unconfined Aquifer west of Waukesha—This is a viable source of water supply with good water quality. The aquifer is largely protected from the effects of drought, and there are no substantive issues of long-term sustainability. The amount of water that can be pumped from this aquifer without causing significant adverse impacts to surface water bodies has not been determined. There would likely be adverse impacts on shallow domestic wells and surface water features, but the amount of impact is not known. The groundwater flow model used could not appropriately address these issues. Therefore the environmental impacts of withdrawals on Waters of Wisconsin are unknown. There are no environmental impacts of withdrawals on Waters of the Great Lakes Basin.

Silurian Dolomite Aquifer—This aquifer could provide a sustainable supply of 2 to 3 Mgd. The potential environmental impacts of withdrawals are not presented. Therefore the environmental impacts of withdrawals on Waters of Wisconsin are unknown. There are no environmental impacts of withdrawals on Waters of the Great Lakes Basin.

Deep Confined Aquifer—This aquifer could supply up to 14 Mgd from existing operational wells, although the Application only considers smaller withdrawals (7.6 Mgd) from this aquifer in combination with other sources. Withdrawals from this aquifer may be sustainable, however specific modeling to consider sustainability was not done. That is, no modeling scenario was run using updated regional pumping and ongoing pumpage of 7.6 Mgd from Waukesha. Specific impacts of Waukesha's pumpage on surface water are not known, because modeling done to consider this was done using a regional model, rather than a local model. Therefore the environmental impacts of withdrawals on Waters of Wisconsin are unknown. There are no environmental impacts of withdrawals on Waters of the Great Lakes Basin.

Shallow Aquifer (Troy Bedrock Valley Aquifer)—The amount of water that could be withdrawn from this aquifer without having significant adverse impacts on surface water or domestic wells has not been determined. There would likely be adverse impacts on shallow domestic wells and surface water features, but the amount of impact is not known. The groundwater flow model used could not appropriately address these issues. Therefore the environmental impacts of withdrawals on Waters of Wisconsin are unknown. There are no environmental impacts of withdrawals on Waters of the Great Lakes Basin.

Shallow Aquifer (Fox River Alluvium)—This aquifer may be able to provide a sustainable supply of 6 Mgd or more, provided there is wastewater return upstream to mitigate effects of reduced flow in the Fox River. The model of a hypothetical well field did not address any impacts on specific domestic wells. The Vernon Marsh was outside the local modeling area. There would likely be adverse impacts on shallow domestic wells and surface water features, other than the Fox River. Site-specific modeling of a planned well field would be needed to determine local effects on domestic wells and surface water. Therefore the environmental impacts of withdrawals on Waters of Wisconsin are unknown. There are no environmental impacts of withdrawals on Waters of the Great Lakes Basin.

Lake Michigan—This source can meet Waukesha's future needs. There would be some negative environmental impact on the Fox River due to smaller WWTP discharges. Therefore the environmental impacts of withdrawals on Waters of Wisconsin are small. There are no environmental impacts of withdrawals on Waters of the Great Lakes Basin.

Source	Hydrologic Feasibility and Issues	Environmental Impacts of Withdrawal on Waters of Wisconsin outside Great Lakes Basin	Environmental Impacts of Withdrawal on Waters of the Great Lakes Basin
Deep Unconfined Aquifer west of Waukesha	Sustainability and capacity to meet some or all of Waukesha's future demand cannot be determined from available studies.	Degree of impact of withdrawals on nearby surface water or domestic wells cannot be determined from available studies.	None
Silurian Dolomite Aquifer	Can provide a sustainable supply of 2-3 Mgd.	Not evaluated in available studies.	None
Deep Confined Aquifer	Available wells have a capacity of 14 Mgd. Sustainability of withdrawals to meet some or all of Waukesha's future demand cannot be determined from available studies.	Degree of impact of withdrawals on surface water cannot be determined from available studies.	None
Shallow Aquifer (Troy Bedrock Valley)	Sustainability and capacity to meet some or all of Waukesha's future demand cannot be determined from available studies.	Degree of impact of withdrawals on nearby surface water or domestic wells cannot be determined from available studies.	None
Shallow Aquifer (Fox River Alluvium)	Can provide a sustainable supply of at least 6 Mgd, provided wastewater return occurs upstream of well field.	Impacts on Fox River mitigated by wastewater return. Some negative impact on nearby surface water. Impact on domestic wells not studied.	None
Lake Michigan	Can meet all of Waukesha's future demand.	Baseflow reduction of about 25 percent downstream of current WWTP.	None

Table 5. Summary evaluation of Waukesha's alternative sources.

Summary and Conclusions

The goal of this paper is to provide an objective scientific analysis of particular aspects of the Application of the City of Waukesha's Water Diversion Application submitted to Wisconsin DNR (WDNR) in May 2010. Numerous other associated documents were also reviewed. The scope of this paper is limited to three aspects of the Application: conservation and efficiency measures, demand forecast, and sources of water supply. For sources the focus is on hydrologic and environmental aspects of withdrawals in the Application. Issues related to economic factors and return flow to Lake Michigan, for instance, are not addressed.

Conservation and Efficiency Measures

Waukesha developed a plan for water conservation in 2006 and updated it in 2012. The plan outlines Conservation and Efficiency Measures (CEMs) to meet a goal of 10 percent water savings by 2050 or 1.0 Mgd. The major CEMs are monitoring unaccounted for water, public education, replacing inefficient water fixtures, reducing outdoor watering, and pricing incentives. Specific water savings goals for each CEM are not given, other than for savings related to water fixtures.

Waukesha has relatively low unaccounted for water (about 6 percent) and plans to keep it low with ongoing response to issues shown from system audits. Public education is being carried out through various media and venues to ensure people are aware of the other CEMs. In the first three years of the fixture replacement program, only 88 toilets were replaced. Waukesha plans to increase the toilet rebate from $25 to $100, expand the types of inefficient fixtures in the rebate program, and expand the program to other use sectors other than just residential. Waukesha implemented outdoor watering restrictions in 2006, and these are part of the reason overall demand and maximum day demand have decreased since 2006. The pricing incentive is an inclining water rate block structure that was adopted by Waukesha in 2007 and is the first in Wisconsin. The structure has three rate blocks with a different cost of water in each. For instance, if a residential customer begins using more than 30,000 gallons in one quarter, then their cost of water is about 40 percent higher than when they were using 10,000 gallons or less. Waukesha is considering monthly, rather than quarterly, billing to provide better feedback to customers regarding their water use in each rate block, thus making the pricing incentive stronger.

Waukesha has set a specific conservation goal of 1.0 Mgd by 2050. It will be difficult to track progress toward meeting that goal for most of the CEMs, since there are many confounding factors that affect water use. However Waukesha's CEMs have been successful in conserving similar amounts of water at other municipal utilities in the U.S. If Waukesha's plan is fully implemented and successful, then the amount of water used per person each day (GPCD) should decrease.

Demand Forecast

Waukesha's demand for water has been decreasing since the late 1980's, although population has increased during that time. Thus, GPCD also has decreased since the late 1980s.

Waukesha's most recent demand forecasts for 2050 are an average day demand of 10.9 million gallons per day (Mgd) and a maximum day demand of 18.5 Mgd. Future average day demand is forecast by using a static GPCD of 112, future population estimates, assumptions on unaccounted for water, and a 10 percent reduction in demand from implementing CEMs. Future maximum day demand is based on a ratio of maximum day demand to average day demand of 1.68.

In contrast, Waukesha's 2010 GPCD was 86 and the ratio of maximum day demand to average day demand was 1.30. Only one year since 1970 had a ratio greater than 1.68; the average since 1970 is 1.46.

The demand forecast for 2050 does not account for historical trends in declining GPCD. There is no reason not to expect this decline to continue for some time. A conservative demand forecast could assume decreasing trends in GPCD cease at 86 and that CEMs will not decrease the ratio of maximum day to average day demand beyond the average from 2006-2010, which is 1.45. These assumptions would result in a demand forecast of an average day demand of 8.0 Mgd and a maximum day demand of 11.1 Mgd. To use these assumptions, however, one would have to provide convincing argument that declining trends in GPCD will cease and that CEMs will not further lower maximum day demand.

Alternative Sources

This paper evaluated six alternative sources of water supply: deep unconfined aquifer west of Waukesha, Silurian Dolomite aquifer, deep confined aquifer, shallow aquifer (Troy Bedrock Valley), shallow aquifer (Fox River Alluvium), and Lake Michigan. No combinations of sources were evaluated. These sources were evaluated according to (1) hydrological feasibility of the withdrawal; (2) the environmental impacts of the withdrawal on Waters of Wisconsin outside the Great Lakes Basin (that is, waters that are not defined as *Waters of the Basin* in the Compact); and (3) environmental impacts of the withdrawal on Waters of the Great Lakes Basin, defined as *Waters of the Basin* in the Compact. There is no evaluation of a return flow to Lake Michigan.

The Application raises some issues in evaluating the merits of alternative sources which this paper concludes are either a not an issue or not proven to be an issue. The first is concern about contamination of source waters. This paper points out that all sources can be contaminated, need to be protected, and that rankings related to this issue are not part of this paper's evaluation. The second are issues related to the effect of groundwater withdrawals on Waters of the Great Lakes Basin. This paper shows that none of the groundwater sources are Waters of the Great Lakes Basin and that no studies have been done to show how any changes in only

Waukesha's pumping would affect flow of groundwater to streams tributary to Lake Michigan. The third is the Application's evaluation of how uses of various sources will or will not meet Compact requirements. The Application treats the shallow and deep aquifers as Waters of the Great Lake Basin, which, by Compact definition, they are not. The fourth is related to statements of continuing decline of water levels in the deep confined aquifer. Available data and modeling show that water levels are stabilizing or rising due to recent regional changes, and there are no data presented in the Application to support the argument that significant declines are occurring nor modeling to show that they will occur. The fifth is related to treating source water to meet drinking water standards and how this affects the merit of different sources. All sources need to be treated, and since the issue is cost, it is not part of the scope of this paper.

Each of the alternative sources could provide some of Waukesha's future water needs. Some could meet all. There would be no adverse environmental impact from withdrawals on Waters of the Great Lakes Basin from any of the sources. For none of the groundwater sources, however, is there adequate information to determine the environmental impacts of withdrawals on the Waters of Wisconsin. For some sources, the information is inadequate because the groundwater model, as constructed, could not appropriately address the effect of groundwater withdrawals on surface water (unconfined aquifer west of Waukesha, deep confined aquifer and Troy Bedrock Valley). For others, the model or analysis were appropriately done, but effects of withdrawals on surface water features and domestic wells were not considered or within the scope of the modeling effort (Silurian Dolomite aquifer and Fox River Alluvium).

In conclusion, the Application's demand forecast and evaluation of alternative sources are problematic. The demand forecast does not provide justification for (1) using a GPCD that is higher than any of the last ten years; (2) assuming that the historical downward trends in demand will stop; and (3) why CEMs will not lower GPCD further and decrease the maximum day demand. The evaluation of alternative sources uses results of groundwater flow models that either (1) were inappropriately constructed to evaluate the effects of withdrawals on surface water and domestic wells or (2) did not specifically consider the effects of withdrawals on surface water and domestic wells.

Publications and Documents Reviewed

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1999, P.W. Mayer and others, Residential End Uses of Water, 310 p.

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2002, July, United States Environmental Protection Agency, Cases in Water Conservation: How Efficiency Programs Help Water Utilities Save Water and Avoid Costs.

2004, April, 2003 Annual report of the Waukesha Water Utility to the Public Service Commission of Wisconsin, 80 p.

2005, June, D.T. Feinstein and others, A regional aquifer simulation model for southeastern Wisconsin, SEWRPC Technical Report 41, 63 p.

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2007, September, D.S. Cherkauer, Ground water conditions around the Lather property, report to the Board of the Town of Waukesha, 24 p.

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2009, May, AECOM, Appendix K, Final draft technical memorandum: summary of water requirements, 16 p.

2009, November, K.R. Bradbury and T.W. Rayne, Shallow groundwater quantity sustainability analysis demonstration for the southeastern Wisconsin region, SEWRPC Technical Report 48, 38 p.

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2010, April, Appendix O, Results of groundwater modeling study: Shallow groundwater source Fox River & Vernon Marsh area Waukesha Water Utility, 13 p.

2010, April, CH2MHILL, Appendix D, Water supply service area plan for city of Waukesha, 53 p.

2010, May, Application for Lake Michigan water supply, 120 p.

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2011, March, N. Quirk, Report on Water Conservation Programs to Public Service Commission of Wisconsin, 29 p.

2011, April, various authors, Responses regarding water supply, WS7, WS7A, WS9, WS10, WS11, 324 p.

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2011, December, CDM, Water Efficiency Potential Study for Wisconsin, 95 p.

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2012, March, 2011 Annual report of the Waukesha Water Utility to the Public Service Commission of Wisconsin, 97 p.

2012, May, CH2MHILL, Final Water Conservation Plan, 168 p.

2012, D.T. Feinstein and others, Development and application of a groundwater/surface-water flow model using MODFLOW-NWT for the upper Fox River basin, southeastern Wisconsin, USGS Scientific Investigations Report 2012-5108, 124 p.

Commentary to UWM presentation to DNR on riverbank inducement, dated April 1, 2011.

Letter to Eric Ebersberger and others of the DNR from D.S. Cherkauer, dated June 17, 2011.

Letter to Eric Ebersberger of the DNR from Waukesha Utility Manager Dan Duchniak, dated July 29, 2011

Letter to Waukesha Utility Manager Dan Duchniak from Administrator Johnson, dated July 18, 2012

Letter to Secretary Cathy Stepp from Mayor Barrett and Alderman Hines dated July 18, 2012

Letter to Mayor Barrett and Alderman Hines from Secretary Cathy Stepp dated August 2, 2012

Web Site, USGS, Ground water in the and Great lakes: the case of southeast Wisconsin, http://wi.water.usgs.gov/glpf/

Acknowledgments—This analysis was funded by the National Wildlife Federation (NWF). Any opinions expressed are from the author and not from NWF. The author acknowledges the able assistance of Emily Posthumus in researching CEMs and providing draft materials for that section of the paper. Review of parts of the paper by several anonymous individuals was very helpful. Additionally, a team of Marc Smith (NWF), Peter McAvoy (UW Milwaukee), Karen Hobbs (Natural Resources Defense Council), and Jared Teutsch (Alliance for the Great Lakes) provided scoping advice during the analysis and reviews of the entire paper.

About the author—Jim Nicholas is owner of nicholas-h20, working at the water science and decision-making nexus and providing assistance to organizations in the Great Lakes region. Previously, as Director of the USGS Michigan Water Science Center he helped lead statewide and bi-national research efforts to better understand the relationship of groundwater and surface water in support of the Great Lakes-St Lawrence River Basin Compact and related Michigan legislation. During his 33-year career at USGS, he helped conduct, plan, or review scores of groundwater projects, including ones that examined flow in glacial deposits, Cambrian-Ordovician aquifer, and Silurian Dolomite aquifer. Jim has been a technical advisor to several state and regional groups that deal with the application of hydrology to policy, regulatory, and resource management issues. He holds a B.S. in Geology from Wheaton College, an M.S. in Geology from Northern Illinois University and an M.S. in Civil Engineering—Water Resources from Stanford University.

Appendix 4

GREAT LAKES AND ST. LAWRENCE CITIES INITIATIVE
ALLIANCE DES VILLES DES GRANDS LACS ET DU SAINT-LAURENT

RESOLUTION 2016-1B

OPPOSING THE WAUKESHA WATER DIVERSION APPLICATION

WHEREAS, the Great Lakes and St. Lawrence River Basin represents approximately 20% of the world's surface freshwater resource and supports the third largest economy in the world;

WHEREAS, on December 13, 2005, the Great Lakes Governors of Illinois, Indiana, Michigan, Minnesota, New York, Ohio, Pennsylvania and Wisconsin, and the Premiers of Ontario and Québec signed the Great Lakes—St. Lawrence River Basin Sustainable Water Resources Agreement (the "Agreement"), and the Governors endorsed the companion Great Lakes—St. Lawrence River Basin Water Resources Compact (the "Compact"), which was later approved by the United States Congress and signed by the President, banning new water diversions from the Basin except in communities located in counties straddling the water division line between the Great Lakes-St. Lawrence Basin and other basins; and

WHEREAS, the City of Waukesha, WI, is located in Waukesha County, a county straddling the water division line; and

WHEREAS, the City of Waukesha has applied under the exception for a "Community within a Straddling County" to use water from Lake Michigan as its source of drinking water to the Wisconsin Department of Natural Resources (the "Waukesha Application"); and

WHEREAS, the exception requires the diverted waters be used solely for the "Public Water Supply Purposes" of the specific "Community within a Straddling County" as defined in the Agreement and Compact; and

WHEREAS, the Wisconsin Department of Natural Resources has deemed the Waukesha Application approvable and forwarded it on January 7, 2016 to the Great Lakes-St. Lawrence River Water Resources Regional Body (Regional Body) and Compact Council for its consensus decision; and

WHEREAS, all eight Great Lakes states must vote in favor of the Waukesha Application for it to go forward at a special meeting of the Compact Council in late spring 2016; and

WHEREAS, the Waukesha Application does not meet the terms of the Agreement nor the Compact, as there are significant questions about the necessity of the diversion to meet the drinking water quantity and quality needs of the City of Waukesha, among other concerns; and

WHEREAS, the City of Waukesha plans to provide water to a broader service area consisting of neighboring communities which have not demonstrated a need for a new water supply, contrary to the terms of the Agreement and Compact, and plans to do so based on broader water master plans rather than the specific demonstrated needs of the City of Waukesha; and

WHEREAS, this broader service area is not a "Community within a Straddling County" as defined and required by the exception in the Agreement and Compact; and

WHEREAS, the precedent-setting nature of the Waukesha Application is of great concern to the Mayors of the Great Lakes and St. Lawrence Cities Initiative; and

WHEREAS, the impacts of the proposed return flow of water to Lake Michigan through the Root River will cause significant changes to the ecosystem and to the urban shores of the mouth of the River; and

WHEREAS, the Regional Body review process is inadequate as it provides for only one public meeting to be held in the City of Waukesha, resulting in far too limited public engagement on a matter of great regional, national, and international importance, contrary to the prescribed objectives of the Agreement and Compact; and

WHEREAS, the Regional Body is not providing sufficient public information to residents in the Great Lakes and St. Lawrence River Basin; and

WHEREAS, the Regional Body's decision on Wisconsin Department of Natural Resources' Declaration of Finding, expected on April 21, 2016, allows for input from the eight US Great Lakes states, Ontario and Quebec, and will be key in the final Compact Council decision.

THEREFORE, BE IT RESOLVED, that the Mayors of the Great Lakes and St. Lawrence Cities Initiative reaffirm their commitment to the protection of our water resources by calling on the Governors of Illinois, Indiana, Michigan, Minnesota, New York, Ohio, Pennsylvania and Wisconsin, and the Premiers of Ontario and Québec, and their representatives on the Regional Body and Compact Council to reject the Waukesha Application in its current form; and

BE IT FINALLY RESOLVED, that the Mayors urge the Governors and Premiers of the Regional Body and Compact Council, consistent with good public policy, to ensure complete transparency and full public engagement through open meetings,

webinars, websites and any other appropriate means of communication, including at least one public hearing in each of the ten jurisdictions included in this process.

Signed this 11th day of February, 2016

Mitch Twolan, Chair
Great Lakes and St. Lawrence Cities Initiative
Mayor, Township of Huron-Kinloss, Ontario

TORONTO

Ulli S. Watkiss
City Clerk

City Clerk's Office

Secretariat
Marilyn Toft
Council Secretariat Support
City Hall, 12th Floor, West
100 Queen Street West
Toronto, Ontario M5H 2N2

Tel: 416-392-7032
Fax: 416-392-2980
e-mail: mtoft@toronto.ca
web: www.toronto.ca

In reply please quote:
Ref.: 16-MM12.1

February 16, 2016

His Worship Mitch Twolan
Chair
Board of Directors
Great Lakes and St. Lawrence Cities Initiative
20 North Wacker Drive, Suite 2700
Chicago, Illinois 60606

Dear Mayor Twolan:

Subject: **City Council - Member Motion Item 12.1**
Maintaining High Standards for Removing Water from the Great Lakes and St. Lawrence River Basin - by Councillor Mike Layton, seconded by Councillor Paul Ainslie

City Council on February 3 and 4, 2016, adopted the following:

1. City Council endorse the Great Lakes and St. Lawrence Cities Initiative draft Board of Directors Resolution 2016-1B opposing the Waukesha water diversion application.

2. City Council encourage the Great Lakes-St. Lawrence River Water Resources Regional Body and Great Lakes-St. Lawrence River Basin Water Resources Council, (the Compact Council) to consider the future implications of this diversion and decline the Waukesha application.

3. City Council request that the Regional Body clarify the public consultation requirements involved in the lead-up to a decision on a diversion application with respect to the kind of information that is provided, where and how it is provided and minimum consultation timeframes.

4. City Council request the City Clerk to forward a copy of this Motion to the Government of Ontario, (the Premier and the Minister of the Environment and Climate Change) the Government of Québec, (the Premier and the Minister of Sustainable Development, the Environment and the Fight Against Climate Change) the Mayors of Montréal, Québec City, Chicago and Detroit and the Governors represented on the Regional Body and Compact Council.

Yours sincerely,

for City Clerk

M. Toft/ga

Attachment

Sent to: Premier, Province of Ontario
Minister of the Environment and Climate Change, Province of Ontario
Premier, Province of Québec
Minister of Sustainable Development, the Environment and the Fight Against Climate Change, Sustainable Development, Province of Québec
Mayor of Montréal
Mayor of Québec City
Mayor of Chicago
Mayor of Detroit
Governor of Illinois
Governor of Indiana
Governor of Michigan
Governor of Minnesota
Governor of New York State
Governor of Ohio
Governor of Pennsylvania
Governor of Wisconsin
Great Lakes and St. Lawrence Cities Initiative
Great Lakes-St. Lawrence River Water Resources Regional Body
Great Lakes-St. Lawrence River Basin Water Resources Council

c. City Manager

TORONTO Decisions

City Council

Member Motions - Meeting 12

MM12.1	ACTION	Adopted		Ward:All

Maintaining High Standards for Removing Water from the Great Lakes and St. Lawrence River Basin - by Councillor Mike Layton, seconded by Councillor Paul Ainslie

City Council Decision

City Council on February 3 and 4, 2016, adopted the following:

1. City Council endorse the Great Lakes and St. Lawrence Cities Initiative draft Board of Directors Resolution 2016-1B opposing the Waukesha water diversion application.

2. City Council encourage the Great Lakes-St. Lawrence River Water Resources Regional Body and Great Lakes-St. Lawrence River Basin Water Resources Council, (the Compact Council) to consider the future implications of this diversion and decline the Waukesha application.

3. City Council request that the Regional Body clarify the public consultation requirements involved in the lead-up to a decision on a diversion application with respect to the kind of information that is provided, where and how it is provided and minimum consultation timeframes.

4. City Council request the City Clerk to forward a copy of this Motion to the Government of Ontario, (the Premier and the Minister of the Environment and Climate Change) the Government of Québec, (the Premier and the Minister of Sustainable Development, the Environment and the Fight Against Climate Change) the Mayors of Montréal, Québec City, Chicago and Detroit and the Governors represented on the Regional Body and Compact Council.

Summary

The Great Lakes and the St. Lawrence River represent the largest body of surface fresh water in the world and are a vibrant, diverse ecosystem that is critically important to the economic wellbeing and quality of life of the Canadian and U.S. populations in the region. The Great Lakes provide drinking water to over 40 million, are home to over 350 species of fish, and contain 84 percent of North America's freshwater supply.

Town of Whitby
Office of the Town Clerk
575 Rossland Road East, Whitby, ON L1N 2M8
www.whitby.ca

February 10, 2016

David A. Ullrich, Executive Director
Great Lakes and St. Lawrence Cities Initiative
20 North Wacker Drive, Suite 2700
Chicago, Illinois 60606
Phone: 312.201.4516
david.ullrich@glslcities.org

Re: Correspondence Number 2016-23 from David A. Ullrich, Executive Director, Great Lakes and St. Lawrence Cities Initiative dated January 15, 2016 regarding Waukesha Diversion Application - Resolution for Member Comments

Please be advised that at a meeting held on February 8, 2016, the Council of the Town of Whitby adopted the following recommendation:

Whereas, the Great Lakes and St. Lawrence River Basin represents approximately 20% of the world's freshwater resource and supports the third largest economy in the world; and,

Whereas, on December 13, 2015, the Great Lakes Governors of Illinois, Indiana, Michigan, Minnesota, New York, Ohio, Pennsylvania and Wisconsin, and the Premiers of Ontario and Quebec signed the Great Lakes-St. Lawrence River Basin Sustainable Water Resources Agreement, and the Governors endorsed the companion Great Lakes-St. Lawrence River Basin Water Resources Compact (the Compact), which was later approved by the United States Congress and signed by the President, banning new water diversions from the Basin except in communities located in counties straddling the water division line between the Great Lakes-St. Lawrence Basin and other basins; and,

Whereas, the City of Waukesha, WI, is located in Waukesha County, a county straddling the water division line; and,

Whereas, the City of Waukesha has applied to use water from Lake Michigan as its source of during water to the Wisconsin Department of Natural Resources; and,

Whereas, the Wisconsin Department of Natural Resources has deemed the diversion application approvable and forwarded it on January 7, 2016 to the Great Lakes-St. Lawrence River Water Resources Regional Body (Regional Body) and Compact Council for its consensus and decision; and,

Whereas, all eight Great Lakes states must vote in favour of the application for it to go forward to a special meeting of the Compact Council in late spring 2016; and,

Whereas, the application does not meet the terms of the Compact, as there are significant questions about the necessity of the diversion to meet the drinking water quantity and quality needs of Waukesha and other concerns; and,

Whereas, the City of Waukesha plans to provide water to its neighbouring communities which have not demonstrated a need for a new water supply, contrary to the terms of the Compact; and,

Whereas, the precedent-setting nature of the Waukesha water diversion application is of great concern to the mayors of the Great Lakes and St. Lawrence Cities Initiative; and,

Whereas, the impacts of the proposed return flow of water to Lake Michigan through the Root River will cause significant changes to the ecosystem and to the urban shores of the mouth of the River; and,

Whereas, the Regional Body review process is inadequate as it provides for only one public meeting to be held in Waukesha, resulting in far too limited public engagement on a matter of great regional, national, and international importance; and,

Whereas, the Regional Body is not providing sufficient public information to Basin residents; and,

Whereas, the Regional Body's decision on Wisconsin DNR's Declaration of Finding, expected on April 21, 2016, allows for input from the eight US Great Lakes states, Ontario and Quebec, and will be key in the final Compact Council decision.

Therefore, be it resolved, that the Council of the Town of Whitby, a member of the Great Lakes and St. Lawrence Cities Initiative, reaffirm its commitment to the protection of our water resources by calling the Governors of Illinois, Indiana,

Michigan, Minnesota, New York, Ohio, Pennsylvania and Wisconsin, and the Premiers of Ontario and Quebec, and their representatives on the Regional Body and Compact Council to reject the Waukesha water diversion application in its current form; and,

Be it finally resolved, that the Council of the Town of Whitby urge the Governors and Premiers of the Regional Body and Compact Council, consistent with good public policy, to ensure complete transparency and full public engagement through open meeting, webinars, websites and any other appropriate means of communication, including at least one public hearing in each of the 10 jurisdictions included in this process.

Should you require further information, please do not hesitate to contact the undersigned at 905-430-4302.

Chris Harris
Town Clerk

Office of the County Warden
789 Broadway Street, Box 3000
Wyoming, ON N0N 1T0

Telephone: 519-845-0801
Toll-free: 1-866-324-6912
Fax: 519-845-3160

SENT VIA EMAIL

January 28, 2016

Great Lakes and St. Lawrence Cities Initiative
20 North Wacker Drive, Suite 2700
Chicago, Illinois 60606 USA

Attn: David A. Ullrich, Executive Director

Dear Mr. Ullrich:

Re: Resolution 2016-1B Opposing the Waukesha Water Diversion Application

Please be informed that Lambton County Council, at its January 20, 2016 committee meetings endorsed the attached resolution 2016-1B regarding the proposed diversion of water.

Please contact me should you require any further information.

Sincerely,

Bev MacDougall
County Warden

cc: Marilyn Gladu, M.P. Sarnia-Lambton Riding
Bob Bailey, M.P.P. Sarnia-Lambton Riding

GREAT LAKES AND ST. LAWRENCE CITIES INITIATIVE
ALLIANCE DES VILLES DES GRANDS LACS ET DU SAINT-LAURENT

RESOLUTION 2016-1B

OPPOSING THE WAUKESHA WATER DIVERSION APPLICATION

WHEREAS, the Great Lakes and St. Lawrence River Basin represents approximately 20% of the world's freshwater resource and supports the third largest economy in the world;

WHEREAS, on December 13, 2005, the Great Lakes Governors of Illinois, Indiana, Michigan, Minnesota, New York, Ohio, Pennsylvania and Wisconsin, and the Premiers of Ontario and Québec signed the Great Lakes—St. Lawrence River Basin Sustainable Water Resources Agreement, and the Governors endorsed the companion Great Lakes—St. Lawrence River Basin Water Resources Compact (the Compact), which was later approved by the United States Congress and signed by the President, banning new water diversions from the Basin except in communities located in counties straddling the water division line between the Great Lakes-St. Lawrence Basin and other basins; and

WHEREAS, the City of Waukesha, WI, is located in Waukesha County, a county straddling the water division line; and

WHEREAS, the City of Waukesha has applied to use water from Lake Michigan at its source of drinking water to the Wisconsin Department of Natural Resources;

WHEREAS, the Wisconsin Department of Natural Resources has deemed the diversion application approvable and forwarded it on January 7, 2016 to the Great Lakes-St. Lawrence River Water Resources Regional Body (Regional Body) and Compact Council for its consensus decision; and

WHEREAS, all eight Great Lakes states must vote in favor of the application for it to go forward to a special meeting of the Compact Council in late spring 2016; and

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WHEREAS, the City of Waukesha plans to provide water to its neighboring communities which have not demonstrated a need for a new water supply, contrary to the terms of the Compact; and

WHEREAS, the precedent-setting nature of the Waukesha water diversion application is of great concern to the mayors of the Great Lakes and St. Lawrence Cities Initiative; and

20 North Wacker Drive, Suite 2700, Chicago, Illinois 60606 ~ (312) 201-4516 phone ~ (312) 407-0038 fax
www.glslcities.org / @GLSLCities
Mitch Twolan, Mayor of Huron-Kinloss, Chair
Denis Coderre, Mayor of Montréal, Vice-Chair
Paul Dyster, Mayor of Niagara Falls, New York, Secretary-Treasurer

Great Lakes and St. Lawrence Cities Initiative
Alliance des villes des Grands Lacs et du Saint-Laurent

WHEREAS, the impacts of the proposed return flow of water to Lake Michigan through the Root River will cause significant changes to the ecosystem and to the urban shores of the mouth of the River; and

WHEREAS, the Regional Body review process is inadequate as it provides for only one public meeting to be held in Waukesha, resulting in far too limited public engagement on a matter of great regional, national, and international importance; and

WHEREAS, the Regional Body is not providing sufficient public information to Basin residents. and

WHEREAS, the Regional Body's decision on Wisconsin DNR's Declaration of Finding, expected on April 21, 2016, allows for input from the eight US Great Lakes states, Ontario and Quebec, and will be key in the final Compact Council decision.

THEREFORE, BE IT RESOLVED, that the mayors of the Great Lakes and St. Lawrence Cities Initiative reaffirm their commitment to the protection of our water resources by calling the Governors of Illinois, Indiana, Michigan, Minnesota, New York, Ohio, Pennsylvania and Wisconsin, and the Premiers of Ontario and Québec, and their representatives on the Regional Body and Compact Council to reject the Waukesha water diversion application in its current form; and

BE IT FINALLY RESOLVED, that the mayors urge the Governors and Premiers of the Regional Body and Compact Council, consistent with good public policy, to ensure complete transparency -and full public engagement through open meetings, webinars, websites and any other appropriate means of communication, including at least one public hearing in each of the 10 jurisdictions included in this process

20 North Wacker Drive, Suite 2700, Chicago, Illinois 60606 ~ (312) 201-4516 phone ~ (312) 407-0038 fax
www.glslcities.org / @GLSLCities
Mitch Twolan, Mayor of Huron-Kinloss, Chair
Denis Coderre, Mayor of Montréal, Vice-Chair
Paul Dyster, Mayor of Niagara Falls, New York, Secretary-Treasurer

The Corporation of the Township of Huron-Kinloss

P.O. Box 130
21 Queen Street
Ripley, Ontario
N0G 2R0

Phone 519-395-3735
Fax 519-395-4107
Email info@huronkinloss.com
www.huronkinloss.com

SENT BY EMAIL

February 17th, 2016

Simon Belisle, Program Manager
Great Lakes and St. Lawrence Cities Initiative
20 North Wacker Drive, Suite 2700
Chicago, Illinois 60606
Phone: 312.201.4517
simon.belisle@glslcities.org
www.glslcities.org

Dear; Sir

Re: Support for GLSLCI Board Resolution- Waukesha Diversion Application

On behalf of the Township of Huron-Kinloss Council please find below a resolution of support passed at the February 16th, 2016 Council Meeting for the Great Lakes and St. Lawrence Cities Initiative Board Resolution opposing the Waukesha Diversion Application.

> Motion No: 38
> Moved by: Elliott Seconded by: Sloetjes
> That the Township of Huron-Kinloss Council hereby endorses resolution 2016-1B of the Great Lakes and St. Lawrence Cities Initiative opposing the Waukesha Water Diversion Application and in so doing supports their commitment to the protection of our water resources by calling on the Governors of Illinois, Indiana, Michigan, Minnesota, New York, Ohio, Pennsylvania and Wisconsin, and the Premiers of Ontario and Quebec and their representatives on the Regional Body and Compact Council to reject the Waukesha Application in its current form.
>
> Carried.

We thank you for your work and continued commitment to the health and vitality of the Great Lakes and St. Lawrence basin.

Sincerely,

Sonya Watson, Clerk

c.c. Honourable Kathleen Wynne, Premier

File: 850 Great Lakes St. Lawrence Cities Initiative

TOWN OF Parry Sound

THE CORPORATION OF THE TOWN OF PARRY SOUND
RESOLUTION IN COUNCIL

NO. 2016 – 019

DIVISION LIST	YES	NO
Councillor **P. BORNEMAN**	___	___
Councillor **B. HORNE**	___	___
Councillor **B. KEITH**	___	___
Councillor **J. MARSHALL**	___	___
Councillor **D, McCANN**	___	___
Councillor **K. SAULNIER**	___	___
Mayor **J. McGARVEY**	___	___

DATE: February 16, 2016

MOVED BY: _____

SECONDED BY: _____

CARRIED: ✓ **DEFEATED:** _____ **Postponed to:** _____

Whereas the Great Lakes and St. Lawrence River Basin represents approximately 20% of the world's surface freshwater resource and supports the third largest economy in the world; and

Whereas the City of Waukesha, WI has applied to use water from Lake Michigan as its source of drinking water to the Wisconsin Department of Natural Resources; and

Whereas the Mayors of the Great Lakes and St. Lawrence Cities Initiative's (GLSLCI) Board has deemed that the request does not fall under the guidelines for "Public Water Supply Purposes" as Waukesha plans to supply water to outlying communities that do not fall under the "Community within a Straddling County" guidelines of the Agreement and Compact; and

Whereas the Mayors of the GLSLCI have called on the Governors of Illinois, Indiana, Michigan, Minnesota, New York, Ohio, Pennsylvania and Wisconsin and the Premiers Ontario and Québec and their representatives on the Regional Body and Compact Council to reject the Waukesha Application in its current form; and

Whereas the Council of the Town of Parry Sound passed Resolution 2016-010 on February 2, 2016 supporting the Mayors of the GLSLCI's position;

Therefore, Be It Resolves that Council for the Town of Parry Sound supports the formal resolution of the GLSLCI, Resolution 2016-1B, attached as Schedule "A", rejecting the City of Waukesha, WI's application in its present form; and

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Further, that this resolution be forwarded to the GLSLCI Board and to the Premier of Ontario, Kathleen Wynne.

DEPUTY MAYOR

Schedule "A" - Resolution 2016- 019

Great Lakes and St. Lawrence Cities Initiative
Alliance des villes des Grands Lacs et du Saint-Laurent

GREAT LAKES AND ST. LAWRENCE CITIES INITIATIVE
ALLIANCE DES VILLES DES GRANDS LACS ET DU SAINT-LAURENT

RESOLUTION 2016-1B

OPPOSING THE WAUKESHA WATER DIVERSION APPLICATION

WHEREAS, the Great Lakes and St. Lawrence River Basin represents approximately 20% of the world's surface freshwater resource and supports the third largest economy in the world;

WHEREAS, on December 13, 2005, the Great Lakes Governors of Illinois, Indiana, Michigan, Minnesota, New York, Ohio, Pennsylvania and Wisconsin, and the Premiers of Ontario and Québec signed the Great Lakes—St. Lawrence River Basin Sustainable Water Resources Agreement (the "Agreement"), and the Governors endorsed the companion Great Lakes—St. Lawrence River Basin Water Resources Compact (the "Compact"), which was later approved by the United States Congress and signed by the President, banning new water diversions from the Basin except in communities located in counties straddling the water division line between the Great Lakes-St. Lawrence Basin and other basins; and

WHEREAS, the City of Waukesha, WI, is located in Waukesha County, a county straddling the water division line; and

WHEREAS, the City of Waukesha has applied under the exception for a "Community within a Straddling County" to use water from Lake Michigan as its source of drinking water to the Wisconsin Department of Natural Resources (the "Waukesha Application"); and

WHEREAS, the exception requires the diverted waters be used solely for the "Public Water Supply Purposes" of the specific "Community within a Straddling County" as defined in the Agreement and Compact; and

WHEREAS, the Wisconsin Department of Natural Resources has deemed the Waukesha Application approvable and forwarded it on January 7, 2016 to the Great Lakes-St. Lawrence River Water Resources Regional Body (Regional Body) and Compact Council for its consensus decision; and

WHEREAS, all eight Great Lakes states must vote in favor of the Waukesha Application for it to go forward at a special meeting of the Compact Council in late spring 2016; and

20 North Wacker Drive, Suite 2700, Chicago, Illinois 60606 ~ (312) 201-4516 phone ~ (312) 407-0038 fax
www.glslcities.org / @GLSLCities
Mitch Twolan, Mayor of Huron-Kinloss, Chair
Denis Coderre, Mayor of Montréal, Vice-Chair
Paul Dyster, Mayor of Niagara Falls, New York, Secretary-Treasurer

WHEREAS, the Waukesha Application does not meet the terms of the Agreement nor the Compact, as there are significant questions about the necessity of the diversion to meet the drinking water quantity and quality needs of the City of Waukesha, among other concerns; and

WHEREAS, the City of Waukesha plans to provide water to a broader service area consisting of neighboring communities which have not demonstrated a need for a new water supply, contrary to the terms of the Agreement and Compact, and plans to do so based on broader water master plans rather than the specific demonstrated needs of the City of Waukesha; and

WHEREAS, this broader service area is not a "Community within a Straddling County" as defined and required by the exception in the Agreement and Compact; and

WHEREAS, the precedent-setting nature of the Waukesha Application is of great concern to the Mayors of the Great Lakes and St. Lawrence Cities Initiative; and

WHEREAS, the impacts of the proposed return flow of water to Lake Michigan through the Root River will cause significant changes to the ecosystem and to the urban shores of the mouth of the River; and

WHEREAS, the Regional Body review process is inadequate as it provides for only one public meeting to be held in the City of Waukesha, resulting in far too limited public engagement on a matter of great regional, national, and international importance, contrary to the prescribed objectives of the Agreement and Compact; and

WHEREAS, the Regional Body is not providing sufficient public information to residents in the Great Lakes and St. Lawrence River Basin; and

WHEREAS, the Regional Body's decision on Wisconsin Department of Natural Resources' Declaration of Finding, expected on April 21, 2016, allows for input from the eight US Great Lakes states, Ontario and Quebec, and will be key in the final Compact Council decision.

THEREFORE, BE IT RESOLVED, that the Mayors of the Great Lakes and St. Lawrence Cities Initiative reaffirm their commitment to the protection of our water resources by calling on the Governors of Illinois, Indiana, Michigan, Minnesota, New York, Ohio, Pennsylvania and Wisconsin, and the Premiers of Ontario and Québec, and their representatives on the Regional Body and Compact Council to reject the Waukesha Application in its current form; and

BE IT FINALLY RESOLVED, that the Mayors urge the Governors and Premiers of the Regional Body and Compact Council, consistent with good public policy, to ensure complete transparency and full public engagement through open meetings,

webinars, websites and any other appropriate means of communication, including at least one public hearing in each of the ten jurisdictions included in this process.

Signed this 11th day of February, 2016

Mitch Twolan, Chair
Great Lakes and St. Lawrence Cities Initiative
Mayor, Township of Huron-Kinloss, Ontario

Office of the Mayor / CEO

Randy R. Hope

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Chatham, Ontario
N7M 5K8

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Municipality of Chatham-Kent

February 17, 2016

The Honourable Kathleen Wynne
Premier of the Province of Ontario
Legislative Building
Queen's Park
Toronto ON M7A 1A1

Dear Premier Wynne:

As a Great Lakes shoreline mayor and member of the Great Lakes and St. Lawrence Cities Initiative, an organization representing 121 United States and Canadian cities and over 17 million residents of our region, I am writing to express great concern over the Waukesha water diversion application recently submitted for approval under the Great Lakes-St. Lawrence River Water Resources Management Compact and Agreement (Compact and Agreement). As a member of the Great Lakes – St. Lawrence River Water Resources Regional Body (Regional Body), the Province of Ontario is a key stakeholder with an important voice to protect 20% of the world's surface fresh water. We ask that as part of its role on the Regional Body, the Province of Ontario oppose the Waukesha application.

Mayors of the Cities Initiative are on record opposing the application because it does not meet the requirements of the Compact and Agreement and recently passed the attached resolution. The City of Waukesha has a reasonable alternative to a diversion to provide drinking water at a much lower cost to its taxpayers. In addition, the City of Waukesha plans to provide water to an expanded service area, which does not constitute a community under the terms of the Compact and Agreement. There are also significant concerns about the return flow to Lake Michigan through the Root River. As the first application considered under the Compact and Agreement, approval could set a very dangerous precedent.

In addition, the public engagement process is seriously flawed. The Regional Body and Compact Council reviewing the application plans to hold only one public meeting in Waukesha. Something of this significance requires full public engagement across all eight U.S. and two Canadian jurisdictions. We thank the Province of Ontario for having a public comment period as an example of good public policy leading to an informed decision.

Mayors of the Cities Initiative ask you, as Premier of Ontario, to help protect our freshwater resource and, in the interest of sound public policy, advocate for full public engagement and oppose the Waukesha diversion application and the April 21, 2016 meeting of the Regional Body and Compact Council in Chicago, IL.

Sincerely,

Randy R. Hope, Mayor/CEO, Municipality of Chatham-Kent
Board of Directors, Great Lakes and St. Lawrence Cities Initiative

cc. Minister Bill Mauro, Natural Resources and Forestry

VILLE DE
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Bureau du greffier

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PROVINCE DE QUÉBEC
VILLE DE SOREL-TRACY

Extrait du procès-verbal de la séance ordinaire du conseil municipal de la Ville de Sorel-Tracy tenue le 1er février 2016

Résolution n°2016-02-092 **Alliance des villes des G rands Lacs et du Saint-Laurent – résolution 2016-1B – opposition à la demande de transfert d'eau de la Ville de Waukesha**

CONSIDÉRANT que le bassin des Grands Lacs et du Saint-Laurent représente environ 20 % des ressources mondiales en eau douce de surface et qu'il est à la base de la troisième économie mondiale,

CONSIDÉRANT que le 13 décembre 2005, les gouverneurs des États de l'Illinois, de l'Indiana, du Michigan, du Minnesota, de New York, de l'Ohio, de la Pennsylvanie et du Wisconsin, ainsi que les premiers ministres de l'Ontario et du Québec ont signé l'Entente sur les ressources en eaux durables du bassin des Grands Lacs et du fleuve Saint-Laurent (l'Entente) créant le Conseil régional des Grands Lacs et du Saint-Laurent (Conseil régional) et que les mêmes gouverneurs ont signé le Pacte des Grands Lacs (le Pacte), qui a ensuite été approuvé par le Congrès américain et signé par le président et que ces documents interdisent les transferts d'eau hors du bassin des Grands Lacs et du Saint-Laurent sauf pour les communautés situées dans des comtés chevauchant la ligne de partage des eaux entre le bassin des Grands Lacs et du Saint-Laurent et d'autres bassins,

CONSIDÉRANT que la ville de Waukesha, au Wisconsin, fait partie du comté de Waukesha, qui chevauche ladite ligne de partage des eaux,

CONSIDÉRANT que la Ville de Waukesha a déposé une demande de transfert d'eau du lac Michigan afin de l'utiliser comme source d'eau potable auprès du Wisconsin Department of Natural Resources,

CONSIDÉRANT que le Wisconsin Department of Natural Resources (DNR) a déclaré cette demande admissible et qu'elle a été transférée le 7 janvier 2016 au Conseil régional et au conseil du Pacte des Grands Lacs et du Saint-Laurent pour son étude,

CONSIDÉRANT que les huit États des Grands Lacs doivent voter en faveur de la demande pour qu'elle soit acceptée lors d'une réunion du Conseil du Pacte à la fin du printemps 2016,

CONSIDÉRANT que la demande ne respecte pas les termes du Pacte en raison des questions sur la nécessité du transfert d'eau pour répondre aux besoins en eau et aux critères de qualité d'eau de Waukesha,

CONSIDÉRANT que la Ville de Waukesha planifie de fournir de l'eau à des communautés voisines qui n'ont pas démontré le besoin d'une nouvelle source d'eau, ce qui est contraire aux termes du Pacte,

…/2

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CONSIDÉRANT que la jurisprudence causée par la nature de la demande de la Ville de Waukesha cause de grandes inquiétudes chez les maires de l'Alliance des villes des Grands Lacs et du Saint-Laurent,

CONSIDÉRANT que les impacts de l'écoulement de retour vers le lac Michigan par la rivière Root causeront d'importants changements à l'écosystème et aux berges urbaines de l'embouchure de la rivière,

CONSIDÉRANT que le processus d'étude du Conseil régional est inadéquat et ne contient qu'une seule audience publique, tenue à Waukesha, résultant en une participation du public très limitée dans ce dossier d'importance régionale, nationale et internationale,

CONSIDÉRANT que le Conseil régional ne fournit pas une quantité suffisante d'information au public et aux résidents du bassin versant,

CONSIDÉRANT que le processus de décision du Conseil régional au sujet de la Déclaration de conclusion (Declaration of Finding) du DNR attendue le 21 avril 2016 requiert l'avis des huit États des Grands Lacs, de l'Ontario et du Québec et que cette décision sera déterminante pour la décision finale du Conseil du Pacte sur la demande de Waukesha,

IL EST PROPOSÉ par M. Patrick Péloquin, appuyé par M^{me} Dominique Ouellet :

QUE les maires de l'Alliance des villes des Grands Lacs et du Saint-Laurent réitèrent leur engagement à la protection de nos ressources en eau en demandant aux gouverneurs des États de l'Illinois, de l'Indiana, du Michigan, du Minnesota, de New York, de l'Ohio, de la Pennsylvanie et du Wisconsin, aux premiers ministres de l'Ontario et du Québec ainsi qu'à leurs représentants au sein du Conseil régional et du Conseil du Pacte de rejeter la demande de transfert d'eau de la Ville de Waukesha dans sa forme actuelle,

QUE les maires exhortent les gouverneurs et les premiers ministres représentés au Conseil régional et au Conseil du Pacte, dans le but de favoriser un processus décisionnel équitable et responsable, d'assurer l'entière transparence du processus d'étude de la demande et de favoriser la participation du public par des réunions ouvertes au public, des webinaires, un site web et tout autre moyen de communication approprié, ainsi que par au moins une audience publique dans chacune des dix juridictions représentées dans ce processus.

Adoptée à l'unanimité des conseillers présents

Extrait certifié conforme

Sorel-Tracy, le 2 février 2016

René Chevalier, greffier

RC/ena

EXTRAIT DU LIVRE DES DÉLIBÉRATIONS DE LA SÉANCE ORDINAIRE DU CONSEIL DE LA VILLE DE SALABERRY-DE-VALLEYFIELD TENUE À L'HÔTEL DE VILLE, LE MARDI 16 FÉVRIER 2016, À 19 HEURES

Sont présents à cette séance les membres du conseil Denis Laître, Jean-Marc Rochon, Louise Sauvé, Jacques Smith, Patrick Rancourt, François Labossière, Jean-Luc Pomerleau et Normand Amesse, sous la présidence de M. le maire Denis Lapointe, formant la totalité des membres du conseil.

2016-02-040 **OPPOSITION À LA DEMANDE DE TRANSFERT D'EAU DE LA VILLE DE WAUKESHA**

ATTENDU QUE le bassin des Grands Lacs et du Saint-Laurent représente environ 20 % des ressources mondiales en eau douce de surface et qu'il est à la base de la troisième économie mondiale;

ATTENDU QUE le 13 décembre 2005, les gouverneurs des États de l'Illinois, de l'Indiana, du Michigan, du Minnesota, de New York, de l'Ohio, de la Pennsylvanie et du Wisconsin, ainsi que les premiers ministres de l'Ontario et du Québec ont signé l'Entente sur les ressources en eaux durables du bassin des Grands Lacs et du fleuve Saint-Laurent (l'Entente) créant le Conseil régional des Grands Lacs et du Saint-Laurent (Conseil régional) et que les mêmes gouverneurs ont signé le Pacte des Grands Lacs (le Pacte), qui a ensuite été approuvé par le Congrès américain et signé par le président et que ces documents interdisent les transferts d'eau hors du bassin des Grands Lacs et du Saint-Laurent, sauf pour les collectivités situées dans des comtés chevauchant la ligne de partage des eaux entre le bassin des Grands Lacs et du Saint-Laurent et d'autres bassins;

ATTENDU QUE la ville de Waukesha, au Wisconsin, fait partie du Comté de Waukesha, qui chevauche ladite ligne de partage des eaux;

ATTENDU QUE la Ville de Waukesha a déposé une demande de transfert d'eau du lac Michigan afin de l'utiliser comme source d'eau potable, selon l'exception des « collectivités situées dans des comtés chevauchant la ligne de partage des eaux » auprès du Wisconsin Department of Natural Resources (demande);

ATTENDU QUE l'exception requière que « toute l'eau ainsi transférée soit uniquement utilisée à des fins d'approvisionnement public en eau dans cette même collectivité »;

ATTENDU QUE le Wisconsin Department of Natural Resources (DNR) a déclaré cette demande admissible et qu'elle a été transférée le 7 janvier 2016 au Conseil régional et au conseil du Pacte des Grands Lacs et du Saint-Laurent pour son étude;

ATTENDU QUE les huit États des Grands Lacs doivent voter en faveur de la demande pour qu'elle soit acceptée lors d'une réunion du Conseil du Pacte à la fin du printemps 2016;

ATTENDU QUE la demande ne respecte pas les termes de l'Entente et du Pacte, entre autres, en raison des questions sur la nécessité du transfert d'eau pour répondre aux besoins en eau et aux critères de qualité d'eau de la Ville de Waukesha;

ATTENDU QUE la Ville de Waukesha planifie fournir de l'eau à une aire de service formée de collectivités voisines qui n'ont pas démontré le besoin d'une nouvelle source d'eau, ce qui est contraire aux termes de l'Entente et du Pacte;

ATTENDU QUE l'aire de service proposée dans la demande ne constitue pas une « collectivité située dans un comté chevauchant la ligne de partage des eaux », tel que défini et requis par l'exception de l'Entente et du Pacte;

ATTENDU QUE la jurisprudence causée par la nature de la demande de la Ville de Waukesha cause de grandes inquiétudes chez les maires de l'Alliance des Villes des Grands Lacs et du Saint-Laurent;

ATTENDU QUE les impacts de l'écoulement de retour vers le lac Michigan par la rivière Root causeront d'importants changements à l'écosystème et aux berges urbaines de l'embouchure de la rivière;

ATTENDU QUE le processus d'étude du Conseil régional est inadéquat et ne contient qu'une seule audience publique, tenue sur le territoire de la Ville de Waukesha, résultant en une participation du public très limitée dans ce dossier d'importance régionale, nationale et internationale et contraire à l'esprit de l'Entente et du Pacte;

ATTENDU QUE le Conseil régional ne fournit pas une quantité suffisante d'information au public et aux résidents du bassin versant des Grands Lacs et du Saint-Laurent;

ATTENDU QUE le processus de décision du Conseil régional au sujet de la Déclaration de conclusion (Declaration of Finding) du DNR attendue le 21 avril 2016 requiert l'avis des huit États des Grands Lacs, de l'Ontario et du Québec et que cette décision sera déterminante pour la décision finale du Conseil du Pacte sur la demande de Waukesha;

Il est proposé par M^{me} la conseillère Louise Sauvé,
appuyé à l'unanimité,
et résolu

QUE les maires de l'Alliance des Villes des Grands Lacs et du Saint-Laurent réitèrent leur engagement à la protection de nos ressources en eau en demandant aux gouverneurs des États de l'Illinois, de l'Indiana, du Michigan, du Minnesota, de New York, de l'Ohio, de la Pennsylvanie et du Wisconsin, aux premiers ministres de l'Ontario et du Québec ainsi qu'à leurs représentants au sein du Conseil régional et du Conseil du Pacte de rejeter la demande de transfert d'eau de la Ville de Waukesha dans sa forme actuelle;

QUE les maires exhortent les gouverneurs et les premiers ministres représentés au Conseil régional et au Conseil du Pacte, dans le but de favoriser un processus décisionnel équitable et responsable, d'assurer l'entière transparence du processus d'étude de la demande et de favoriser la participation du public par des réunions ouvertes au public, des webinaires, un site web et tout autre moyen de communication approprié, ainsi que par au moins une audience publique dans chacune des dix (10) juridictions représentées dans ce processus.

ADOPTÉ

2016-02-18 2016-02-17

Denis Lapointe, maire

Alain Gagnon, greffier

Copie certifiée conforme le 23 février 2016

Alain Gagnon, greffier